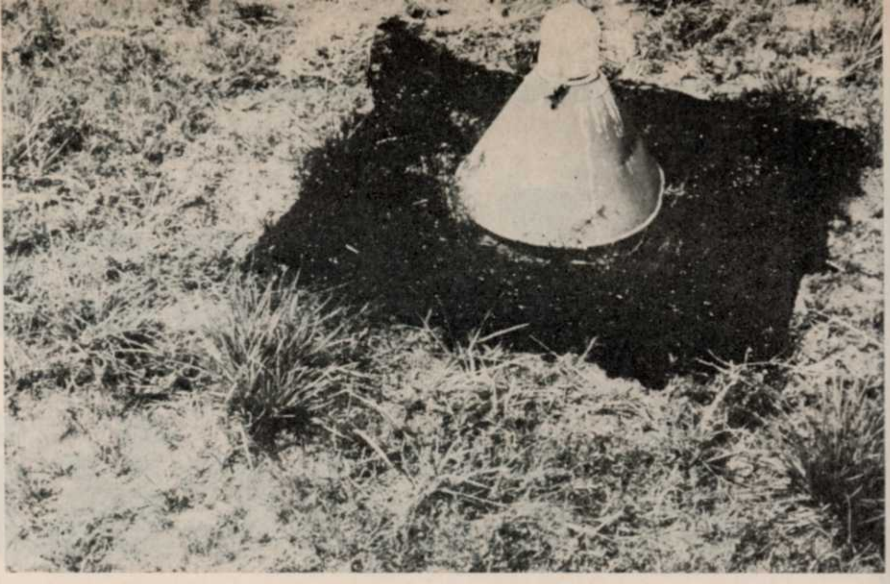


Standard type MC-1 cutback asphalt used in Texas A&M study gives a thin film which barely covers the soil surface.

Can Herbicides be Effectively Impregnated Into Asphalt?

By WILLIAM J. BOWMER and WAYNE G. McCULLY
Texas A&M University, College Station

ASPHALT PAVEMENTS often are victims of invasion by Bermudagrass and certain other plants. Sometimes these plants grow through the pavement from plant parts or seeds contained in the base material; or they may originate from vegetative runners from parent plants outside the paved area. They can also arise from seeds washed or blown into the cracks in the pavement.

Regardless of the means by which vegetation becomes established in asphalt pavements, the plants cause a drastic reduction in the life of the pavement, are unsightly, and present a safety hazard by obscuring the pavement edge.

Adjacent Damage Possible

A number of herbicides can prevent growth of plants in pavements when they are applied directly to the underlying base material. However, several of these materials have damaged plants outside the treated area. The damage is caused by roots absorbing material from the treated area or by water carriage of the herbicides away from the treated area and into contact with plant roots.

Mixing the herbicide with asphalt appears to offer several advantages. A sufficient concentration of herbicide should prevent plants from penetrating the asphalt layer. If the herbicide was contained in the asphalt, damage from leaching or from absorption by plants outside the treated area should be minimized. Oil-soluble formulations which are chemically stable at relatively high temperatures would be desired for this type of treatment. The asphalt-herbicide mixture could be applied as the prime or seal coat, or it could be used around sign posts, under guard rails and in association with other structures.

In August 1964, a cooperative research study by the Texas Transportation Institute at Texas A&M University under sponsorship of the Texas Highway Department and the U. S. Bureau of Public Roads was initiated to study the effect of incorporating herbicides into asphalt.

The experiments were conducted on Easterwood Airport, College Station, Texas, where vegetative growth around runway lights is a safety hazard and requires continual maintenance. Bermudagrass was the predominant plant but other plants such as Johnsongrass, *Sorghum halapense* (L.) Pers., and Dallisgrass, *Paspalum dilitatum* Poir., were were also present.

The soil material on the experimental area was a mixture of surfaces and subsoils used as fill to elevate and level the runways. The soils involved were characteristically fine sandy loams on the surface with tight clay subsoils. Herbicides were applied as surface treatments only, not incorporated into the soil.

Six Herbicides Tested

A square yard area, centered on each light, was scraped bare of vegetation prior to treatment. Six herbicides were selected for application. Application methods for the herbicides were: (1) Applied to the open soil area and

Based upon a paper presented at the Nineteenth Annual Meeting of the Southern Weed Conference in Jacksonville, Florida on January 18-20, 1966.

left exposed; (2) Applied to open soil and covered with an asphalt cap; and (3) Mixed with and applied in the asphalt. Two rates of each herbicide were used, and each treatment was applied around four lights. Herbicides and rates were: (1) TCA, sodium salt, at 100 and 200 lbs. per acre; (2) TCA ester at 100 and 200 lbs. per acre; (3) prometone at 10 and 20 gals. per acre; (4) erbon at 40 and 80 lbs. per acre; (5) fenac at 6 and 12 lbs. per acre; and (6) tritac at 8 and 16 lbs. per acre.

