Experts View
Tree, Turf Fertilization

WEEDS TREES and TURF

A TRADE MAGAZINES PUBLICATION

March 1967

Lawn trees, golf course trees, landscape trees, any trees are most easily and economically fertilized with needed nitrogen by a lawn spreader (see page 8).

Fertilizing Trees Economically 8

Fertilizers Crowd Weeds from Turf . . 12

Fertilizer: What's It Worth? 16

Monthly magazine of methods, chemicals and

equipment for vegetation maintenance and control

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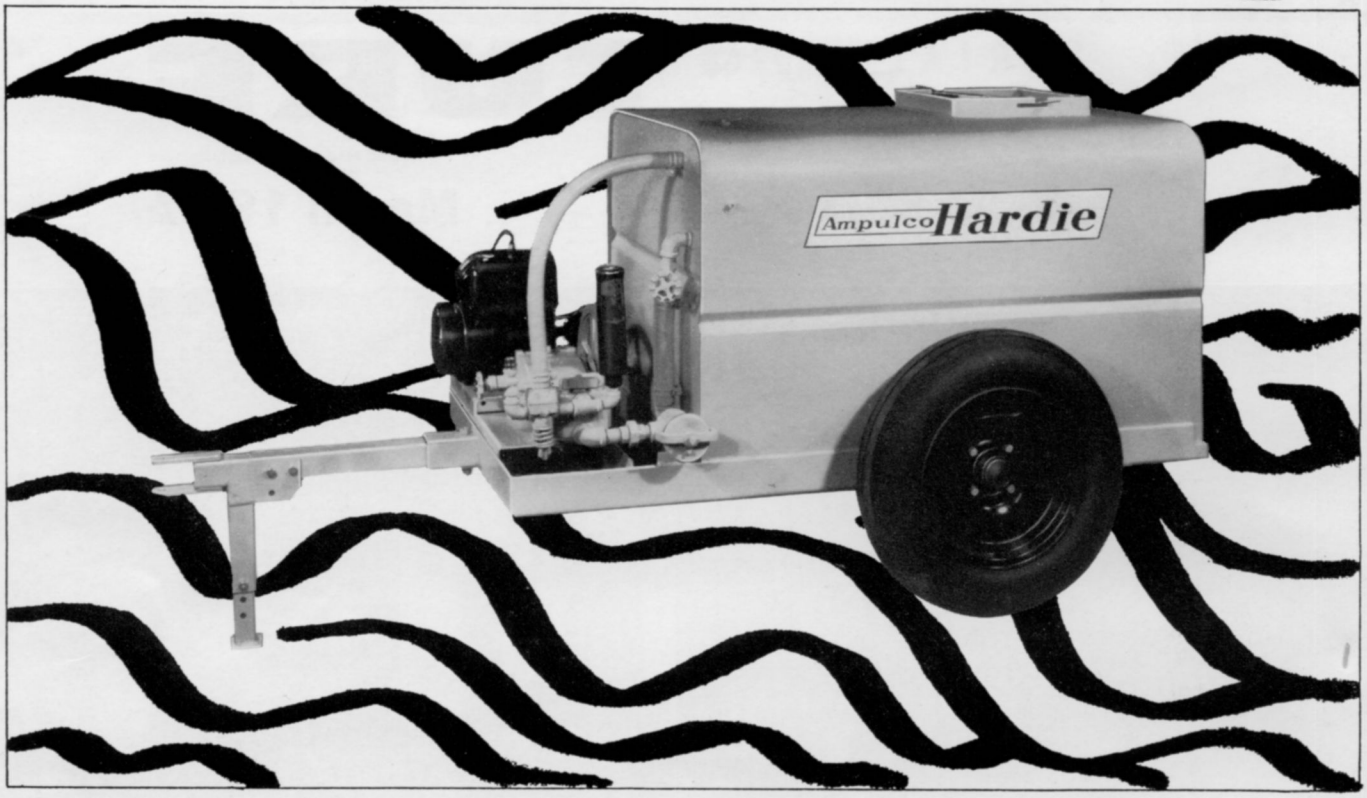

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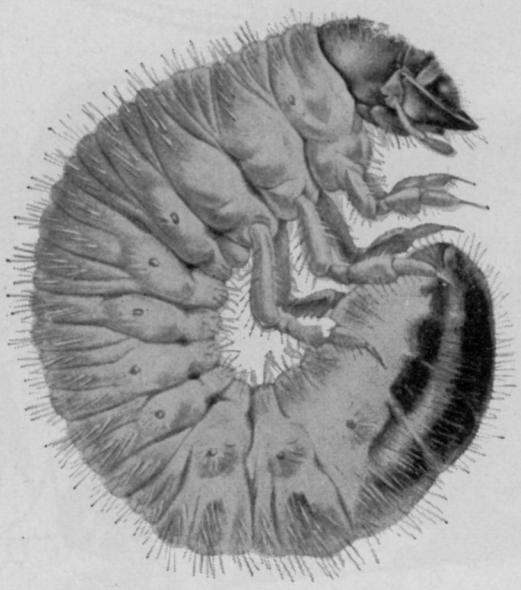
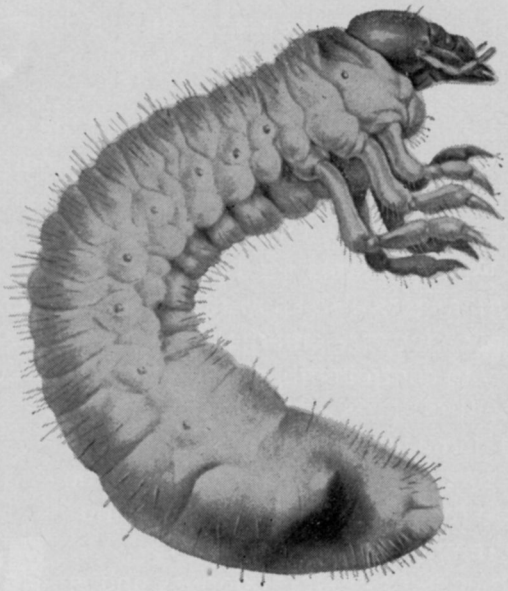


White grubs "work" in the soil for 2-3 years—chewing roots, cutting grass off from water and fertilizer in the soil.



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WEEDS TREES and TURF

FORMERLY WEEDS AND TURF

March 1967
Volume 6, No. 3

Features:

Can Trees Be Fertilized Economically?
By Dr. Dan Neely and Dr. E. B. Himelick 8

Fertilizing Helps Turf Crowd Out Weeds
By Dr. Eliot C. Roberts and Flave E. Markland 12

Fertilizer: What's It Worth?
By David E. Lofgren 16

Do You Consider These Factors Before Buying Fertilizers? 18

Recordbreaking International Turf Show
Attracts 3,000-Plus to Washington, D.C. 20

Sodmen Move To Form National Group 26

OSU Short Course Talks Turf in Columbus, Jan. 23 32

Three Steps to Compute Small Fertilizer Applications 38

Departments:

Editorial: Sodmen on the Move 6

Meeting Dates 36

Know Your Species: Cheat 37

Insect Report 40

Classifieds 41

Advertisers Index 41

Trimmings 42

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Sodmen on the Move

Without wishing to appear possessed of a case of "associationitis," *WTT* again lends its editorial support to a fledgling organization. We're referring to the National Sod Producers' Association, which took its first formative steps at last month's Sod Producer Session, conducted during the International Turfgrass Conference and Show (for a report on this session, see page 26).

We were, frankly, impressed by the reasonable attitude surrounding this formative step. With a complete absence of speeches and a minimum of fuss and bother, attending sodmen nominated and selected a committee to study bylaws and constitution for a workable organization. Five producers who form the committee are home-based from California to New Jersey and Florida.

But even more important than this representative geographical spread is the fact that many on the committee have gained previous experience with state or regional sod associations. Committeemen Ben Warren and Wiley Miner have long been active, respectively, in the Mid-America and New Jersey associations. Also auguring well for the group was the appointment of Ohioan George Hammond, who has substantial organizational experience behind him, to serve the committee in an advisory capacity.

It looks to us very much like the sort of go-ahead group that will do what needs to be done, will take the necessary steps to make the National Sod Producers' Association a reality. Formation comes at a propitious time. The unprecedented expansion of America's sod industry has reached a point where producers are experiencing a growing need to evaluate their own industry and its practices.

Though there is a vast amount of high-quality cultivated sod under production, there are still many unanswered questions and problems, ranging from agronomic considerations to educating the purchasing public in the value and versatility of sod, as well as in its selection and care.

In these and other matters, a national association can serve both industry and public. With a degree of understatement, Rutgers' Dr. Henry Indyk, who chaired the sod session, commented that such a group will be valuable if for no other reason than to sponsor a yearly program for sod producers. We quite agree. And we suspect that a national association can do a great deal more for the industry.

WEEDS TREES AND TURF is the national monthly magazine of urban/industrial vegetation maintenance, including turf management, weed and brush control, and tree care. Readers include "contract applicators," arborists, nurserymen, and supervisory personnel with highway departments, railways, utilities, golf courses, and similar areas where vegetation must be enhanced or controlled. While the editors welcome contributions by qualified freelance writers, unsolicited manuscripts, unaccompanied by stamped, self-addressed envelopes, cannot be returned.

WTT Mailbox

Concerned About Editorial

I am concerned over your editorial "Incident in Vermont" appearing in the January 1967 issue of WEEDS TREES AND TURF. To many of us this is not a "backwater" case. Any case of this nature is serious because of the precedent it may set. It should, therefore, be carefully researched and the true facts determined before it is given national publicity.

During my presence at the trial, no one tried to convince ". . . a jury of hard-headed Vermonters that it is perfectly all right to put a combination of chemical weed-killer and No. 2 fuel oil into a farmers water supply." On the contrary, a considerable amount of testimony was given to show why the chemical could not have gotten to the water supply. First, it was not mixed at the water hole. There was no reason to use water since the brushkiller was to be applied as a stump spray in a fuel oil carrier. Second, the material was applied to stumps at a considerable distance from the water hole and the stream leading to it. Third, the amount applied to the treated area was less than three quarts of the brushkiller diluted in 15 gallons of fuel oil. This was a summer stump treatment. Conditions were ideal for rapid breakdown of the 2,4-D and 2,4,5-T contained in the brushkiller by soil bacteria.

The farmer claimed that two of his cows were killed and the entire herd affected by the chemical-fuel oil mixture. No autopsy had been performed and no evidence was presented to show that the amount of chemical and fuel oil in question could kill a cow. Much testimony to the contrary was given by two university weed scientists.

I cannot agree that this case illustrates a chemical misuse or an unsafe practice as your editorial implies. Stump sprays of 2,4-D/2,4,5-T brushkillers have been applied to right-of-way brush in this manner for 20 years. To my knowledge there has never been a case of herbicidal poisoning of livestock from this technique. It is one of the safest that can be employed and is widely recommended by weed scientists and extension personnel all over the world.

John H. Kirch

Marketing Manager
Industrial Chemicals
Amchem Products, Inc.
Ambler, Pa.

Can Trees Be Fertilized Economically?$?

By DR. DAN NEELY and DR. E. B. HIMELICK
Illinois Natural History Survey, Urbana, Illinois

THE FIRST question to ask of tree fertilization is: *Will the anticipated results justify the cost?* The answer to this question will be determined by the age, size, and vigor of the tree and by the structure and fertility level of the soil.

Healthy, vigorous trees growing under optimum soil and water conditions should survive indefinitely without the addition of fertilizer. Trees weakened by disease, insects, drought, or other adverse conditions, and trees growing in soil of poor structure or low fertility will benefit markedly from fertilizing.

Trees that show the greatest response to fertilizing are small, young, and growing in soil of low fertility. Adding fertilizer to soil frequently increases the annual rate of tree growth by 50 to 100%. Therefore, a young tree can be stimulated to grow rapidly and give abundant shade at an early age. This should encourage greater use of tree species that are generally considered too slow-growing to give quick shade.

Probably the greatest need for tree fertilization comes in those areas where the original soil has been disturbed during building construction. Residual soil often does not have suitable structure or enough fertility to support vigorous tree growth, with the result that annual growth is low and trees are often pale green.

The next question to ask is: *What fertilizers are recommended, and what is the most economical source of supply?* Nitrogen, phosphorus, and potassium are the nutrients of primary concern in fertilizers.

N Basic To Tree Growth

Plant growth is more often limited by deficiency of nitrogen than of any other nutrient. Available nitrogen in the soil is either used by plants or carried away by water so that it is nec-

Consider These Advantages and Disadvantages To Fertilizing Trees:

Advantages:

A vigorously growing tree is less susceptible to certain diseases and insect pests than a less vigorous tree.

Canker-causing fungi occur more commonly on weakened trees. Also, many noninfectious tree diseases develop when soil nutrients and moisture are unfavorable.

Healthy, vigorous trees have a greater tendency to resist borers.

Fertilization may stimulate additional growth in established trees weakened by leaf diseases, insect defoliation, mechanical injury, soil compaction, drought, etc., so that trees can compensate for the conditions causing decline.

Disadvantages:

Although the advantages far outweigh the disadvantages, certain points should be kept in mind. Fertilizing trees or shrubs in lawns may also stimulate grass growth, and frequent mowing may be necessary.

Unless regularly pruned, small ornamental shrubs, through fertilization, may outgrow their locations in a few years.

Heavy nitrogen applications tend to increase twig growth and reduce flowering in some ornamental shrubs.

American beech, white oak, and some crab apple varieties have been reported injured by fertilizer formulations containing nitrogen, phosphorus, and potassium.

Adapted from "Fertilizing and Watering Trees," by the authors of this article. Single copies of the circular are available free of charge from the Illinois Natural History Survey, Urbana, Ill. 61801.

The authors recommend applying granular nitrogen fertilizers to soil surface by means of common lawn fertilizer spreaders, which are suitable for fertilizing either grass or trees. Nitrogen applied in this manner becomes available to tree roots following rainfall or irrigation.

essary to add nitrogen at regular intervals to maintain an ample supply.

Most soils that contain sufficient organic matter and clay have enough phosphorus for adequate plant growth. However, in some soils additional quantities of phosphorus may be needed for best growth.

Soils usually contain more potassium than nitrogen or phosphorus. Those most likely to be deficient in potassium are sandy soils in areas of heavy rainfall.

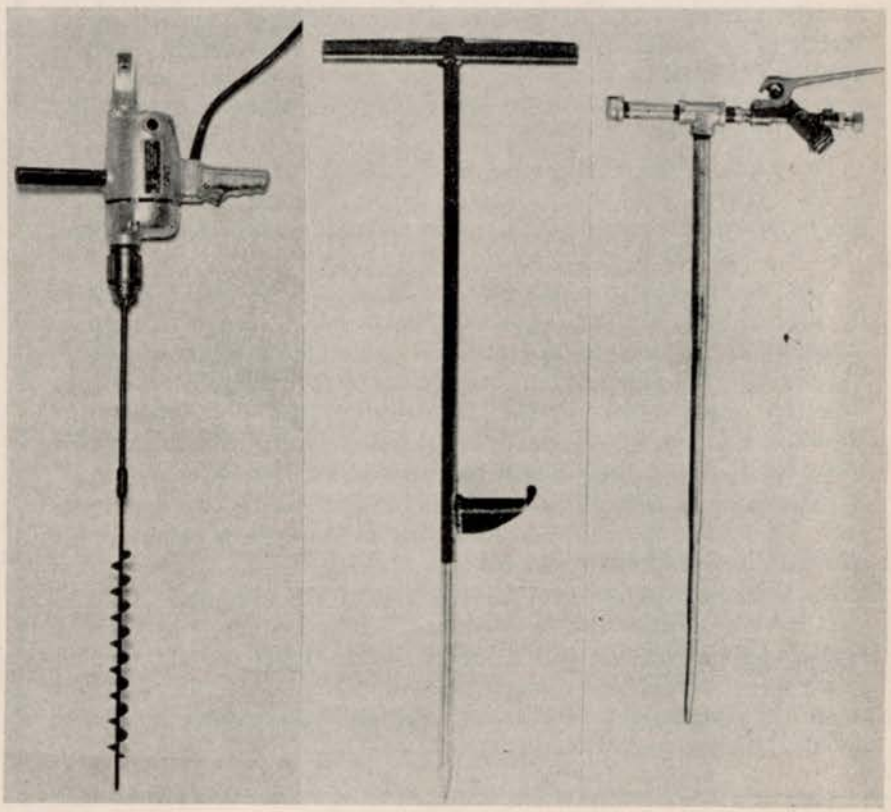
Nitrogen is the basic element in tree fertilizing. Need for phosphorus or potassium will vary from place to place, and an agronomist, farm advisor, or extension specialist should be contacted for advice on local soil conditions.