The asphalt used was standard type MC-1 cutback, applied at the rate of 1 gal. per 4 square yards. At this rate, a thin film was obtained which barely covered the soil surface (see illustration). Only oil-soluble herbicides were mixed with the asphalt. All treatments were made using a knapsack sprayer with a fantype T-jet nozzle. The applications were made with a constant nozzle pressure of 35 p.s.i.

The results shown in Table 1 are from a single study, and present a definite contrast with earlier work in presurface application of herbicides in which all materials applied effectively prevented Bermudagrass and other plants from emerging through new pavements. Of the materials in the present test, only sodium TCA and erbon were included in the earlier presurface experiments.

The higher rates of all materials applied to bare soil except tritac and TCA ester gave better control than did the lower rates (Table 1). The same materials applied to the soil surface and then covered with an asphalt cap performed similarly, except fenac. Of the six materials used, only the higher rates of TCA sodium salt and prometone showed an improved performance when the treated area was covered with asphalt. The lower rate of fenac showed some improvement with capping, but the higher rate was somewhat less effective. Both rates of Tritac were less effective covered than when applied to bare soil.

Three of the materials were oil soluble, and were diluted in asphalt for application. Results of mixing erbon and TCA ester in the asphalt were disappointing. Erbon failed to perform better than when applied directly to the soil at either rate of application. The lower rate of TCA ester was more effective applied in the asphalt, but there was no improvement in effectiveness using the higher rate. Although the lower rate of prometone was somewhat less effective applied in asphalt than directly to the soil surface, the higher rate of prometone applied in asphalt not only was more effective, but gave the best control of all the treatments used.

Bermudagrass was present in all treatments where regrowth was recorded. The reinfestation of Bermudagrass was from emergent plant material rather than encroachment from outside the treated area. Yellow woodsorrel, *Oxalis dillenii* var. *dillenii* also was present in many of the treated areas. Of the plants previously listed as being associated with Bermudagrass, none was present to any degree within any of the treated areas.

Herbicides Must be in Top ¼ Inch of Asphalt

The standard treatment, 200 lbs. per acre of sodium TCA, was somewhat less effective than usual under the conditions of this study. Prometone and erbon were the most persistent of the materials applied to the soil surface. The poor results noted in this experiment may be due in part to the relatively low volume of application used. Past experience has shown that herbicides applied to the base material should be distributed through approximately the top one-fourth inch to be most effective.

The results of this experiment indicate that some herbicides which are oil soluble may be effective when applied directly in asphalt. Although the asphalt solution used in these tests was applied at ambient air temperature, asphalts without solvent usually are heated to temperatures of at least 300°F for application. Consequently, any herbicide dispersed or dissolved in undiluted asphalt would have to be stable at relatively high temperatures. Thickness of the asphalt layer, not a consideration in this test, probably should be treated as an independent variable in future testing. While recommendations cannot be made on the basis of this limited study, further research may develop specifications for applying materials in the surfacing material.

Table 1. Relative control of Bermudagrass and other plant species with herbicides applied on bare soil, on soil and capped with asphalt, or mixed in the asphalt.

Herbicide	Rate/Acre (Lbs. active) ingredient or gallons	Method of Herbicide Application		
		On Bare Soil	Capped With Asphalt	In Asphalt
		Average Rating*		
TCA, Sodium Salt	100#	1.00	1.00	
	200#	1.25	1.75	
TCA ester	100#	1.00	1.00	1.75
	200#	1.00	1.00	1.00
Prometone	10 gal	1.25	1.25	1.00
	20 gal	1.75	2.25	2.75
Erbon	40#	1.50	1.50	1.50
	80#	2.00	2.00	1.50
Fenac	6#	1.00	1.25	
	12#	1.50	1.25	
Tritac	8#	1.50	1.25	
	16#	1.50	1.00	

*The treated area around each light was evaluated by the following scale.
1.0—No control (Plots not visible)
2.0—Some control (Plots visible)
3.0—Good control (Plots with no live vegetation)

Faulty Construction Is Cause of Problems in Athletic Turf Duich Tells Minn. Turf Management Short Course

By JOSEPHINE B. NELSON

"Many of the most serious problems encountered in maintenance of satisfactory turf on athletic fields and golf courses are the direct result of faulty construction," according to a university agronomist.