Many granular commercial fertilizers contain nitrogen, phosphorus, and potassium. The guaranteed analysis of most fertilizers is shown on the bag as three numbers, for example, 12-12-12. Fertilizers containing all three nutrients are called balanced or complete fertilizers.

Usually, it is more economical to buy the nutrients separately. A suggested source of nitrogen is urea (45-0-0); of phosphorus, triple superphosphate (0-45-0); and of potassium, muriate of potash (0-0-60). If only nitrogen is needed, the cost per pound in different fertilizers varies greatly as shown below (current, local, wholesale prices):

Fertilizer	Cost of N/lb.
Urea (45-0-0)	$ .12
Ammonium nitrate (33.5-0-0)	.12
Ammonium sulfate (21-0-0)	.13
12-12-12 (not water soluble)	.28
Ureaform (38-0-0)	.58
20-20-20 (water soluble)	1.20

The last question to ask before work begins is: *What is the*



Right: tools of the trade for applying fertilizers into the soil. An electric drill with a soil auger (left), or a punch bar (center), can be used to prepare holes for application of dry phosphorus and potassium fertilizers. Soil needle (right), fed by a hydraulic pump, can be used to inject water-soluble fertilizers into the soil.

most economical method of applying the fertilizer? Three methods of fertilizing that have proved successful are surface application, placement of dry fertilizers in holes in the soil, and injection of liquid fertilizers into the soil.

Apply N To Surface

Surface application is the easiest, simplest, and most economical means of applying fertilizers. However, for shade tree fertilization, only nitrogen materials should be applied in this manner. Phosphorus and potassium fertilizers should not be applied to soil surface for two reasons: First, they move very slowly into soil and will not be available to tree roots when placed on the surface; and second, they are likely to burn turf when applied at rates recommended for trees.

Preparing holes for placing dry fertilizer in the soil requires considerable labor. This method is time-consuming and expensive if enough holes are made. Injection of liquid fertilizers into soil requires expensive equipment and a more expensive fertilizer, one that is completely soluble in water.

However, placing dry fertilizer in holes and injecting liquid fertilizers are the two most satisfactory methods of applying needed phosphorus and potassium. Since these methods are more expensive than surface application, they should be used only when phosphorus and potassium are deficient in the soil. If these methods are used, nitrogen is mixed with the phosphorus and potassium to make a balanced fertilizer, and all three nutrients are applied at the same time.

Summary of Recommendations:

1. Measure accurately the area to be fertilized and determine its size in square feet. For ease in calculating size and applying fertilizers, a square or rectangular area is suggested.

2. Weigh accurately the amount of fertilizer material to be used. (A bucket and kitchen scale are used by the authors).

3. Apply nitrogen fertilizers annually to soil surface at the rate of 6 lbs. of nitrogen per 1,000 sq. ft. This is easily and uniformly accomplished with spreaders commonly used to apply fertilizer to lawns. Nitrogen fertilizers are most effective when applied in April or early May before trees break dormancy. To prevent grass burn, wash fertilizer off grass blades immediately after application.

4. Apply phosphorus and potassium fertilizers every three to five years. Phosphorus should be applied at the rate of 3.6 lbs. of phosphoric acid (P_2O_5), and potassium at 6 lbs. of potash (K_2O) per 1,000 sq. ft.

One method is to place dry fertilizer in a series of holes 12 to 15 in. deep at 2-ft. intervals in parallel lines 2 ft. apart throughout the area to be fertilized. A second method of applying phosphorus and potassium is to use water-soluble materials, injecting them into soil with a hydraulic pump and soil needle. Injections are made 18 in. deep at 2½-ft. intervals in parallel lines 2½ ft. apart throughout the area to be fertilized.

Phosphorus and potassium can be applied in the spring or fall. They are often applied in spring when hole preparation or soil-needle injection is easiest.

5. Discontinue fertilization when it fails to accomplish a purpose or when other factors become of primary concern. Often, fertilizing can be continued indefinitely. Some woody species, however, may become succulent or develop a weeping appearance after prolonged fertilizing. All fertilized plants should be carefully observed each year.

CSU Scientists Study Grass Reestablishment

Results of a study in the use of contact herbicides to kill bentgrasses in bluegrass lawns were reported at the 13th Rocky Mountain Regional Turfgrass Conference, January 25 to 26, at Colorado State University, Fort Collins.

Separating the grasses from the grasses and reestablishing the desirable variety has long been a problem to turfmen. Reporting Colorado results was Homer M. Hepworth, of CSU's Department of Botany and Plant Pathology, who conducted the study with Dr. Jess L. Fults and John W. May. Two herbicides, potassium cyanate (KOCN) and paraquat were tested in a local home lawn, which was heavily infested with bentgrass.

These herbicides were selected because of the difference in growth habits of bent and bluegrass, Hepworth told conferees. Bents are rather shallow rooted and form stolons, while bluegrass is more deeply rooted with subsurface rhizomes. Contact chemicals were used to kill all aboveground growth, on the theory that bents would be wiped out completely and bluegrass would regrow from the protected rhizomes.

Applications of both herbicides were made to separate sections of the lawn in September of last year. The lawn was power-raked to remove dead thatch and debris seven days after herbicides were applied, then bluegrass was seeded. Hepworth reported that, within two weeks, bluegrass had emerged, with an excellent stand forming by late fall.

Both KOCN and paraquat were satisfactory in the test. Spot treatments are not recommended, Hepworth warned. Not only is it likely that some bentgrass will be skipped, but the resulting turf is likely to be spotted and unattractive. It's essential, then, that grass be completely covered with the chemical.

Plans are underway to expand the test program, with selective removal of perennial grasses from bluegrass the next object.

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Technical assistants count crabgrass plants in lawn turf treated with various fertilizers and preemergence herbicides as part of Iowa State's turf tests.

FERTILIZING Helps Turf Crowd Out Weeds

By
DR. ELIOT C. ROBERTS, and FLAVE E. MARKLAND*
Iowa State University
Ames, Iowa

WEED control in turf is becoming more widely practiced each year and is rightfully being credited with major improvements in lawn quality. Several of the newer preemergence and postemergence herbicides combine improved selectivity with greater toxicity to unwanted weeds. It is generally recognized that, as long as there is some turfgrass cover, chemical weed control can eliminate undesirable plants so that a complete turfgrass cover is realized.

A point is reached, however, when the original turf cover may be too weak or thin to fill back in following weed elimination. In other instances, grass may afford such limited competition that weeds outgrow the herbicide's effect.

Research at Iowa State University has been conducted to determine relative competitive natures of several turfgrasses and to evaluate effects of time of year, fertilization, and irrigation on grass vigor as measured by production of vegetative buds.

In addition, tests have evaluated the effects of fertilization and irrigation on crabgrass establishment and of fertilization on spread of dandelions. Study of the annual weed, crabgrass, and the perennial weed, dandelion, have provided an opportunity to compare grass competition in two entirely different weed situations.

Time of Year Affects Turf Competitiveness

Both fine-textured and coarse-textured turfgrasses vary in their competitive nature. Number of vegetative buds per square inch has been correlated with turfgrass vigor and ability to compete with, and crowd out, other plants. In general, fine-textured, spreading grasses have more buds per square inch than coarse-textured clump types. Thus, fine-textured grasses provide better competition against weeds.

We have found that when temperature and moisture conditions are favorable for growth, as in late spring, Pennlawn red fescue has more than twice as many buds per square inch as Kentucky 31 fescue (see Table 1). Astoria Colonial bentgrass and Merion Kentucky bluegrass have intermediate bud counts.

Under high temperature and moderate moisture stress, as is common in late summer, Pennlawn red fescue thinned out considerably as shown by a 50% reduction in number of buds. Kentucky 31 fescue and Merion bluegrass maintained about the same number of buds as under more favorable growth conditions in late spring. Thus, the competitive nature of these two grasses should not be expected to change throughout the entire season. A 50% increase in buds of Astoria bentgrass was recorded from June to August; this grass is apparently more vigorous during warm weather.

Weeds may be expected to become established and spread in

No room for weeds in Merion Kentucky bluegrass turf that's well fertilized (right in photo). Turf is too dense for weeds to get a start. Where bluegrass is not adequately fertilized (left), there are plenty of open spaces where weeds can become established.

*Respectively, Professor of Agronomy and Horticulture and Research Associate in Agronomy and Horticulture.

turf when the grasses have the fewest number of vegetative buds and are thus least vigorous.

Merion Competitive Under Water Stress

Grasses vary considerably in response to irrigation (see Table 2). We have found that irrigated Astoria bentgrass and Pennlawn red fescue have about four times as many buds as when not irrigated. Nonirrigated Merion bluegrass and Kentucky 31 fescue were only slightly reduced in bud counts, however. It is well known that bentgrasses require considerable moisture to keep them competitive and that Kentucky 31 fescue can withstand drought without injury.

Sensitivity of red fescue and tolerance of Merion bluegrass to lack of moisture have often been noted under field conditions, but these responses are not well documented in turfgrass texts and research bulletins. Many weeds have deep root systems that help make them more competitive than turfgrasses with shallow roots. Both Merion and Kentucky 31 are deep-rooted grasses, and this growth characteristic may help to explain their superior quality and resistance to weed invasions during dry weather.

Fertilize for Needs Of Dominant Grasses

Grasses also vary in their competitive response to fertilization (see Table 3). We have found that bluegrasses respond to seedbed and maintenance fertilizer applications with an increased number of buds per square inch. Red fescues have more buds when seedbed and maintenance fertilizers are withheld or kept at low levels. Thus, fertilization which favors one grass and makes it more competitive may retard development of another. It is essential that fertilization practices be set up to promote optimum vigor of those grasses that are expected to remain dominant and contribute most to a high-quality turf.

In addition, fertilizer should be applied when it will be of most benefit to turfgrasses and of least benefit to seedling weeds. In general, the fact that weeds like knotweed and crabgrass germinate and start growth in spring lends credence to the value of fall fertilizer applications.

Table 1. Effect of Time of Year on Competitive Nature of Turfgrasses as Evidenced by Bud Counts.

Grass	Buds/sq. in. June	Aug.
Astoria bentgrass	10.8	16.2
Pennlawn red fescue	18.7	8.5
Merion bluegrass	12.3	12.4
Kentucky 31 fescue	7.1	6.7

Table 2. Effect of Irrigation on Competitive Nature of Turfgrasses as Evidenced by Bud Counts.

Grass	Buds/sq. in. Irrigated: Yes	No
Astoria bentgrass	16.2	4.3
Pennlawn red fescue	8.5	2.1
Merion bluegrass	12.4	10.3
Kentucky 31 fescue	6.7	6.3

Table 3. Effect of Seedbed N on Competitive Nature of Turfgrass Mixtures Maintained under High and Low N as Evidenced by Bud Counts.

Treatment	Buds/sq. in. Blue-grass	Red Fescue
High Seedbed N		
High maint. N	13.5	0.5
Low maint. N	11.7	2.1
Low Seedbed N		
High maint. N	12.0	1.4
Low maint. N	7.6	8.0

Table 4. Effect of Nitrogen Fertilization and Soil Moisture on Numbers of Crabgrass Seedlings in Bluegrass Lawn Turf.

Herbicide	Seedlings/sq. in. With N Dry	Wet	Without N Dry	Wet
Dacthal	0.1	0.2	0.5	1.0
Zytron	0.1	0.5	0.4	1.7
Check	0.3	0.8	4.8	5.5

Table 5. Effect of Seedbed and Maintenance N on Dry Weight Production of Crabgrass in Merion and Kentucky Bluegrass-Red Fescue Mix.

Treatment	C'grass Plants Gm./1000 sq. ft. Merion	Mix
High Seedbed N		
High maint. N	18.4	37.0
Low maint. N	10.0	23.4
Low Seedbed N		
High maint. N	69.0	36.0
Low maint. N	83.6	71.4

Table 6. Effect of Seedbed and Maintenance N on Numbers of Dandelions in Merion and Kentucky Bluegrass-Red Fescue Mixed Turf.

Treatment	Dandelions/ 1000 sq. ft. Merion	Mix
High Seedbed N		
High maint. N	20	350
Low maint. N	216	990
Low Seedbed N		
High maint. N	18	424
Low maint. N	1234	2416

Creeping bentgrass can become a weed once it is established in a bluegrass lawn or athletic field. Its highly aggressive nature causes it to clump and crowd out all other vegetation in the area. Proper nitrogen use can help keep bluegrass clear.

N, Water Influence Crabgrass Controls

Use of preemergence herbicides for crabgrass control in turf is a common practice despite varying degrees of success. Often, when herbicides fail to provide satisfactory weed control, treatments have been made to thin stands of turf, while areas of competitive turf are clear of

Kentucky bluegrass that receives adequate nitrogen fertilization throughout the year (left) contains far fewer dandelions than turf (right) that is maintained with inadequate nitrogen levels.

crabgrass following treatment with weed killers.

Since water and nitrogen fertilizer are two of the most important factors contributing to turfgrass vigor, a greenhouse experiment was conducted to evaluate effects of watering and fertilization practices on degree of crabgrass control obtained with DCPA (Dacthal) and DMPA (Zytron), as compared to bluegrass turf that received no herbicide.

Fertilized turf received activated sewage sludge at 40 lbs. per 1,000 sq. ft. (2 lb. actual nitrogen). A wet soil treatment was established by watering the soil to field capacity every two to three days. A dry soil treatment consisted of lightly watering the surface ½- to ¾-in. of soil once or twice a day. Water was applied in both instances with a mist apparatus that resulted in slow, uniform watering to prevent washing of soil or seed.

Within each irrigation and nitrogen treatment, six replicates were arranged for a nontreated check and for DCPA and DMPA applied at rates of 0.23 and 0.25 lb. per 1,000 sq. ft., respectively. Both herbicides were spread uniformly over the turf. Crabgrass was seeded at a calculated rate of 6.1 live seeds per square inch, and a covering of washed quartz sand was placed over seeds to keep them in place. Numbers of crabgrass seedlings growing in random, square-inch samples were recorded (see Table 4).

Most crabgrass seedlings (over five per square inch) were found where bluegrass was neither treated with herbicide nor fertilized and turf was maintained wet. Only slightly fewer seedlings were noted in this treatment sequence where turf was maintained dry. From one to nearly two crabgrass seedings per square inch were found where turf was treated with herbicide and kept wet, but not fertilized with nitrogen. This degree of crabgrass infestation was greater than that obtained where no herbicide was used, but the turf was treated with nitrogen and maintained wet.

More crabgrass was found where turf was treated with herbicide and maintained dry with no nitrogen, than where no herbicide was used and turf maintained dry with nitrogen added. Least crabgrass was noted where turf was treated with herbicide, fertilized with nitrogen, and maintained dry.

Effect of turf competition on the degree of crabgrass control obtained from these herbicides is striking. Even more significant are the differences in crabgrass infestation where no herbicides were used and nitrogen-watering practices varied. It is evident that moist soil favors establishment of crabgrass seedlings, and where weed killers are used, may actually enhance their escape from concentrations of herbicide in upper soil layers.

Also, nitrogen fertilization prior to crabgrass seed germination has the valuable effect of making the turfgrass more competitive, which retards development of crabgrass seedlings and makes them more susceptible to herbicide injury.

Seedbed vs. Added Nitrogen Studied

In other experiments, the effect of seedbed nitrogen treatments was compared with the effect of maintenance nitrogen on crabgrass infestation. Merion bluegrass and Kentucky bluegrass-Pennlawn red fescue plots have been established on Nicollet clay loam soils fertilized with ureaform, which was applied to seedbeds at rates up to 20 lbs. of nitrogen per 1,000 sq. ft. These treatments were compared with ammonium nitrate applied at rates up to 2 lbs. of nitrogen per 1,000 sq. ft.

Twenty lbs. of ureaform nitrogen and 2 lbs. of ammonium nitrate nitrogen are considered maximum safe treatments on this soil. Yearly spring applications of ureaform to established turf were made at 2 and 10 lb. rates. Grams dry weight of crabgrass foliage harvested in midsummer was correlated with high and low seedbed nitrogen treatments and with high and low maintenance nitrogen levels (see Table 5).

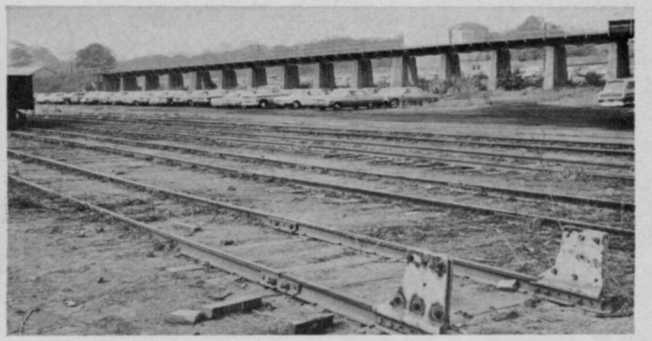
Merion plots contained more crabgrass than Kentucky bluegrass-red fescue plots when treated with low seedbed nitrogen, but less crabgrass under high seedbed nitrogen. This indicates that Merion bluegrass, which is known to be a slow-starting grass, is made significantly more competitive by high seedbed nitrogen treatment.

Plots treated with high seedbed nitrogen contained less crabgrass when maintained under low nitrogen levels than under high. Apparently, high maintenance applications (in spring) provide extra nitrogen that benefits crabgrass more than turfgrass. However, plots low in seedbed nitrogen contained more crabgrass when maintained under low levels. In this instance, maintenance applications are at least partially responsible for

(Continued on page 24)

The problem...unwanted weeds

This railroad siding was infested with fire-hazardous vegetation before "Hyvar" X bromacil weed killer was applied. "Hyvar" X controls perennial weeds and grasses (such as Johnson, Bermuda, nut, horsetail, plaintain, wild carrot and bouncing bet).



The same siding after a single application of "Hyvar" X. Note excellent control of unwanted vegetation. Other products containing bromacil, such as "Hyvar" X-WS, give equally effective control wherever unwanted vegetation is a problem.

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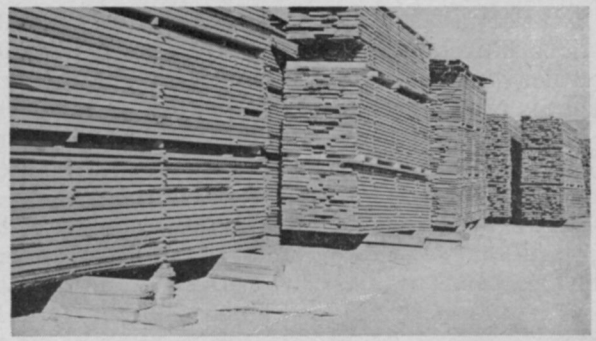

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It's in the Bag . . .

FERTILIZER What's It Worth?

By
DAVID LOFGREN
Director, Institute of Maintenance Research
Salt Lake City, Utah

CONFUSED with such semiscientific terms as "formula, ratio, rate, and demands"?

Let's review some facts about fertilizers. Plants remove nutrients at varying rates. For example, Kentucky bluegrass turf will deplete soil nutrient reserves at the rate of about 150 lbs. of nitrogen, 50 lbs. of phosphorus, and 100 lbs. of potassium per acre each year, with between two and three tons of clippings.

Mixed landscape tree leaves show a dry weight composition of approximately 0.75% nitrogen, 0.16% phosphorus, and 0.3% potassium. In both of these instances, it may be noted that the ratio is approximately 3:1:2 of nitrogen to phosphorus to potassium. What ratio are you using to replace these losses?

The Institute of Maintenance Research recommends a 3:1:2 ratio through a 22:7:15 or 24:8:16 fertilizer. Why? Because it gives us the desired ratio and application rate without too much labor.

Table 1. How Much Actual Ingredient Are You Buying? Pounds of Actual N, P_2O_5, or K_2O per Bag.

When Nutrient Formula % Is:	25 Lb. Bag	40 Lb. Bag	50 Lb. Bag	80 Lb. Bag	100 Lb. Bag
1%	0.25	0.4	0.5	0.8	1.0
3%	0.70	1.2	1.5	2.4	3.0
4%	1.00	1.6	2.0	3.2	4.0
5%	1.25	2.0	2.5	4.0	5.0
6%	1.50	2.4	3.0	4.8	6.0
10%	2.50	4.0	5.0	8.0	10.0
16%	4.00	6.4	8.0	12.8	16.0
21%	5.25	8.4	10.5	16.8	21.0
22%	5.50	8.8	11.0	17.6	22.0
24%	6.00	9.6	12.0	19.2	24.0
34%	8.50	13.6	17.0	27.2	34.0
44%	11.00	17.6	22.0	35.2	44.0
60%	15.00	24.0	30.0	48.0	60.0

Check the left hand column against the fertilizer package formula—read across to the right to find actual quantity of specific nutrient in bag (top row) of either N—P_2O_5 or K_2O.

Table 2. How Much Fertilizer Do You Really Need to Get a Desired Coverage? Use This Amount per 1,000 Sq. Ft. for Indicated Formulation Percent.

To Get This Pound Rate 1000 Sq. Ft.	1%	4%	6%	10%	16%	21%	24%	34%	44%	51%	60%	To Get This Rate/Acre (Close Approx.)
0.25	25	6.25	4.17	2.5	1.56	1.20	1.04	.74	.57	.49	.42	10.89
0.5	50	12.50	8.33	5.0	3.13	2.38	2.08	1.47	1.14	.98	.83	21.78
1.0	100	25.00	16.70	10.0	6.25	4.76	4.16	2.94	2.27	1.96	1.67	43.56
1.5	150	37.50	25.00	15.0	9.37	7.14	6.25	4.41	3.41	2.94	2.50	65.34
2.0	200	50.00	33.30	20.0	12.50	9.50	8.33	5.88	4.54	3.93	3.33	87.12
3.0	300	75.00	50.00	30.0	18.75	14.28	12.50	8.82	6.81	5.88	5.00	130.68
4.0	400	100.00	66.70	40.0	25.00	19.04	16.67	11.76	9.09	7.84	6.67	174.24
5.0	500	125.00	83.30	50.0	31.25	23.80	20.80	14.70	11.36	9.80	8.33	217.80
10.0	1000	250.00	166.70	100.0	62.50	47.60	41.60	29.40	22.07	19.60	16.67	435.60

Where total nutrient need is indicated (check left column chart # 2), read across top row to formulation % column as listed. Chart will then give you the *total quantity of material needed* to give the actual quantity desired (in lbs/1000 sq. ft.)

Compare liquid fertilizers purchased in 5-gal. cans with the same material purchased in 1-gal. cans: If one 5-gal. can is bought instead of five 1-gal. cans and two minutes more are spent each time the 5-gal. can is handled, as opposed to the 1-gal. can, and if the 5-gal. can is handled 12 times for each gallon of fertilizer for a total of 60 times, then two hours are being wasted in handling. At $2.50 per hour for labor, you could afford to pay $1.00 more per gallon to get the material in the smaller size. Then consider convenience, safety, etc.

Table 3. What is Extra Labor Costing You? Compare Labor Expended to Cash Lost.

Annual Salary	$2500.00	3000.00	3500.00	4000.00	4500.00	5000.00	5500.00	6000.00
Hourly Equivalent	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
Cents per Minute	2.08	2.50	2.91	3.33	3.75	4.16	4.59	5.00
	Minimum Cost To Be Added To Actual Cost (To Nearest ¢)							
Extra Minutes Lost in Waiting or Handling								
1 min.	.02	.02	.03	.03	.04	.04	.05	.05
2 min.	.04	.05	.06	.07	.07	.08	.09	.10
3 min.	.06	.07	.09	.10	.11	.12	.14	.15
4 min.	.08	.10	.12	.13	.15	.17	.18	.20
5 min.	.10	.12	.15	.17	.19	.21	.23	.25
7 min.	.15	.17	.20	.23	.26	.29	.32	.35
10 min.	.20	.25	.29	.33	.37	.42	.46	.50
20 min.	.40	.50	.58	.67	.75	.83	.92	1.00
50 min.	1.00	1.25	1.45	1.66	1.95	2.08	2.29	2.50

These Figures Based on 250 Eight Hour Days per Year or 2000 Working Hours per Year

with 2 lbs. actual nitrogen applied in midwinter and 1 lb. applied around Labor Day.

Check your fertilizer for actual ingredients, along with ratios and rates, in the accompanying tables and formulas. Check these to compare the value of your materials with others. Comparative values of different formulations can be confusing when you have both actual pounds of nutrient and percent figures to contend with. These tables and formulas let you compare products competitively.

Tables 1 and 2 provide actual quantity of specific nutrients in fertilizers and total quantity of material needed to obtain a desired coverage. Actual cash values of these nutrients will require checking into retail selling prices for your area.

For rough formulation evaluation, compute the price per pound of actual nitrogen (N), phosphate (P_2O_5), or potash (K_2O). This is done by dividing the cost of material per 100-lb. bag by the percent of material in the bag. Sample percentages are given below:

Ammonium sulfate	21%	N
Ammonium nitrate	34%	N
Blood meal	13%	N
Muriate of potash	60%	K_2O
Potassium sulfate	51%	K_2O
Triple superphosphate	44%	P_2O_5

For example: What is the cost per pound of actual nitrogen in an 80-lb. bag of ammonium sulfate? Based on local retail price, the bag would cost about $3.95. Divide this by 21% of 80 lbs., or the amount of actual nitrogen in the bag. This figure, which can be obtained from Table 1, is 16.8 lbs. Therefore:

$$\frac{\$3.95}{16.8 \text{ lbs.}} = 23.5¢ \text{ per lb.} = \text{cost of actual nitrogen}$$

In general, it will be found that nitrogen costs about three times as much as potash, and that phosphate costs about twice as much as potash. This gives N a value of about 24¢, P_2O_5 a value of 16¢, and K_2O a value of about 8¢.

The approximate worth of materials in 100 lbs. of 10:6:4 fertilizer would then be: 10x24¢ + 6x16¢ + 4x8¢ or $2.40 + $.96 + $.32 = $3.68. When thinking of mixing your own, don't forget to add costs of mixing, packaging, warehousing, and labor of handling bulk over packaged fertilizers (see Table 3).

For a more exact cost determination, price out all basic ingredients to cents-per-pound and insert into this formula:

XA + YB + ZC = value of 100 lbs. of mix
X = cost/lb. of actual N
Y = cost/lb. of P_2O_5
Z = cost/lb. of K_2O
A = % of N in formulation
B = % of P_2O_5 in formulation
C = % of K_2O in formulation

*Actual cost figures then become:

X (23.5¢) x A (10)	=	$2.350
Y (16.9¢) x B (6)	=	1.014
Z (7.9¢) x C (4)	=	.316
		$3.68

Or, a value of $3.68 for raw materials in 100 lbs. of the fertilizer mix—close either way it's computed. A little pencil-and-paper work with these charts and formulas can remove a great deal of confusion and save many dollars in wasted expenses. Remember, consider labor costs, too, if mixing your own fertilizer.

Also, when thinking of fertilizers, be sure you are supplying your plants with the materials they need. Many established landscapes and turf areas can benefit from added iron and trace elements. If these are to be included in the fertilizer mix, add approximately 75¢ to the value of a 50-lb. bag.

Let's follow through with a fertilizer problem:

Fertilizer A is a 6:22:16 mix, sells for $7.50 per 50-lb. bag, and is listed to cover 10,000 sq. ft.

Fertilizer B is a 22:7:15 mix, sells for $7.95 per 50-lb. bag, and is also listed to cover 10,000 sq. ft.

*Based on the Salt Lake City, fall 1966 list prices.

Problem: 25,000 sq. ft. of turf needs a 3:1:2 fertilizer, applied at 2 lbs. actual N per 1,000 sq. ft.

From Table 2, we find that fertilizer "A" will require 33.3 lbs. of material to provide 2 lbs. of nitrogen. Multiply 33.3 lbs. by 25 (thousand square feet to be covered). This gives 832.5 for the total pounds of "A" required. Thus, 17 50-lb. bags of "A" would be needed at a cost of $127.50.

Fertilizer "B" will require 9.5 lbs. of material to yield 2 lbs. of nitrogen. Multiply 9.5 by 25, which gives 237.5 for the total pounds of "B" required. Only five 50-lb. bags of "B" would be needed at a cost of $39.75, a savings of $87.75 over fertilizer "A", not including the additional savings in labor from handling 600 lbs. less material.

Also, if "A" had been selected, an excessive buildup in phosphate and potash reserves would have resulted. Cutting the quantity would only have caused a shortage of nitrogen.

Do You Consider These Factors Before Buying Fertilizers?

1. Fertilizers vary greatly in price because of *nutrient content, ingredients, form, added materials, and package size.* Are the more expensive products worth the additional cost? After considering these factors, you may decide they are. Or, you may decide that the least expensive fertilizer is satisfactory for your needs.
2. *Nutrient content.* Products containing a high percentage of plant nutrients cost more per pound than those containing a smaller percentage of nutrients. For example, 1 lb. of 10-20-10 contains the same amount of nutrients as 2 lbs. of 5-10-5. But, an 80-lb. bag of 10-20-10 may cost only one-third more than an 80-lb. bag of 5-10-5. For greatest economy, buy fertilizer for its weight of nutrients, not its total weight.
3. *Ingredients.* Products containing slowly available forms of nitrogen (as ureaform and other organic sources) cost more per pound than those containing quickly available forms. Before plants can make use of the nitrogen in a fertilizer mixture, the nitrogen source material must break down into soluble forms, nitrates or, in some cases, ammonia. More expensive forms of nitrogen break down slowly and release nitrogen to plants over a long period of time. Less expensive nitrogen fertilizers are already in available form; they can be used by plants immediately.
4. *Form.* Pelleted or granular fertilizers, and soluble fertilizer concentrates cost more than powdered materials. However, they may be a lot more convenient to use. Powdered fertilizers can be objectionable because they are too dusty, particularly on windy days. They may become damp, and cake, and fail to feed evenly through fertilizer spreaders. And they may stick to plant foliage, causing fertilizer burn. On the other hand, pelleted materials spread readily and roll off plant foliage, reducing burn hazard. Fertilizer concentrates, mixed with water, are readily available to plants, and some nutrients are absorbed by plant leaves. Because materials are considerably diluted in application, there is little danger of damaging foliage.
5. *Added materials.* Adding trace elements, insecticides, or weed killers to fertilizers increases their cost. Usually, these added components cost more when bought in combination products than when bought separately. Combinations may be more convenient to use since only one application is necessary. However, their misuse can kill desirable plants or make soil unproductive.