Speaking at the University of Minnesota's Turf Management Short Course on the St. Paul Campus, March 16, J. M. Duich, associate professor of agronomy at Pennsylvania State University, declared that among the built-in mistakes that create future maintenance problems are failure to provide for adequate surface and subsurface drainage, poor root-zone mixtures subject to severe compaction, inadequate soil preparation and shoddy seeding methods. Expensive major reconstruction or renovation is often necessary to correct these errors.

The building of a modern golf course or athletic field is a specialized operation, Duich emphasized. Preparation of a complete and concise set of specifications is the first step in protecting a substantial initial investment against future unnecessary outlays of additional funds and of insuring against permanent mediocrity of playing conditions.

Dense Sod Essential

In discussing athletic fields and play areas, the Pennsylvania State University agronomist pointed out that a dense, wear-resistant sod is essential on athletic fields and play areas to provide playing safety, good footing, and pleasing appearance.

Production and maintenance of such a turf depend on the kinds of grasses used, proper design and construction, good soil drainage and preparation, adequate fertility and a maintenance program that recognizes the special nature of the care involved.

To insure athletic field turf of satisfactory quality, a good maintenance program is just as necessary as sound establishment methods. Duich listed these essentials of a good maintenance program:

Dr. J. M. Duich (right) listens to comments on an athletic fields bulletin he prepared. Holding the bulletin is D. B. White, coordinator of the short course program, and associate professor of horticultural science at the University of Minnesota. Duich is associate professor of agronomy at Pennsylvania State University.

"Here's a valuable session . . . " Paul Stegmeir (seated) tells Robert Hokanson (right) manager of Camp Courage crippled children's camp, Maple Lake, Minn., as they look over the short course program. Stegmeir is with the University of Minnesota Agricultural Short Course department.

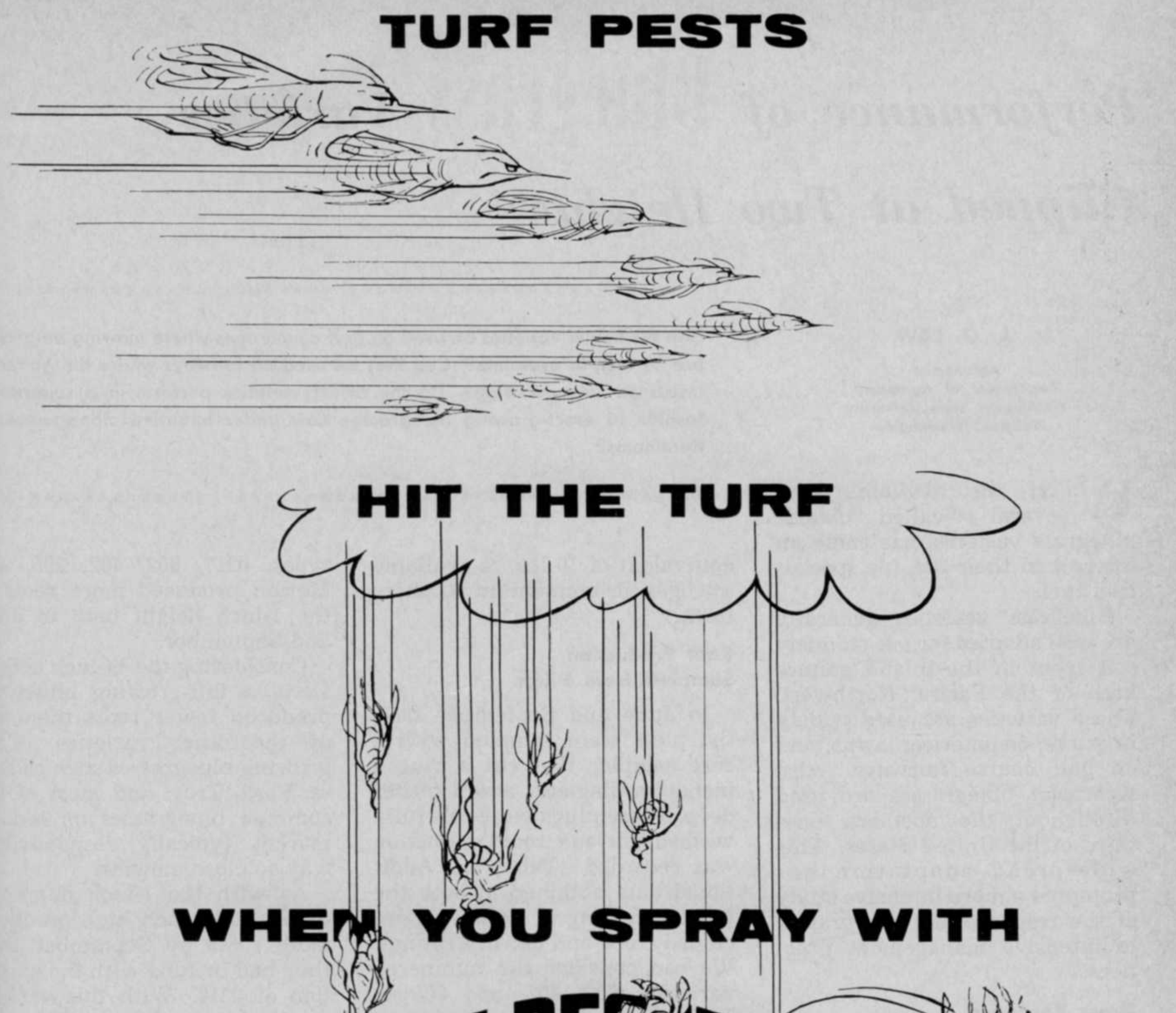
- That it produce tough grass with maximum wear resistance.
- That it be designed to maintain high density to resist weed invasion and encroachment of undesirable grasses.
- That it encourage deep rooting to provide good anchorage and firm footing.
- That mowing height be adjusted to both grass requirements and playing demands.
- That fertilizing and watering be done at such times and in such manner as to provide steady growth and maximum quality.
- That consideration be given to the endurance limits of the turf in scheduling use of the field.
- That provision be made for repair of injuries due to wear and other causes.