   Trace elements (more properly, micronutrients) are essential to plant growth, but are needed only in very small amounts. Known micronutrients are iron, manganese, zinc, copper, molybdenum, boron, and chlorine. There may be others. Do not apply trace elements routinely; an overabundance may be toxic to plants.

   Combinations of fertilizer with insecticides or herbicides are generally designed for lawn use. They may be satisfactory *if* the proper season for applying both fertilizer and pesticide is the same, and *if* nutrient content and pesticide concentration are so adjusted in combination that both are applied at the proper rate.
6. *Package size.* Fertilizer in small containers costs more per pound than the same product in larger containers. Packaging costs account for much of the expense of fertilizer merchandising. Paying the higher rate for smaller containers is justified if only a small amount is needed, if the ease and time saving of handling smaller packages is enough of an advantage, or if storage of large packages is a problem.

Based on material prepared by Soil and Water Conservation Research Division, Agricultural Research Service, U. S. Department of Agriculture, as abstracted from Massachusetts Turf Bulletin.

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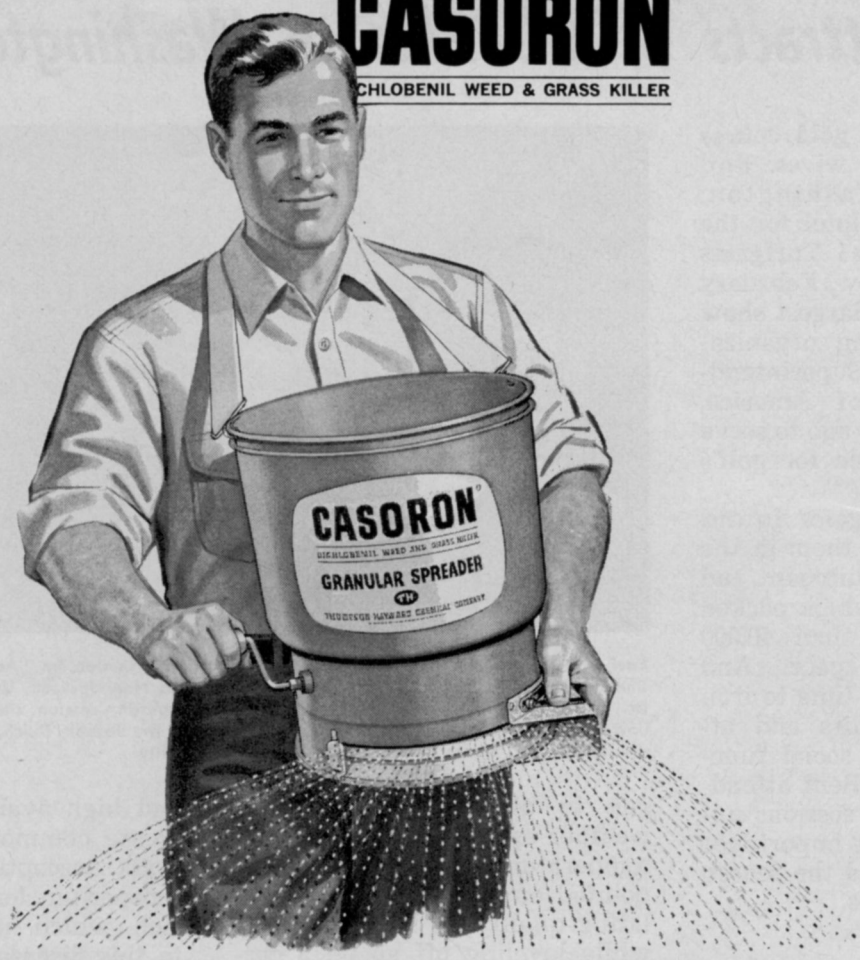

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Recordbreaking International Turf Show Attracts 3,000-Plus to Washington, D. C.

More than 3,000 golf course superintendents, wives, and guests crowded Washington, D.C.'s new Hilton Hotel for the 38th International Turfgrass Conference and Show, February 5 to 10. It was the largest show since the sponsoring organization, Golf Course Superintendents Association of America, was formed 40 years ago to serve as the national voice for golf's turfmen.

Registered delegates found ample time allotted them in the schedule to visit equipment and chemical displays, which packed the Hilton's more than 40,000 sq. ft. of exhibit space. And there was plenty of time to iron out association affairs and attend the numerous social functions. But, the excellent attendance at educational sessions underlined the pressing importance of turf problems and the search for better techniques.

Turf specialists who addressed GCSAA's educational session on "Advancements in Research" line up for WTT's camera. From left to right are Dr. Noel Jackson, University of Rhode Island; Dr. A. A. Hanson, USDA, Beltsville; Dr. M. H. Ferguson, session chairman, from Texas A&M University; Dr. Eliot Roberts, Iowa State University; Dr. Joseph Duich, Pennsylvania State University; and Dr. James Beard, Michigan State University.

Disease Comparisons And Nitrogen Effects

Dr. Noel Jackson, Assistant Professor of Plant Pathology, University of Rhode Island, Kingston, led off technical reports with a comparison of disease problems in the United States and Great Britain. Examining the two countries in perspective, Jackson noted that, as standards of turf management improve, problems—notably turf diseases — increase correspondingly. He generalized that British turf management practices "tend toward the necessary minimum, while in the U.S. they tend toward the maximum." Hence, more disease problems in this country.

Terming nitrogen fertilization "one of the most important factors in maintaining turf quality," Dr. Eliot Roberts, Professor of Agronomy and Horticulture, Iowa State University, Ames, stressed that temperature is a qualifier of nitrogen efficiency. Comparing applications of nitrogen to bluegrass in the cool weather of June and the higher temperatures of August, Roberts pointed out that the turf-stimulating quality of June nitrogen, while leveling off above a certain point, is quite different from the effect of summer applications, which actually decrease grass quality when nitrogen content of foliage becomes about 4%.

Relating nitrogen to other factors, he cautioned against too-heavy fall fertilization, particularly with organic fertilizers. Though N boosts winter root development and spring recovery, an excess is apt to cause spring succulence and unreliable response to varying spring weather conditions. When it comes to severe moisture stress, Roberts indicated that lower N may stimulate root growth, though at the temporary cost of turf quality. Nitrogen should not be considered alone; in all cases, the value of nutrients depends directly on a proper relationship between the different elements, and an imbalance can cause a hard-to-correct situation.

Turning to disease problems, Roberts noted that overwatering and high available nitrogen increase common Kentucky bluegrass susceptibility to Helminthosporium leaf spot, while Merion, which has good resistance to this disease, is better able to resist rust when it receives extra midsummer nitrogen and frequent watering. Iowa tests have also correlated incidence of dollar spot in highly susceptible Washington bentgrass to the amount of nitrogen fertilization; more N equals less disease. However, Roberts said, the source of N is a most important factor in this case, with activated sewage sludge giving best results.

Also on the subject of turf fertilization, Dr. A. A. Hanson, USDA, Beltsville, Md., reported results of greenhouse experiments conducted with Dr. F. V. Juska on the upper limits of turf tolerance to phosphorus. Red fescue, Merion, and common Kentucky all proved to have a high phosphorus tolerance, with no harmful effects noted even at extreme levels. However, there was an indication that high phosphorus may have an effect on some preemergence herbicides, a factor said to need further evaluation under actual conditions.

Soil Modification Report

Dr. Joseph M. Duich, Associate Professor of Agronomy at Pennsylvania State University University Park, reported preliminary results of tests with 81 soil mixtures studied under putting green management.

Water infiltration rate was considered the most reliable index of what was occurring in the plot, Duich said, but he cautioned that desirable rates cannot be standardized but must depend on grasses, climate, irrigation system, and other local factors. In Penn State plots, heavy compaction was applied to various combinations of sand, peat, and soil, with a substantial reduction of infiltration rates. The definite trend toward decreasing infiltration over a four-year test period spotlights the need for long-range research, Duich commented.

Coarse sand (5-Q) proved best in easing compaction, with a rapid increase in effectiveness as sand content was increased from 40% to 80%. However, infiltration in these plots also decreased greatly over the test period. Fine sand increased infiltration the least but showed a less drastic decrease. Concrete sand proved intermediate. With sand-modified plots (as with calcined clay and slags also tested), Duich concluded that "the effectiveness of sand type over a period of years is primarily determined by size and range of particle sizes and the gap between silt and the most predominant sand size."

Growing Grasses in Shade

Estimating that about 20% of the turfgrass area in the U.S. comes under the influence of shade, Dr. James B. Beard, Assistant Professor in Crop Science at Michigan State University, East Lansing, cited several shade factors that alter grass growth and cause management problems.

Shade will be the greatest problem where there is a dense stand of trees, forming a thick canopy able to screen out as much as 95% of radiation. This causes reduced light intensity, altered light quality, moderation of temperature extremes, restricted wind movement, increased relative humidity, increased intensity and duration of dews, decreased carbon dioxide in the air, and tree root competition for water and nutrients.

Trees respond to these conditions with reduced root and shoot growth, and reduced rhizome or stolon growth. In general, root growth decreases more rapidly than topgrowth, lowering the ratio between the two. Turf density is reduced and a more upright growing habit is noticeable. At Michigan State, test plots were established under a dense sugar maple canopy to study the effect of shade on different grasses.

Beard's conclusion: grass responses are primarily to diseases rather than to such factors as moisture, etc. While shade-planted Merion and common Kentucky bluegrasses never recovered from disease attacks, Pennlawn red fescue grew stronger and was the only individual grass to increase in density over a three-year period, though a mixture of 33% each of Pennlawn, common Kentucky, and roughstalk bluegrass showed highest density at the end of the test period. Mixed stands moderated the severity of disease attack on any species.

Beard offered these suggestions for growing grass successfully in shade: use adapted grass species, such as Pennlawn, St. Augustine, and improved Bermudas; raise mowing height; avoid excessive nitrogen; use deep but infrequent irrigation; and avoid excessive traffic. Managing trees will also help: prune limbs up to 8 to 10 ft.; thin limbs in crown area; remove surplus shrubs and brush; pick up fallen leaves immediately; and avoid surface tree feedings under dense shade.

Of Crabgrass and Insects

"Of course crabgrass is here to stay," Dr. Ralph Engel, Professor of Turf Management, Rutgers University, New Brunswick, N. J., told turfmen. But even so, it's not the problem it was 20 years ago. Giving much of the credit to preemergence herbicides, the Rutgers expert advised turf managers not to be frightened from their use by an unsuccessful experience.

Choose the correct chemical. On the basis of his research experience, Engel singled out DCPA, DMPA, and siduron. Apply most preemergents in dry form for best results, and apply at the right time of year. Respect the tolerances of a given grass, and use extreme care to get an even application at the correct rate.

John C. Schread, Entomologist

New officers of the Golf Course Superintendents Association of America. From left to right: Walter Boysen, superintendent, Sequoyah Country Club, Oakland, Calif., president; Director Robert Mitchell of Sunset Country Club, St. Louis, Mo.; James Brandt, vice president, from Danville, Illinois Country Club; Keith Nisbet, director, from Westview Golf Club, Aurora, Ontario, Canada; and Herman Johnson, director, from Quail Creek Golf and Country Club, Oklahoma City, Okla.

WHIZARDS

Small International® fleet handles all the

Palma Ceia Country Club observed its 50th anniversary at Tampa, Florida, last year. Its annual tournaments include the Florida Seniors and the Gasparilla Festival. Members are challenged by huge, ominous traps and by more than 500 trees—a dozen varieties ranging from banana and mock orange to holly and weeping willow. All fairways are underground irrigated and kept clipped to one-half inch. Superintendent Kelly Kee says, "My members insist on seeing that ball from tee to green." Palma Ceia is one of the most demanding, high-maintenance mowing jobs of any club in the country. That makes Mr. Kee an International man. All International.

OLD FAITHFUL This is one of two 5-year-old IH tractors which have carried the mowing load for five years—gang mowing fairways and flail mowing the rough. Mr. Kee says, "We haven't had a total of 3 days down time since we got them."

EXACT FIT Mr. Kee says this new 2424 Lo-Boy® is sized just right for his operation, and foresees a time soon when two of them with the 3414 will handle all his maintenance. The IH fleet is expected to do all construction, too. This year, for instance, four greens will be torn out, reshaped and rebuilt in a major modernization program.

year round maintenance at demanding Palma Ceia Country Club

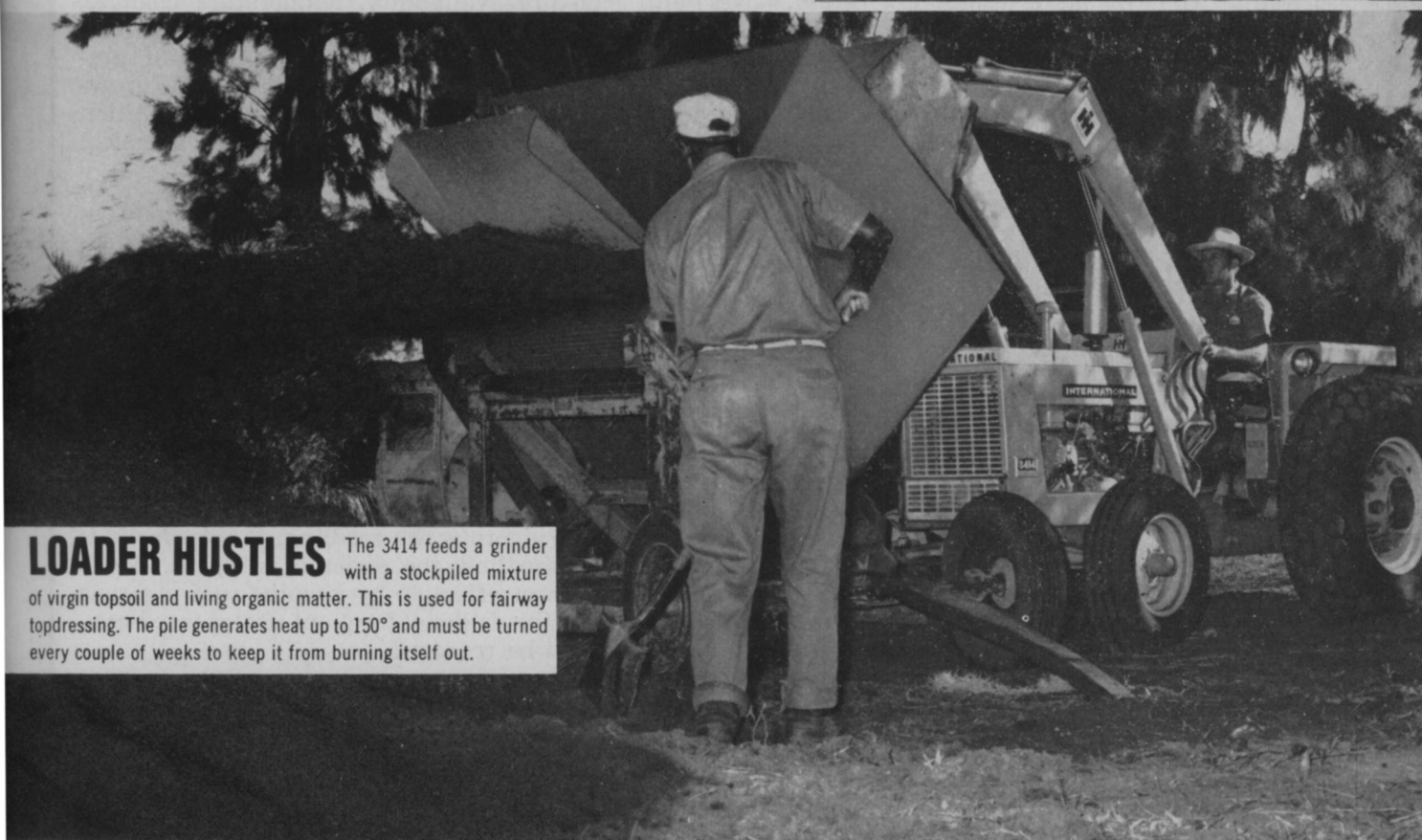
What about your course? Demanding? Your IH dealer has an exact fit for any golf course maintenance problem. Usually the best answer to be found. After all, he represents the most complete line of tractors and flail, rotary and cutter bar mowers in the industry. Talk to him soon about a demonstration. International Harvester Company, Chicago 60690.

INTERNATIONAL HARVESTER COMPANY

The people who bring you the machines that work

Mr. Kee has been in turf work for 43 years, supervises 15 men year-round at Palma Ceia. Of his 3414 loader tractor he says:

"We bought that one on competitive demonstration—looked at others just to make sure we weren't wrong sticking with International. And we weren't. The 3414 was tops. We use it for everything. It handles topsoil, pulls the aerator, gang mows, and serves as a scraper on our maintenance roads. We use it with a disc for rebuilding tees, pull out posts and stumps with a chain, and even carry sand a bucket at a time from a central pile to our bunkers. That way we avoid the compaction of a truck."



LOADER HUSTLES The 3414 feeds a grinder with a stockpiled mixture of virgin topsoil and living organic matter. This is used for fairway topdressing. The pile generates heat up to 150° and must be turned every couple of weeks to keep it from burning itself out.

at the Connecticut Agricultural Experiment Station, New Haven, cited the frit fly, clover weevil, and European chafer as newer insect problems for turf managers to contend with. Frit fly damage is already a fact; clover weevil damage has been noted on golf courses in New York; and the European chafer is posing a problem similar to other white grubs, such as that of the Japanese beetle.

Schread pointed to these controls: DDT seems to be lessening in its control of the frit fly, but lead arsenate has given satisfactory results; in two locations, dieldrin and Diazinon have controlled the clover weevil; and chlordane and dieldrin are now in common use against chafers.

Noting changes in insecticide recommendations because of pest resistances, Schread used frit flies and DDT as an example. Another is the chlordane-chinch bug relationship, which is often unsatisfactory nowdays from the turfman's standpoint. Diazinon, ethion, Sevin, Trithion, and Baygon have killed chinch bugs and are in wide use in place of chlordane, Schread stated.

GCSAA's '67 election produced the following officers for the coming year: president, Walter R. Boysen, Oakland, Calif.; vice president, James W. Brandt, Danville, Ill.; rechosen secretary-treasurer was John J. Spodnik, LeRoy, Ohio. Plans are already underway for 1968's "Greatest Show on Turf," due to convene in San Francisco, Calif.

(For a detailed report of sod producer activities, held in conjunction with this year's turf meeting, turn to *WTT's* Sod Industry Section, page 26).

VPI Turf Course Described

A new leaflet, describing opportunities in turf ecology and Virginia Polytechnic Institute's four-year Turf Option in the Department of Agronomy, has just been made available by the school. To obtain a copy or more information about the study program, contact Dr. H. L. Dunton, Head, Department of Agronomy, Virginia Polytechnic Institute, Blacksburg, Va. 24061.

Fertilizing Helps Turf Crowd Out Weeds

(from page 14)

improved turf vigor, not all of nitrogen's value going to benefit crabgrass.

Seedbed nitrogen was more help in combating crabgrass in Merion than was maintenance nitrogen. However, only when maintenance levels were low was seedbed nitrogen of value in suppressing crabgrass in Kentucky bluegrass-red fescue turf. It is apparent that grasses and grass mixtures vary so greatly in their response to fertilization that changes in the competitive nature of the grasses affect weed infestations.

Maintenance Nitrogen Combats Dandelions

Relations of seedbed and maintenance nitrogen treatments to dandelion infestation was also studied in this field experiment (see Table 6).

Maintenance nitrogen had a pronounced effect on numbers of dandelion plants found in Merion bluegrass turf. Plots having high seedbed nitrogen produced fewer dandelions than those with low seedbed nitrogen except where Merion was maintained under high levels. In this case, there was no significant difference, and the value of maintenance nitrogen was so pronounced that it masked any effect of seedbed application. In general, maintenance nitrogen did more to reduce dandelion infestation than did seedbed treatments.

Thus, the perennial weed, dandelion, competes with turfgrasses differently from the annual weed, crabgrass. Getting new turf off to a fast start with plenty of nitrogen helps more to slow down and keep out crabgrass than dandelions. On the other hand, continued fertilization as a regular maintenance practice proves a greater asset in keeping dandelions out than in preventing crabgrass infestations.

Findings and Recommendations Summarized:

Crabgrass seedling vigor is influenced by watering and by competition from bluegrass. In turn, competitive nature of bluegrass varies with moisture availability, temperature changes, and fertilization practices. These weed-turfgrass growth relationships are important to predict the effectiveness of preemergence crabgrass killers. A crabgrass seedling that is growing well because of relatively moist soil or lack of competition from bluegrass will more likely escape the effects of a chemical weed killer than a slow-growing seedling.

With preemergence herbicides, fertilize turf well and so water it that a dense grass cover is produced prior to crabgrass germination. Adequate nitrogen in the seedbed of a newly established turf is good insurance against crabgrass. Use of extra nitrogen from ureaform sources has proved of value to get turf off to a faster start. In this way, bluegrass turf can help make a chemical crabgrass control treatment more effective.

Regular fertilization of established turf, particularly during late summer and early fall, will help cut down populations of dandelions and other weeds. Remember, the vigor of weed seedlings has an influence on how readily they are controlled by chemicals. The more vigorous the seedling, the harder it is to kill; the weaker the seedling, the easier it is to kill. Make chemical weed control most effective by keeping turf vigorous and competitive. Where this is done, frequent use of weed control chemicals should not be required.

Sodmen Move to Form National Group

Meeting in the Washington (D.C.) Hilton Hotel in conjunction with the 38th International Turfgrass Conference, sodmen from around the country took initial steps to form a national association of sod producers.

Action came at the Thursday, February 9, sod session, chaired by Dr. Henry Indyk, Rutgers University extension specialist. "In the absence of a formally organized national sod producer organization, a program committee with representation from the sod industry and educational institutions scheduled the Sod Producer Session to provide producers an opportunity to meet on a national basis to discuss developments as well as problems pertinent to the rapidly growing sod industry," Indyk told *WTT*.

Opening the discussion of a national group, Indyk announced that the Mid-America and New Jersey sod associations had formally voiced approval of a national organization, and that support had been received from other groups and producers.

With an eye toward a committee representing as wide an area as possible, these sodmen were chosen to study details for the proposed association: Wiley Miner, Princeton Turf Farms, Inc., Cranbury, N.J.; Ben Warren, Warren's Turf Nursery, Palos Park, Ill.; Tobias Grether, California Turf Nurseries, Camarillo, Calif.; James E. Ousley, Ousley Sod Co., Pompano Beach, Fla.; and Eugene D. Johanningsmeier. Hiram F. Godwin and Son, Inc., South Lyon, Mich. Named to the committee in an advisory capacity was George Hammond, Paint Valley Bluegrass, Columbus, Ohio.

This year's sod program came in two parts, a morning session for producers and an afternoon session arranged by the GCSAA program committee. Next year's program will be up to the committee formed at this meeting.

Maryland Researches Sod

Leading off educational talks on the producers' program, Dr. Elwyn Deal, turf specialist from the University of Maryland, College Park, cited the growing consumer demand for only highest quality sod. Noting that there has been almost no research to date on sod production as such, Dr. Deal suggested that the three greatest agronomic problems facing the industry were rhizome development, root development, and numbers of roots and rhizomes in sod grasses.

Dr. Arne Hovin (left), USDA turf researcher, makes a point during sod producers' discussions, as Dr. Henry Indyk, Rutgers extension specialist, looks on.

How important is rhizome development? Deal pointed to recent instances of Merion sod with good rhizome development, which nevertheless failed to hold together when cut. This is an important factor when it comes to reestablishing cut sod, but it remains to be seen how important it is to the physical handling of sod.

Grasses need a good network of roots. But, how deep do they need to be? Only in the upper ½ in. to 1 in. for harvesting, but deeper roots are needed to survive under sod field conditions.

How does population density of grasses tie in? As population density increases beyond a certain point, size of individual plants decreases and when these begin to compete with each other there will be fewer roots per plant. Management practices will largely determine density and development, Deal said. As examples, overfertilization with nitrogen and overirrigation will interfere with root development. Also, mowing too often, too closely, will hamper roots and rhizomes. A 2-in. cut at intervals of a week or more is preferable to a 1½-in. cut at twice weekly intervals.

Important for producers is the manner in which sod holds together and the techniques that will produce a well-knit product. Extensive tests are underway at the University of Maryland in an effort to find out just how these factors relate.

Consider Roots and Tops

"Any long-term benefit to grasses can be achieved only if maintenance practices favor both roots and tops," Dr. R. E. Schmidt, Assistant Professor of Agronomy from Virginia Polytechnic Institute, Blacksburg, told sodmen. Leaf and root development can not be divorced; they are closely related in good grass production.

Mowing practices, moisture availability, light intensity, soil pH, temperature, and nutrition are major factors in grass production. Emphasizing nutrition, Schmidt said that as long as there is sufficient K_2O and P_2O_5 present, grasses will develop adequate roots *if* nitrogen fertilization practices do not interfere.

Nitrogen application must be carefully managed. This element

is needed for root growth, but too much will favor tops at the expense of roots. There is a big difference between adding nitrogen where none is present and overapplying nitrogen where it is already present at low levels.

Turning to other management factors, such as thatch formation and watering, Schmidt told growers they should be shooting for a 12- to 18-month production period for sod; with good management, thatch should not be too much of a problem in that time. When it comes to watering, the fine line between letting soil get bone dry and letting it dry out a bit should be observed. A bit of dryness is desirable for root growth, while higher mowing, less frequent mowing, and adequate phosphorus and potassium fertilization will help sod get through periods of drought with good recovery.

Drs. Elwyn Deal (left, from the University of Maryland) and R. E. Schmidt (right, from Virginia Polytechnic Institute) compare slides presented to sod gathering.

Wiley Miner, head of Princeton Turf Farms, spoke on industry mechanizations and sod specifications. At the a.m. producers' session, he was named to the national committee.

Sod producers Eugene Johanningsmeier (left) and Ben Warren (right) were both selected to serve on the committee investigating formation of a National Sod Producers' Association.

"Sprigging and Plugging" panelists (left to right), Tobias Grether, Wade Stith, and James E. Ousley, wait for session to get underway. Grether and Ousley are also committeemen for the proposed national sod group.

"Interim" Grass Varieties

The ideal new turfgrass for the bluegrass region should be resistant to the diseases (such as stripe smut, rust, powdery mildew, and fusarium) that are now attacking Merion, Dr. Arne Hovin, USDA, Beltsville, Md., told producers.

Ultimately, hybridization will be employed to combine disease-resistant grasses, Hovin said. For the present, some of the newer varieties show promise: Scott's Windsor; Chicago Shade, developed by Warren Nurseries; Park, which is well adapted to cooler areas of the bluegrass region; 0217, or Fylking bluegrass; and Delft, a prostrate-growing Dutch development.

Of warm-season grasses, Tifgreen "will be replaced by Tifdwarf," the first true dwarf Bermuda, Hovin predicted. Santa Ana, a West Coast development, was also cited as promising. Among zoysias, there has been no great improvement in billbug resistance, though Emerald is somewhat better than Meyer zoysia in this respect.

Also addressing the producers' gathering were Wiley Miner, president of Princeton Turf Farms, Cranbury, N.J., and Professor Wallace A. Mitcheltree, of Rutgers University.

Tracing the development of Princeton Turf Farms' new sod harvester, which is now available commercially, Miner predicted that producers will eventually have to employ mechanical harvesting techniques if they are to survive in the industry. This leads to another consideration, Miner noted: pro-

ducers will need a high quality of sod in order to handle it mechanically.

Begin Before the Beginning

"What is done before starting to grow sod can have a lot to do with what the end product will be," Dr. Deal told the afternoon sod session held jointly with golf superintendents.

Of prime importance in preparing for sod production are the selection of a suitable soil, adequate grading and leveling, adequate nutrition, and good planting practices. For sprig production, a light, sandy soil is satisfactory. But, for producing plugs or sod, a heavier soil is required. Fields should be graded until they are gently sloping. Most important, sunken patches, or water pockets, must be eliminated. Calling this a big cause of trouble for many farms, Dr. Deal recommended fallowing the field for several months before planting. This allows soil to settle so that trouble spots can be corrected, and also allows time for weed elimination.

In the early stage of grass establishment, lime and phosphorus are more critical needs than nitrogen and potash, which can best be added later. Lime and phosphorus should be thoroughly mixed throughout the top 3 or 4 in. of soil. When planting, seeding in two directions at right angles to each other is suggested. For final seedbed preparations or maintenance operations, tractor tires with cleats or lugs should not be used. This is another common cause of sod loss, Deal explained.

Why Vegetative Establishment?

Defining vegetative establishment as the use of mature plant tissues for establishing a plot of grass, Ben Warren, president of Warren's Turf Nursery, examined the advantages of this practice as it applies to both whole sod and use of plant parts, such as plugs, sprigs (stems), and stolons (stems chopped into fine pieces).

Chief characteristic of whole sod is the "immediacy" of establishment, according to Warren. A grass cover is immediately available to control erosion, or form a playing surface, or serve an aesthetic purpose. Only a short critical maintenance period of two to three weeks is required after establishment; then, normal maintenance is possible. Further advantages include purchase of a finished product, which can be examined for quality, and flexibility of installation—any time the ground can be worked.

Establishing plugs, sprigs, or stolons is often a matter of necessity when grass varieties do not reproduce from seed, or have a poor seed yield, or seed is difficult to germinate, or reproduction from seed is not consistent. Here again, establishment is marked by a shorter intense-care period and a somewhat more flexible planting schedule.

Growing, Buying, Selling Sod

Placing greatest emphasis on the importance of a *uniform* stand of sod, Dr. Indyk offered some suggestions for producing quality grasses. After selecting well-drained land with an abundant water supply and a minimum of hard-to-control weeds, and after adequate seedbed preparation, the grower must seed carefully. Late summer and early fall seedings usually perform best, often outstripping seedings made in the spring of the same year. Also, light to medium seeding rates are most desirable if grasses are to develop a good root and rhizome system.

After seeding, a constant and closely watched maintenance program will bring sod to maturity, at which time it should be thin-cut (¾ in. to 1 in. thick). Thick-cut sod complicates handling and reestablishment.