Many Subjects Presented

Other speakers at the short course included University of Minnesota staff members G. R. Blake, professor of soil science, who spoke on "What is a Good Soil"; D. B. White, associate professor of horticultural science, on "Cultural Methods of Weed Control"; and T. B. Bailey, graduate assistant in horticultural science, on "What Kind of Turf Equipment Do You Need?"

A panel moderated by L.C. Snyder, head of the Department of Horticultural Science, reported on research at the University of Minnesota in horticulture, agronomy and plant genetics, plant pathology, soil science, agricultural engineering and entomology.

Program coordinator for the short course was D. B. White, who commented that it was "another highly successful Turf Management Short Course." The short course was attended by some 200 people professionally interested in the care and management of turf for golf courses, sodding, parks, institutional grounds and recreational areas.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Performance of Bluegrass *Varieties Clipped at Two Heights*

By
A. G. LAW
Agronomist
Department of Agronomy
Washington State University
Pullman, Washington

Can the newer varieties be used on golf course tees where mowing heights are ½ inch or even less? Can they be used on fairways where the golfer insists on close mowing? Do the dwarf varieties perform in a superior fashion to erect-growing bluegrasses now under intensive management treatments?

WITH the availability of several so-called "dwarf" bluegrass varieties has come an interest in their use for specialized turf.

Bluegrass varieties generally are well adapted for use on many soil types in the inland empire area of the Pacific Northwest. These varieties are used widely in parks, cemeteries, lawns, and on golf course fairways. Also Kentucky bluegrasses are used throughout the northern one-third of the United States. This widespread adaptation has prompted a more intensive study of the response of these grasses to intensive management practices.

Grass Response to Clipping Tested

To test the response of bluegrass varieties to clipping, turf research tests were plotted. Seven varieties were seeded in turf trials in the spring of 1962. They were clipped to 1 inch during the establishment year and fertlized with 4 lbs. of actual nitrogen per 1,000 sq. ft. High phosphorus and potassium levels were maintained based on soil tests. Plots were irrigated as needed to keep the soil moisture above the wilting point.

In 1963, 1964, and 1965, the plots were split, one half being mowed to 1 inch, the other half to ½ inch. They were mowed twice weekly during the growing season which extended from mid-April to October 1 of each year. During the three treatment years, all plots received the equivalent of 10 lbs. of available nitrogen in ammonium sulphate form.