What factors should the sod purchaser consider? Wiley Miner enumerated these points: suitability of grass type to the intended area and purpose; source and maturity of sod; quality, including uniform density, texture, and color, and freedom from plant and insect pests; thinness of cut; short time lapse between lifting and installing; and such installation factors as sodbed preparation, laying, rolling, and watering sod, and main-

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6 gals. EMULSAVERT 100 plus ⅔ gal. TRANSVERT in 24 gals. volume per acre. Apply through the Amchem SPRA-DISK® when brush is in full leaf and growing actively.

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Watch for more detailed Aerial prescriptions in the April issue.

GROUND FOLIAGE

CROPPED OR NON-CROPPED AREAS

1) 2 gal. T-D-B/100 gals. water. Apply to thoroughly wet foliage and stems to groundline when brush is in full leaf and actively growing.
2) 1⅓ gals. EMULSAMINE BRUSHKILLER/100 gals. water. Apply as in (1) above.

Watch for more detailed prescriptions for Ground Foliage Spraying in the June issue.

DORMANT SPRAYS

BRUSH DENSE **CANE BROADCAST**

1½ gals. DINOXOL/ 100 gals. fuel oil. Spray to thoroughly wet dormant canes and root collar zone. Spray exposed roots and suckers.

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4 gals. DINOXOL in 100 gals. fuel oil. Thoroughly wet base of clumps until solution puddles around root collar.

Watch for more detailed prescriptions of Dormant spray techniques in the September issue.

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taining the grass during its early, critical period.

"A sound, functional sod certification program can help bring a better quality sod to the market," J. L. Newcomer, University of Maryland professor, related. With the wide range in quality of sod being sold around the country, at least six states have cultivated sod certification programs underway, and the International Crop Improvement Association Grass Committee is working on General Certification Standards for Sod. Why certify? "Certification can help in marketing of quality sod of named varieties," Newcomer stated. The general public, and particularly architects and builders, want and need more information on suitable grasses and the assurance they are getting what has been requested.

Panel Views Sprigs and Plugs

"Rooting of stolons or sprigs is affected by the same three basic elements as seed: water, heat, and oxygen," Tobias Grether, president of California Turf Nurseries, told the joint meeting of golfmen and sodmen. Considering establishment characteristics of both bents and Bermudas, Grether outlined some basics for a good stand from stolon or sprig plantings.

Bents are easier to germinate and grow, though depth of planting is a critical factor. Intimate contact of stolons with soil must be established in the top ¼ to ⅜ in. of soil. Constant watering to nearly field capacity is then required. Temperature can range from a daily average of 38° to 90°, with the optimum growing temperature at 60° to 70°.

Planting Bermuda stolons is a more critical operation, and greater care must be taken to get intimate contact between soil and stolons, since material left on the surface will generally desiccate. Just as it is important to avoid planting Bermuda stolons in a dry soil, irrigation is required almost immediately after planting. Temperature average must be at least 50° with no frost to establish Bermudas and zoysias.

Describing sprigging and plugging as "the most popular methods of vegetative propagation of large turf areas in the Southeast," James E. Ousley, president of Ousley Sod Co., pointed out that bermudagrass, zoysiagrass, and creeping bent are generally sprigged, while St. augustinegrass and centipedegrass usually give better results from plugging.

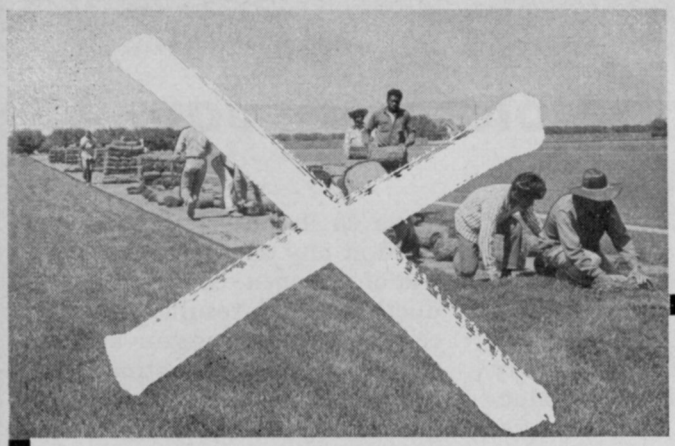
Sprigging is most commonly used on large turf areas, and gives faster, more uniform coverage than plugging. It is less expensive but more susceptible to weather changes and requires greater initial irrigation. Plugging carries a higher planting cost but is desirable where only limited water is available.

Wade Stith, West Point Products Corp., West Point, Pa., emphasized temperature and moisture as determinants of how well harvested stolons will stand up. "Excessive moisture can cause disease and loss of grass and a poor stand, while dryness can cause death when stolons are planted," he related. Experiments with refrigeration of harvested grasses have shown that they can be kept in excellent condition for several weeks as long as the temperature is maintained at the proper level.

A short question and answer session followed up the "Sprigging and Plugging" forum, with much of the discussion aimed toward Ben Warren's contention that seeded Penncross bent will show considerable variability in color, texture and disease behavior when observed in space plantings.

Harder Publishes Price List

Harder Arborist Supply Company, New York distributors of a complete line of tree surgeon's tools and supplies, as well as of pesticides for arborist use, announces the availability of new price lists for both chemicals and equipment. Interested treemen can obtain a copy by writing the company at 63 Jerusalem Avenue, Hempstead, New York 11551.



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OSU Short Course Talks Turf in Columbus, Jan. 23

Turf managers, arborists, landscape contractors, garden center operators, and nurserymen all had sessions aimed to their interests during the 38th Ohio State University Short Course, January 23 to 26 in Columbus, Ohio. Opening day of this year's short course saw treemen discussing plant identification, research, and problems of municipal, industrial, and utility arborists. At the same time, turf talks opened with a discussion of the sod industry by Dr. James Beard, Michigan State University agronomist.

Citing a twentyfold increase in Michigan's sod production, from one thousand acres in 1955 to more than 20,000 in 1965, Beard said this is due in part to the fertile soils of the eastern half of Michigan's lower peninsula and to the cool, favorable summer temperatures. Adding to the great increase in quality commercial sod has been the decrease in use of low-quality pasture-stripped turf, aside from occasional roadbank plantings.

Beard suggested these seeding rates for establishing new stands of sod: bluegrass, 25 to 40 lbs. per acre; red fescue, 60 to 100 lbs. per acre; bluegrass-red fescue mixtures, 35 to 65 lbs. per acre. Exceeding these rates will give a heavy stand of young seedlings, which will develop into sod slowly due to competition for light. Factors which play a part in selecting proper seeding rates were described as: percent of seed germination, seed purity, seedbed condition, time of seeding, rainfall and irrigation, and temperature.

Proper mowing techniques will do much to determine the quality of a turfgrass crop, Beard continued. Mowing should be frequent enough to remove no more than a third of the foliage. New vegetative growth is stimulated by severe defoliation, with a consequent reduction in the rate of rhizome and sod formation. In addition, thatch appears to be more of a problem when grass blades are cut to longer lengths. Very low cutting heights (about ¾ in.) appear to stimulate turf density and increase rhizome production, the Michigan researcher reported. But he suggested that this practice not be used commercially until further research has been conducted, since other considerations are involved.

Beard recommended these rates for applying nitrogen to sod growing on organic and mineral soils (in lbs. of N per acre):

	Organic	Mineral
Merion	120-180	240-320
Common Kentucky	80-120	80-160
Red fescue	40-75	60-100

Nitrogen fertilization is affected by rate of release from soil and by irrigation and rainfall. Intervals of four to six weeks were suggested between application, with no more than 40 to 60 lbs. of N per acre applied at any one time. Improper use of nitrogen, causing root reduction in sod, results from: excessive total nitrogen application, with a resultant stimulation of top growth; excessive nitrogen at any one feeding; or application of too much nitrogen at high temperatures, bringing about rapid release from the soil and slowdown in plant growth.

With the application of good management procedures, Beard forecast that many growers may soon be getting three crops every two years. Once the sod is stripped, however, postharvest problems arise, one of the most common being sod damage from high temperatures during shipping and storage. Referring to a study in which thermocouples were placed in stacked sod, Beard recounted that damage occurred at temperatures of 100° to 105°, too low for standard heat damage. This might be attrib-

Ohio turf specialists, Dr. Merle Niehaus (left, at the microphone), and Dr. R. R. Davis (standing, right) addressed turfmen at The Ohio State University's annual short course.

Dr. L. C. Chadwick (right) secretary of the Ohio Chapter, ISTC, congratulates T. D. Neil, of the Ohio Power Co., Canton, on his election as chapter vice president. Chosen president of the Ohio group was Harold C. Simon, of the Natorp Landscape Organization, Cincinnati.

uted, he felt, to a gaseous interchange of some sort.

Sod Motivates Seed Purity

The sod industry has been a prime motivating factor in the demand for higher seed purity, Dr. Robert Schery, Director of The Lawn Institute, Marysville, Ohio, asserted.

Among the determinants of quality grass seed are genetic, physiological, and purity factors. Consumers, boosted by new federal laws requiring publication of certain information on purity and type of grass seed, are now convinced that better grass varieties are available. Better seed depends on such a complex of elements that watering and fertilizing treatments given parent plants may even show up in seeds.

Turning to purity—freedom from contaminants such as chaff, weeds, and unwanted grass seeds —Schery referred to a survey in which 1707 assorted seed samples were analyzed for contamination by noxious plants. Findings were compared to a listing of all reported noxious plants. It is interesting to note, Schery said, that most reported noxious weeds did not even occur in the samples, and of those that did occur, most can be easily controlled with chemicals.

Bad Year for Bluegrass

Turning to grass breeding research at the Ohio Agricultural Experiment Station, Wooster, Ohio, Dr. Merle Niehaus called 1966 a bad year for bluegrass because of prolonged drought and high summer temperatures. However, adverse growing conditions greatly facilitated evaluation of tolerant varieties.

Niehaus ranked some twenty bluegrass varieties under test on the basis of leafspot occurrence, fall color, percentage of bare ground in sodded area, percentage of weeds in plots, density ratings, and melting out losses. Plots were located at Wooster, Ripley, and Columbus, Ohio, though some varieties were tested at only one location. Merion topped the list, followed by Windsor. Among the more commonly known varieties, these were followed by Newport C-1,

Campus, Newport, Prato (about midway in the standings), Park, Arboretum, common Kentucky, Cougar, NuDwarf, and Delta.

Pointing out the similarity between this composite ranking and relative resistance to Helminthosporium leaf spot, Niehaus emphasized the importance of tolerance to this disease.

No new varieties are yet available from the Ohio Station, the researcher reported, due to the time required for selection and buildup of desirable strains. Selection is the most common approach to producing new varieties of apomictic bluegrasses. Isolation of desirable phenotypes from a plot of grass, although difficult, provides the breeder with material for a conscientious program of breeding and selection, Niehaus said.

Emphasizing that the next major problem confronting the turf industry is that of getting a sound grass breeding program established, the speaker specified several ways to approach new introductions: introduction of a single line as a variety; mixing of those lines showing strong points; release of several lines with recommendations for blending; and mixing on the basis of seed productivity with a blend of the several varieties, a slow process due to the time required to test lines.

Mowing as a Science

Mowing is the most reliable way to control bluegrass flowering, Dr. R. R. Davis, Ohio State University agronomist, stated. Bluegrass normally grows with bursts in the spring and fall and a slower period of growth in the warmer summer. If permitted, it will usually flower during the late spring. However, low nitrogen levels can bring about greater flower production in some varieties.

It has been shown, Davis continued, that reduction of top growth and development, as well as of root growth, is directly proportional to clipping depth. For example, he pointed to work done with red fescue, where consistent mowing at ½ in. for a three-year period resulted in growth 40% to 75% lower than check plots mowed at a height of 2 in. Low mowing, according to Davis, not only stimulated regrowth of foliage with a corresponding decrease in root production, but greatly reduced the photosynthetic area as well. Another benefit of a 2-in. clipping height is that weed control problems are minimized because of heavier sod formation, Davis added.

Actual mowing height should depend on the use to be made of the area and the growth habit of grasses employed. Reel mowers are preferred, particularly for closer clippings. Further, turf should be mowed in different directions periodically to prevent grass from being constantly pushed at one angle. Concluding his remarks, the Ohio agronomist maintained that removing clippings after each mowing takes needed minerals from the soil, resulting in a gradual depletion of nutrients.

Weeds Defy Description

The precise description of a weed is impossible to formulate, since what may be a weed to one person is being cultivated by the next, Dr. E. W. Stroube, of the Department of Agronomy, The Ohio State University, told the turf session. Best weed controls are a dense turf providing stiff competition to germinating weed seeds, and weed-free grass seed.

Good chemical controls are available today for almost all broadleaf weeds, Stroube said. Amine form of 2,4-D can be used to great advantage, but although this form greatly reduces spray drift, spraying should still be done on a calm day with low pressures and avoidance of direct contact with desirable plants. For plants resistant to 2,4-D, silvex can be used; however, it is more powerful and requires greater care in handling. Dicamba can be used on those plants which are resistant to 2,4-D and silvex; but once again, it is still more powerful and demands even greater care. Finally, MCPP can be safely used on bents.

Although a dense turf prevents germination of much crabgrass, its eradication from turfgrasses can be accomplished with such chemicals as Bandane, benefin, Betasan, calcium arsenate, Dacthal, Tupersan, and Zytron. Stroube defined Betasan and calcium arsenate as safest on bents, and Tupersan (siduron) as safest on new bluegrass seedlings. Preemergent seedbed materials should be applied in February, March, or April, he concluded.

Bluegrass Masters Tall Fescue

With reference to the 1961 renovation of Ohio State University's football field, Dr. R. W. Miller, University agronomist, remarked that, by the end of the second football season, the new turf was entirely bluegrass, whereas the original seeding mixture had been 90% tall fescue.

Bluegrass dominance was aided by mowing at a 2-in. level, and by repeated high nitrogen fertilization. Severe winter kill of tall fescue was given as the final reason for bluegrass dominance. In an experiment to prove this point, Miller demonstrated that high nitrogen plus cold temperatures followed by warm temperatures caused a loss of much fescue. Conversely then, if it is desired to maintain a high percentage of fescue, low nitrogen levels must be maintained.

Dr. Miller is executive secretary of the Ohio Turfgrass Foundation, formerly Ohio Turfgrass Council, one of the organizations sponsoring the Columbus short course. New president of the Buckeye turf group is Harry Murray, Akron, who takes over from retiring president, Curtis Overton, of Worthington. Charles Tadge, Toledo, is first vice president; Robert Reiman, Woodville, is second vice president; and Richard Baldridge, Lima, serves as treasurer.

Other sponsors of the four-day meet were the departments of Agronomy, and Horticulture and Forestry, The Ohio State University; Ohio Nurserymen's Association; and the Ohio Chapter, International Shade Tree Conference. Cooperating in the program were the Ohio Agricultural Research and Development Center, and the Ohio Cooperative Extension Service.

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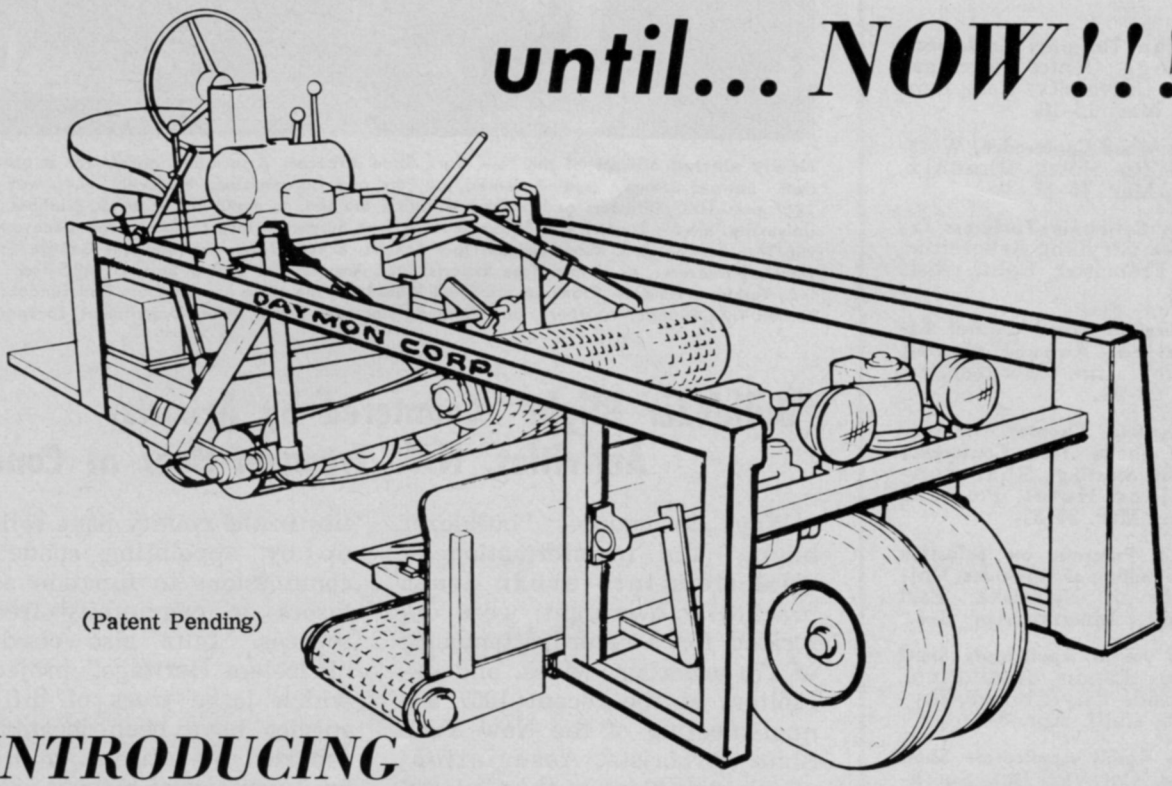

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The Daymon Sod Roller is the product of 4 years of experimentation and has successfully rolled over six million yards of sod at the giant Emerald Valley Turf Nursuries in Gregory, Michigan, saving them more than $100,000 in labor costs.

This machine can save you enough on labor cost to pay for itself on the first 75 acres of sod harvested!! This fact alone sold the Daymon Sod Roller to 12 of the first 15 men to see it.

The refinements this machine has undergone have given it a clean, uncluttered design and a sleek, low look. (It measures 96" long, 36" wide and 28" high). The steering mechanism and conveyor drive are tucked neatly inside the tubular frame, out of the way for easy servicing.

We can have one of these machines in your field to roll the first sod of the 1967 season. We invite your inquiries and visits to our Gregory, Michigan plant. Or we will come to you. The time to eliminate next season's problems is right now!

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Meeting Dates

Southern Shade Tree Conference, John Marshall Hotel, Richmond, Va., Mar. 12-15.

Iowa Turfgrass Conference, Hotel Savery, Des Moines, Mar. 13-14.

Michigan Turfgrass Conference, Kellogg Center, Michigan State University, East Lansing, Mar. 15-16.

Western Weed Conference, Westward Ho Hotel, Phoenix, Ariz., Mar. 15-17.

Northern California Turfgrass Exposition, Strybing Arboretum, San Francisco, Calif., Mar. 22-23.

West Virginia Weed Control Association, Annual Meeting, Holiday Inn, Morgantown, Mar. 28-29.

New England Chapter, International Shade Tree Conference Annual Meeting, Sheraton-Eastland Hotel, Portland, Maine, Mar. 30-31.

Nebraska Program on Selection and Handling of Pesticides, University of Nebraska, East Campus, Lincoln, Apr. 3-4.

Western Aerial Applicators Short Course, Landis Auditorium, Riverside City College, Riverside, Calif. Apr. 3-4.

Western Aerial Applicators Short Course, Caravan Inn, Sacramento, Calif., Apr. 5-6.

Canadian Chapter, International Shade Tree Conference, Annual Convention, Holiday Inn, Ottawa, Ontario, Apr. 27-28.

Florida Turfgrass Trade Show, Diplomat Hotel, Hollywood By The Sea, Fla., Apr. 27-29.

Western Chapter, International Shade Tree Conference, Annual Meeting, Hotel Coronado, San Diego, Calif., Apr. 30-May 3.

Florida Nurserymen and Growers Association, Annual Convention, Robert Meyer Motor Inn, Orlando, May 25-27.

The Hyacinth Control Society, Annual Meeting, Holiday Inn, Fort Myers, Fla., June 18-20.

American Association of Nurserymen, Annual Convention, Americana Hotel, Bal Harbour, Fla., July 8-13.

International Shade Tree Conference, 43rd Annual Convention, Marriott Motor Hotel, Philadelphia, Pa., Aug. 27-31.

Newly elected officers of the New York State Arborists Association gather for a group portrait. Edward Johnson (seated center), of Parr and Hanson, Inc., Hicksville, N.Y., was elected 1967 president. Directors and officers standing are (left to right) Dr. A. M. S. Pridham, Cornell University, Ithaca; Frederick R. Micha, Monroe Tree Surgeons, Inc., Ontario; Fred Donovan, Donovan Tree Service, Inc., Mechanicville; Jack Schultz, Schultz Nurseries, Merrick; George Callaway, secretary-treasurer, of Llenroc Tree Experts, Inc., Argyle; and Walter Sturmer, ABC Tree Service, Inc., Yorktown Heights. Flanking president Johnson at the table are directors Carl Lundborg (left), Bartlett Tree Experts, Westbury; and Peter Bartholomew (right), Parks Department, Lockport.

"Bulldozer Blight" Countered by Arborist Activities, N.Y. Treemen Hear at Concord

Ways to counter "bulldozer blight," the transformation of rural areas into urban areas practically overnight, were described for a record attendance of 170 arborists, wives, and exhibitors at the recent 1967 annual meeting of the New York State Arborists Association, which took place at the Concord Hotel, Monticello, N.Y.

Paul A. Lutz, Cooperative Extension Agent for Rockland County, described the change from rural, historic Hudson River country into an urban area in a single year, an experience already felt in Nassau and other New York counties. Only by creating public awareness has an informed citizenry been able to effectively moderate the change brought on by construction of three major thruways and numerous housing units within county limits.

Concern over the loss of shade trees led to Arbor Day plantings around the Rockland County Court House and other locations in the city. With editorials in local papers adding to public interest, some 20,000 trees have been planted in four years of cooperative effort. Many communities in the county have followed up by appointing shade tree commissions to function as advisors on community tree resources. Lutz also cited the "Priceless Heritage" project, in which large trees of different species have been located and reported by citizens to provide an inventory of historic trees in the county.

Also emphasizing Rockland County's drive to save and enhance its natural resources was Joseph St. Lawrence, county assemblyman, who addressed the association's annual banquet. Bulldozer blight and suburban sprawl have been curtailed and channeled into planned activities, St. Lawrence said. Rockland County's Conference on Natural Beauty, organized a year ago, has been instrumental in getting many citizen organizations to highlight the importance of trees and park woodlands, as well as water resources and open land for public activity. Congratulating arborists on their participation in these activities, the assemblyman concluded that such necessary and timely measures will promote a healthy environment for modern living.

Technical Problems Reviewed

Professor Carl Gortzig, extension leader in Cornell University's ornamental horticulture department, chaired a second-day discussion session on updated tree care. Problems raised by attending arborists covered various phases of pest control, including the possibility of periodic population counts as a basis for predicting insect peaks and pesticide needs. It was emphasized that reports from arborists in the field could help follow pest developments in order to establish correct timing for optimum control measures.

Other problems broached included the decline of shade trees during long periods of drought, a matter now under investigation. Conferees were also cautioned that study of new cultivar plantings is needed to establish performance records.

Moving on to urban tree plantings, Dr. Robert Mower, of Cornell University, Ithaca, recounted his experience with newly planted shade trees under city conditions of Buffalo and Long Island. Yearly records are kept on new plantings along city streets and highways, Mower explained. Using Buffalo as an example, he added that, though public interest is keen, records show that new plants are often mistreated.

Improvement of tree vigor through watering and fertilizing was another point raised by arborists during the discussion sessions. Attention was drawn to the fact that root action continues through late October and November into December, and that fall fertilizers are taken up to improve twig and bud growth during the short period of early spring, when most growth for the year actually occurs.

A midwinter tree planting ceremony and exhibits of specialized equipment for treemen also marked the '67 meeting, which was hosted by Hudson Valley arborists. Honored at the New Yorkers' banquet was Cornell Professor A. M. S. Pridham, who will soon be retiring after 42 years of service. Site of the '68 annual meeting has been designated as Ithaca.

Know Your Species

CHEAT

(Bromus secalinus)

Among the more than 40 species of bromegrass found in the United States are some of our most important forage grasses and also some of the most bothersome weeds. This particular species, cheat or chess, is described as being nearly typical of the entire group. If the plants were more palatable to farm animals during the entire growing season, instead of during only spring and late fall, they would be considerably more important as feed crops.

Cheat was introduced into the U.S. as an impurity in seed, and is widespread throughout the country. Plants are found in grain fields, grasses, along roadsides, and in various waste places. Cheat is widely regarded as a noxious weed, and its seed often appears in large-seeded grasses, such as tall fescue.

An annual or winter annual, cheat spreads by seed. Young plants often appear in the fall, produce some growth before winter, and resume in the spring. Leaf blades are typically flat, with edges of the sheath growing together to form a tube. Smooth, erect, unbranched stems grow up to 4 ft. tall (1 shows the lower stem). Seed heads are usually open, forming panicles (2).

Each spikelet (3) contains 6 to 10 seeds (4), which are deeply grooved, rather canoe-shaped, and of dark orange-brown color. Seeds may bear a short bristle, ⅛ to ¼ in. long.

With a long growing season, plants are able to withstand periods of drought. Since reproduction is by seed, regular mowing of grasses offers little chance for continued survival of the species. Cheat is resistant to 2,4-D, 2,4,5-T and silvex. It has been suggested that chemical control may be obtained from applying Betasan (selective, preemergence herbicide) in the fall when seeds germinate, using normal crabgrass rates of the chemical.

(DRAWING FROM NORTH CENTRAL REGIONAL PUBLICATION NO. 36, USDA EXTENSION SERVICE)

3 Steps to Compute Small Fertilizer Applications

Nurserymen, landscape managers, and others concerned with fertilizing small areas often have difficulty figuring how much fertilizer to use, since the recommended amounts usually are given in pounds per acre. For small areas, the convenient measuring tools are pints, cups, tablespoons, and teaspoons.

The accompanying table will help convert pounds to teaspoons. Conversions shown are not exact, but are accurate enough to serve as a guide in determining the proper amount of fertilizer.

Listed are weights of fertilizers to be applied to areas of 100 and 1,000 sq. ft. Also listed are the equivalent volumes for various fertilizer materials applied to 10 and 100 sq. ft. Note that the volume of fertilizer to be applied varies with different materials, even though the weight to be applied is the same. This is because of differing weight/volume ratios. A pint of ground limestone weighs 23 ozs., while a pint of ammonium nitrate weighs approximately 13 ozs.

To use the accompanying table, follow these three steps:

1. Find the desired material.
2. Find the recommended rate per acre.
3. Determine the amount of fertilizer needed for the area to be covered.

For example, if the material

1. Find Material in List Below	2. Find Recommended Rate/Acre	3. Determine Amount of Fertilizer Needed for Your Area			
Material Grouped by Approx. Weight per Pint	**Lbs. per Acre**	**Use These Weights: lbs./100 sq. ft.**	**lbs./1000 sq. ft.**	**Use These Volumes: tbsps./10 sq. ft.**	**pts./100 sq. ft.**
Act. sewage sluge	100	.2	2.3	1.2	.4
Dried blood	500	1.2	11.5	6.0	1.9
Sulfur (10 ozs./pint)	1000	2.3	23.0	12.0	3.7
Ammonium chloride	100	.2	2.3	.9	.3
Ammonium nitrate	500	1.2	11.5	4.5	1.4
Urea (13 ozs./pint)	1000	2.3	23.0	9.0	2.8
Ammonium phosphate	100	.2	2.3	.7	.2
Gypsum	500	1.2	11.5	3.5	1.2
Mixed fertilizers	1000	2.3	23.0	7.0	2.3
Potassium chloride (16 ozs./pint)					
Ammonium sulfate	100	.2	2.3	.6	.2
Calcium nitrate	500	1.2	11.5	3.0	1.0
Mixed fertilizers	1000	2.3	23.0	6.0	2.0
Superphosphate (19 ozs./pint)					
Ground limestone	100	.2	2.3	.5	.2
Potassium sulfate	500	1.2	11.5	2.5	.8
(23 ozs./pint)	1000	2.3	23.0	5.0	1.6
	2000	4.6	46.0	10.0	3.2

Equivalents that can aid conversions:

An acre equals 43,560 square feet (a plot about 209 ft. by 209 ft.).
A pint of water weighs about 1 pound.
A pint equals 2 cups, or 32 tablespoons, or 96 teaspoons.

is ammonium sulfate and the recommended rate is 500 lbs. per acre, use 1.2 lbs. or 1 pt. for a 100-ft. area. To compute the amount to apply of fertilizers not listed, scoop the material loosely into a 1-pt. container and weigh carefully. If the material weighs 16 ozs., for example, use the third block in the chart.

From material prepared by B. A. Krantz, Extension Soils Specialist, University of California, and N. C. Welch, Farm Advisor, San Bernardino County, California.

Emphasize Basic Research, Campana Tells Penn Treemen

We are rapidly losing time in developing the basic knowledge necessary to solve and prevent problems affecting our trees, Dr. Richard Campana, president of the International Shade Tree Conference, told members of ISTC's Pennsylvania-Delaware Chapter at their recent annual meeting, held in conjunction with the 2nd annual Pennsylvania Shade Tree Symposium, at University Park, Pa.

Though immediate problems of environment, pathology, and entomology have been fairly well met with known methods, priority should go to basic research in arboriculture. Dr. Campana, botany professor at the University of Maine, suggested it is time for ISTC to re-evaluate its purposes and potentials, and for arborists to analyze their profession more deeply.

Beautification, plant selection, care of newly setout trees, and tree evaluation were discussed for the more than 100 arborists attending the tree symposium. Liveliest discussion revolved around the contention of Dr. L. C. Chadwick, ISTC's executive director, that a given tree has a given value regardless of its location. An arborist is qualified to evaluate trees, not real estate, Chadwick pointed out.

Elected '67 president of the Penn-Delaware Chapter was Walter Morrow, Sewickley, Pa. George Maurer, Greenville, Del., and Fred A. Ashbaugh, Delmont, Pa., are vice presidents. Re-elected secretary-treasurer was John Anspach, Bethlehem, Pa.

Insect Report

WTT'S compilation of insect problems occurring in turfgrasses, trees, and ornamentals throughout the country.

Turf Insects

A CHINCH BUG
(Blissus insularis)

Texas: Moderate in several lawns of St. Augustinegrass at Austin, Travis County. Early activity probably due to unseasonably warm weather.