Root Production Sampled from Plugs

In June and September 1965, the plots were sampled with a core sampler that cut a plug 4 inches in diameter and 6 inches deep. These plugs were carefully washed out and root production was recorded (Table 1). Additional data obtained in both the fall and spring of each year included color and density ratings. We can consider the numbered varieties, 602, 402, and 205 in Table 1, as "Cougar," a recent variety released from the Washington Agricultural Experiment Station.

The erect-growing variety, Delta, shows the lowest production of roots at the 1-inch height compared to all other varieties cut to the same height. Dwarf types, 0217, 602, 402, 205, and Merion produced more roots at the 1-inch height both in June and September.

Considering the ½-inch height, Delta, a tall-growing bluegrass, produced fewer roots than any of the other varieties. Tall-growing bluegrasses such as Delta, Park, Troy, and most of the common bluegrasses on today's market typically respond this way to close mowing.

As with the 1-inch clippings, plots cut ½ inch high produced more roots by September than they had in June with the exception of 0217. With this variety, production was essentially the same for both June and September.

Variety 0217, an experimental line developed by the Jacklin Seed Co., shows one other characteristic different from the other dwarf bluegrasses in this test. It took almost twice as much

Table 1. Average root production in grams under bluegrass varieties cut at two heights and harvested at two dates in 1965.

Variety	One Inch		One-Half Inch	
	June g.	Sept. g.	June g.	Sept. g.
0217	17.2	19.8	14.9	14.1
602	11.5	14.0	10.1	18.7
205	17.5	20.0	14.4	15.9
402	16.0	24.6	9.7	19.8
Merion	12.2	20.3	10.3	14.4
Newport	10.7	17.4	9.6	16.9
Delta	11.0	12.9	7.1	10.5
Cougar[1]	14.9	20.6	5.8	9.2
Nebr. blend[1]	4.2	19.7	7.4	9.6

1. These varieties in the second cutting year; all others in third cutting year.

time to wash soil from the root plugs of 0217 as it did from other dwarf bluegrasses. This longer washing time is apparently related to the greater amount of fibrous roots and, conversely, a lower amount of rhizomes in the upper 6-inch profile of the 0217 plugs. Density readings at the turf surface indicate that there was approximately 50% reduction in density of Delta compared to the low-growing bluegrass cut at the ½-inch height.

Tall Delta Can't Take Close Clip

Root yield, percent rhizomes, and surface density of bluegrass varieties grown in trials at Pullman, Wash., are shown in Table 2. These plots were clipped at ½- and 1-inch heights and were irrigated to prevent wilting. Root data from these plots were taken in the fall of the second clipping year. Here again, Delta, the tall-growing variety, produced much less root growth under both the 1-inch and ½-inch cut. Also, surface density of Delta is significantly less than that of dwarf varieties, indicating that this variety can not tolerate close clipping for any extended period. In addition, the percent rhizomes, as determined by Dr. R. L. Goss, shows a highly significant difference between the 3 dwarf varieties, Newport, Cougar, and Merion, compared with the tall-growing variety, Delta. Similar data have been reported by other workers with many plants. In every case, dwarf plants consistently withstand closer defoliation than erect-growing plants.

Data obtained from this study and those of Dr. Goss are in agreement. They show that many of the failures of bluegrass plantings on such specialized

Table 2. Root yield, percent rhizomes, and surface density of bluegrass varieties grown in 1957 and 1958[1]

Variety	Yield in Grams 1" cut	Yield in Grams ½" cut	% Rhizomes	Surface Density
Newport	5.5	4.1	47	100
Cougar	4.8	3.8	48	100
Merion	3.4	3.1	40	92
Delta	2.4	2.2	12	65

1. Data adapted from Ph.D. thesis by Dr. R. L Goss, 1960

sites as golf course tees can be attributed to the use of tall-growing varieties rather than the modern, dwarf types currently available.

Data reported for Cougar and "Nebraska blend" in Table 1 are from plots seeded in the fall of 1963. These plots were cut to ½- and 1-inch heights in the spring of 1964 and during 1965. Note particularly the root production of these two varieties; they were not allowed to become well established before cut to the ½-inch height. Bluegrass must be well established before clipping back to ½-inch. At the 1-inch height, Cougar root production was comparable to that of the varieties in the older trial.

Research Seeks Growth Habit Difference

Seedling characteristics of 4 bluegrass varieties are shown in Table 3. In the laboratory we attempted to identify some structural characteristic that could be measured to define the difference in their growth habits. Number of tillers and leaf sheath length have been proposed as possible distinguishing factors. We have not yet arrived at a satisfactory standard in our trials for measuring leaf sheaths (Table 3). Cougar and 0217 in seed production plots have the shortest mature plant stature. Thus, they are considered the most nearly true dwarfs of the varieties in this study. Yet, Delta and Nebraska dwarf have the shortest leaf sheaths. On the other hand, Cougar and 0217 show the greatest number of tillers which is one measure of grass ability to heal after mechanical injury. More refined tests are to be conducted in 1966 greenhouse trials to search for a characteristic that will distinguish bluegrass variety growth habits.

Table 3. Seedling characteristics of four bluegrass varieties in 1965.

	Average Number[1] Tillers	Average Leaf[1] Sheath Length (mm)
Cougar	2.0	7.1
0217	2.3	8.0
Delta	0.9	7.0
Nebr. Dwarf	1.7	6.5

1. 9 weeks after planting.

How to Diagnose Tree Diseases
(from page 17)

trees examined by the authors have been caused by injuries to roots or diseases of root systems.

The sudden death of a tree usually results from the destruction of nearly all the roots or from the death of the tissues at the trunk base near the soil line. Factors most commonly involved are infection by disease organisms (Fig. 9), winter injury, rodent damage, heavy concentrations of natural gas, lightning, and various types of toxic chemicals. Trees that progressively weaken over a period of years may be affected by girdled roots, decay following nearby pavement work, poor soil or drainage, lack of food, grade changes, natural gas leaks, and excessive planting depths. Any of these factors and several more may contribute to the ultimate death of the tree. Diagnosticians must be ever alert for the symptoms above ground as well as for those not so obvious below the soil.

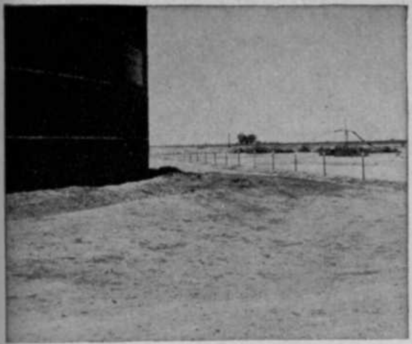
Apply Fungicide Now To Check Snow Mold

Lawn care specialists who applied fungicide to customers' lawns last November or December for snow mold control should plan to make another application this spring.

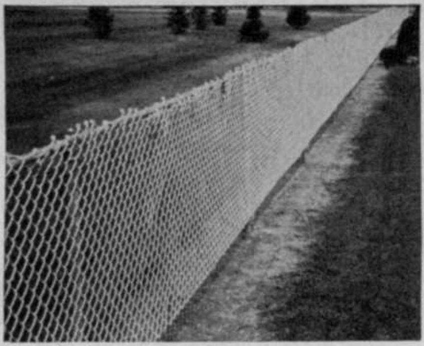
But even if lawns were not treated last fall, applying a fungicide now will help control the disease.

This advice comes from Dr. R. E. Partyka, Ohio State University Extension plant pathologist, who says fungicides containing mercury provide satisfactory chemical control of snow mold. He suggests fungicides with organic mercury such as phenyl mercury acetate, or inorganic mercury as mixtures of mercurous chloride and mercuric chloride. Also effective are Tersan OM, Thimer, Dyrene, and Ortho Lawn plus Turf Fungicide, Partyka says.

Mercury compounds can cause plant damage if applied in heavy doses, the specialist warned. He advises that special attention be given to manufacturer's recommendations for chemical use.



Around this oil pumping station—Hyvar® X bromacil weed killer controlled fire-hazardous vegetation all season. Other products containing bromacil, such as "Hyvar" X-WS, give equally effective control.



Under fence lines—Just one application of "Hyvar" X will control perennial weeds and grasses (such as Johnson, Bermuda, nut, horsetail, plantain, wild carrot, and bouncing bet).

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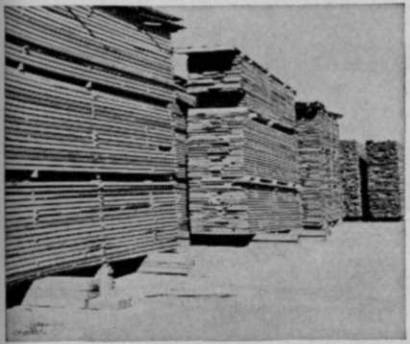

In lumber yards—Control moisture-holding vegetation that tends to decay lumber. Unwanted vegetation also creates fire hazards during dry periods. Applying "Hyvar" X-WS bromacil prevents these problems.

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