RANGE CRANE FLY
(Tipula simplex)

California: Larvae heavy in rain gutters along concrete apron of freeway in Sacramento, Sacramento County. Crane flies appearing in several areas as result of more than normal rainfall. Continued wet weather may result in damaging infestations in turf.

Insects of Ornamentals

APHIDS

Alabama: *(Eulachnus,* spp.) continue to increase on pine needles in central section. *Aphis spiraecola* eggs and some hatching noted on spires in central and southern areas. Light to medium numbers of aphids feeding on leaves and some blossoms developing as result of extended mild weather. Eggs heavy on stems and branches of these ornamentals. **Arizona:** *(Macrosiphoniella sanborni)* heavy on ornamentals in yards throughout Yuma, Yuma County. **California:** *(Aphis gossypii)* adults heavy on crassula at Escondido, San Diego County; beginning to show on citrus also. *Myzocallis arundinariae* medium on bamboo nursery stock in San Diego County. **New Mexico:** *(Cinara)* species medium to heavy on arborvitae in Las Cruces; honeydew covered sidewalks. Light to heavy on ponderosa and pinyon pines in Albuquerque, Bernalillo County. **Oklahoma:** *(Cinara Tujafilina)* continues problem on evergreens in several areas of State.

DOGWOOD BORER
(Thamnosphecia scitula)

Alabama: Larvae numerous under bark and feeding on cambium layer of ornamental dogwood trees in central area. Some feeding by flickers observed. Larvae 2-10 on larger trees.

NANTUCKET PINE TIP MOTH
(Rhyacionia frustrana)

Oklahoma: Pupae present in 80 percent of ornamental pines checked in Sequoyah State Park, Wagoner County.

PEACH TREE BORER
(Sanninoidea exitiosa)

Alabama: Larvae severely damaged several flowering peach shrubs in Lee County. Larval feeding at and below ground line on peach, laurelcherry and flowering peach during recent warm, balmy weather caused considerable amount of gum residue to accumulate around injured bark.

Tree Insects

BROWN SOFT SCALE
(Coccus hesperidum)

California: Heavy on redbud trees in Arcata, Humboldt County.

EASTERN TENT CATERPILLAR
(Malacosoma americanum)

Florida: Eggs hatching on wild plum and wild black cherry at Gainesville, Alachua County.

GIANT BLACK APHID
(Longistigma caryae)

Alabama: Large number of wingless females noted at location in Decatur, Morgan County; apparently leaving hibernation and seeking food source. This aphid heavy on oak trees at this location last year. **Texas:** Infesting shade trees in Beaumont, Jefferson County, and Orange, Orange County.

PINE NEEDLE SCALE
(Phenacaspis pinifoliae)

California: Heavy on Monterey pine trees in Gilroy, Santa Clara County. Medium on pine trees in Escondido, San Diego County. This scale insect has been very prevalent in past year in many areas.

Compiled from information furnished by the U. S. Department of Agriculture, university staffs, and WTT readers. Turf and tree specialists are urged to send reports of insect problems noted in their areas to: Insect Reports, WEEDS TREES AND TURF, 1900 Euclid Ave., Cleveland, Ohio 44115.

Classifieds

When answering ads where box number only is given, please address as follows: Box number, c/o Weeds Trees and Turf, 1900 Euclid Avenue, Cleveland, Ohio 44115.

Rates: "Position Wanted" 5c per word, minimum $2.00. All other classifications, 10c per word, minimum $2.00. All classified ads must be received by Publisher the 10th of the month preceding publication date and be accompanied by cash or money order covering full payment.

POSITION WANTED

GRADUATE AGRONOMIST, experienced in weed control, turf and horticulture maintenance, management, and experimentation, desires position. References and résumé available. Military status 5A. Twenty-eight, married, with no dependents. Write Box 23, Weeds Trees and Turf magazine.

TREE MAN. Certified by the state of New Jersey as an expert seeking employment in the New Jersey, Pennsylvania and Delaware area. Over 30 years' experience in a supervisory capacity in private tree work, landscaping, line clearance, flat clearing, and estimating in all of the above-mentioned areas. Write to RD #2, Box 68-C, Pleasantville, N. J.

HELP WANTED

AGRONOMIST OR BOTANIST. If you have B.S. or M.S. in either of above fields, then we would like to talk to you about our industrial weed control service. Send complete resume to Western Soil Management Corp., 3909 Baltimore Ave., Philadelphia, Pa.

OPPORTUNITY. Man to assist owner as landscape foreman and management of established nursery, garden shop, and landscaping operation in Indiana. Requirements: pleasant personality, ambitious, understanding of plant material. Excellent wages, paid vacation, yearend bonus, fringe benefits, plus opportunity for industrious man to acquire ownership. Please reply to Box 24, Weeds Trees and Turf magazine.

WANTED TO BUY

HIGH-PRESSURE sprayers, skid or truck mounted, prefer 500-1500 gal. tank capacity. Paul Kucik, 17207 Archdale, Detroit, Mich. KE 3-8589.

FOR SALE

WANT TO RETIRE. Thriving 34-year-old tree and landscape business in central Pennsylvania. No real estate, but all equipment, materials, records, etc. Sell outright or on terms. Can stay with buyer, and sell on commission basis if desired. For full details, phone Area Code 717 + 545-7221 about 7 P.M.

Maine Hosts New England Arborists, March 30-31

Third Annual Meeting of the New England Chapter, International Shade Tree Conference, on March 30 and 31, will be hosted by the Maine Arborists Association at the Sheraton-Eastland Hotel in Portland.

With the "down east" welcome to include a lobster banquet and a ladies program, arborists have also arranged an educational program to cover such tree subjects as selection, sources, trees in urban renewal, salt injury to maple, air pollution damage, drought injury, and landscaping industrial sites. A panel of municipal arborists and tree experts is scheduled to discuss the status of shade tree care in the community. Commercial exhibits and field demonstrations are on tap, too.

For further details, contact Herbert J. Cran, Jr., secretary-treasurer of the New England Chapter, at The Connecticut Light and Power Co., P.O. Box 2010, Hartford, Conn. 06101.

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INDEX TO ADVERTISERS

Amchem Products, Inc. .....28 & 29
Chevron Chemical Co., Ortho Div. 11
Colloidal Products Corp. 33
Diamond Alkali Co. .....2a & 2b
E. I. duPont de Nemours & Co., Inc. .....15 & 4th Cover
Geigy Agricultural Chemicals ..25
Hardie Sprayers .....2nd Cover
Hercules Incorporated 4 & 3rd Cover
Ideal Crane, Div. of Bert Parkhurst & Co. 6
International Harvester Co. ..22 & 23
Miller Distributor, Inc. 35
The F. E. Myers & Bro. Co. 7
John Nunes Mechanical Harvesting Co. 31
Oregon Fine Leaf Red Fescue Commission 41
B. G. Pratt Co. 30
Robeco Chemicals, Inc. 40
Shell Chemical Co. 3
Seymour Smith & Son 38
Solo Industries, Inc. 39
Stanford Seed Co. 6
Thompson-Hayward Chemical Co. 19
Universal Metal Products 5

Princeton Turf Unveils Production Sod Harvester

A new production model sod harvester, developed by Princeton Turf Farms and tested in its own sod growing operation, was recently unveiled. Requiring three men to operate, the harvester runs on flotation tires to protect grass crops from damage, even in wet weather. Princeton's cutter, guided by the driver, pulls sod up a conveyor in a continuous strip, which can be automatically knifed into any length.

Excess soil and stones are removed from sod by a high-speed flail, which is said to produce a sod pad of uniform thickness no matter what variations occur at the cutting head through changes in land contour. Pads are automatically folded, grass to grass, and conveyed to the rear of the machine, where stackers on each side place them on pallets. The stacking mechanism lowers with each added layer of sod, and when full (as shown by an automatic counter) slides to the field for pickup.

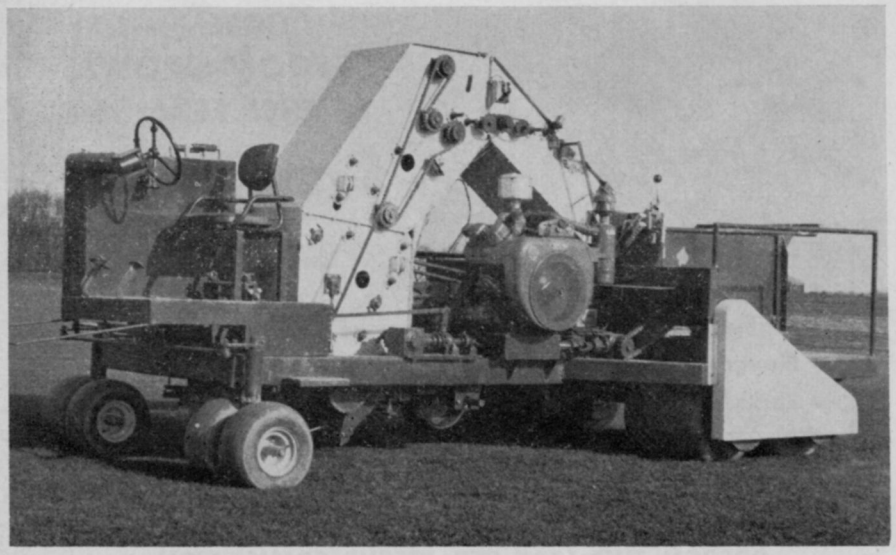
Capability of the harvester extends up to 10,000 sq. ft. of cut and palletized sod per hour, Princeton says. Summarizing the advantages of mechanized sod harvesting, Wiley Miner, president of Princeton Turf Farms, points to the capacity to cut grass fields hour after hour, with three men producing pads of uniform length, width, and depth, automatically folded and stacked on pallets for delivery. Further details on this development can be obtained from Princeton Turf Farms, Inc., Box 392, Cranbury, N.J.

Fla. Turfmen Plan Benefit Golf, Management Counsel

Two unique features of this year's Florida Turfgrass Trade Show, set for April 27 to 29 at the Diplomat Hotel, Hollywood by the Sea, will be a benefit golf tournament and a clinic conducted by a leading management counsel for turfmen.

FTGA's first annual golf tournament, to be held at the Diplomat Country Club, will boost the association's Scholarship and Research Foundation. All entrance fees will be used for future scholarships and grants, which in the past two years, have totaled more than $2,500. Presiding over the management clinic will be Jerome Barnum, international consultant, who will discuss management problems as they relate to the small businessman and the turf industry in particular, and will be available to help with individual or group problems.

More information can be obtained from FTGA executive secretary Walter Anderson, 4065 University Boulevard North, Jacksonville, Fla. 32211.



Princeton Turf Farms' sod harvester has been through several revisions before the production model was perfected and put through its paces on the Princeton turf. Now available, harvester is shown above without protective chain guards.

Trimmings

Same sodmen. The recent sod producers' session held at the International Turf Conference began with a nearly empty room. By the time the meeting was over and assembled sod pros had decided to take the big step toward a national producers' organization, the room was respectably full, if not exactly packed. Yet, glancing around us (we're inveterate glancers around), we couldn't help thinking that only a very few sod producers were represented at this important meeting. Of course, organization is not every man's cup of tea, and we can recall talking with growers to whom any organization is an inconvenience, if not a conspiracy, to be assiduously avoided. Nor did growers gathered in Washington leave any doubt that they were, and expected to stay, a minority party. But the fact remains that, the larger the minority, the more productive the party. And if sodmen are to gain the most from organizing, the relatively few growers who have supported a yearly sod session and who have been active in getting the ball rolling will have to be joined by others equally interested in having a say. Hope to see some new faces next time we have the chance to attend a national sod forum.

* * *

Sorry Gov'nor. *Speaking of sod growers and organizations brings to mind a clipping recently received from Busch country — St. Louis. While truckloads of sod from Arkansas Governor Winthrop Rockefeller's farm stood by (sod is not very good about standing by), competing unions were arguing over which was entitled to resod Bush Stadium's field, a complete turf replacement having become necessary after one year of use. We don't know how the dispute has been settled, but we do know this is the sort of organizational snafu that accomplishes little, costs a lot, and brings a good deal of blood to the boiling point. We wonder if the Governor sent anyone up to picket the picketing union and rescue his sod from its truck bed?*

* * *

Good for contractors. We're still adding to our list of cities passing get-tough weed ordinances. Latest to join the list is Dallas, Tex., which offers residents 10 days to get rid of high weed stands before city workers *or private contractors* are sent to do the job.

* * *

Nothing to crow about. *A crow's life is not, perhaps, all it's cracked up to be. According to estimates of the redoubtable Society for the Preservation of the Crow, there are but 600,000 crows flying as crows fly about the U.S. For shame, says the SPC. "The indomitable crow" is the enemy of grubs, cutworms, beetles, and so forth. More are desperately needed; overwork is the lot of the poor crow. We suspect the SPC may be concealing something. Nevertheless, we urge patience toward the overworked crow. That mouthful of grass seed may really be a grub, and we don't want to have to "eat crow."*

for good coverage and exact placement... take a look at

VISKO-RHAP* herbicides

To Give A Good Pattern

Visko-Rhap* herbicides are especially formulated to hit weeds and brush as heavy, drift-resistant droplets that give good coverage. These herbicides are sprayed as water-in-oil inverts having a mayonnaiselike consistency.

To Give Effective Kill

Visko-Rhap herbicides give good control of weeds and brush susceptible to 2,4-D, 2,4,5-T, and silvex. The oil-coated droplets stick to the plants, resist washoff, and penetrate to give effective kill.

To Resist Drift

The Visko-Rhap invert spray leaves the nozzle in mayonnaiselike strands, resistant to wind and evaporation. Heavy oil-coated droplets that resist drift are formed before the spray hits the plants.

To Get More Information

Contact your Hercules representative at the nearest sales office listed below. You may want him to arrange a showing of "The Particle of Difference," a new motion picture on this herbicide spray that gives drift control and effective kill. Or write: Agricultural Chemicals, Synthetics Dept., Hercules Incorporated, Wilmington, Delaware 19899.

HERCULES

*HERCULES TRADEMARK

SP67-3

BOSTON, MASSACHUSETTS • CHICAGO (OAK BROOK) ILLINOIS • DALLAS, TEXAS • GREENVILLE, MISSISSIPPI • LOUISIANA, MISSOURI
MINNEAPOLIS, MINNESOTA • MONTGOMERY, ALABAMA • ORLANDO, FLORIDA • RALEIGH, NORTH CAROLINA • SAN FRANCISCO, CALIFORNIA

Here's proof that repeated yearly applications of "Tupersan" do not injure the root systems of many established cool season turf grasses, even when "Tupersan" is used at extremely high rates. The Kentucky Bluegrass turf cores shown at the middle and right were taken from plots that were treated with "Tupersan" for three straight years at the rates of 80 and 120 lbs. per acre. The Kentucky Bluegrass turf core at the left was taken from an adjoining plot that was not treated. Note that there is no difference between the treated and untreated cores. Similar results were obtained in plots of fescue and certain strains of bentgrass.

Control crabgrass without injuring turf (cool season grasses) with Tupersan®

SIDURON WEED KILLER

Du Pont "Tupersan" is a unique, highly-selective pre-emergence weed killer for the control of crabgrass (smooth and hairy) and certain other annual weed grasses in turf. "Tupersan" offers a high degree of safety to turf. It can be used on *newly seeded areas* without causing injury to germinating seeds of cool season grasses, as well as on established turf.

You can seed and treat the same day with "Tupersan". It prevents crabgrass—but lets the desirable grass grow. For full information on "Tupersan", consult your golf course supplier—your service agency.

With any chemical, follow labeling instructions and warnings carefully.

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