

Bulletin 271

# *your lawn*



COOPERATIVE EXTENSION SERVICE  
THE OHIO STATE UNIVERSITY

## CONTENTS

<b>Starting Your Lawn</b>		<b>Rolling and Aerating</b> .....	26
Soils .....	3	Watering .....	26
Fertilizer and Lime .....	4	Weed Control .....	26
Seeding the Lawn .....	5	Bentgrasses Diseases .....	26
<b>Caring for Your Lawn</b>		<b>Insect Control in Lawns</b>	
<b>BLUEGRASS AND BLUEGRASS</b>		White Grubs .....	29
<b>MIXTURES</b>		Sod Webworm .....	31
Fertilizer and Lime .....	9	Chinch Bugs .....	32
Reseeding Bare Spots .....	12	Cutworms .....	32
Mowing .....	12	Moles .....	33
Weed Control .....	13	Ants .....	33
Other Lawn Practices .....	18	Earthworms .....	33
Bluegrass Diseases .....	19	<b>Diagnosing Lawn Problems</b>	
<b>BENTGRASS</b>		Brown or Dead Spots .....	33
Fertilizer and Lime .....	25	Moss .....	34
Mowing .....	26	Thin, Unthrifty Lawn .....	35
Controlling Thatch .....	26	<b>Renovating an Old Lawn</b> .....	35
Topdressing .....	26		

## The Authors

*From The Ohio State University:*

Robert W. Miller, *Extension agronomist*

Richard L. Miller, *Extension entomologist*

Robert E. Partyka, *Extension plant pathologist*

Edward W. Stroube, *Extension agronomist*

*From The Ohio Agricultural Research and  
Development Center:*

Richard R. Davis, *professor of agronomy*

Merle H. Niehaus, *associate professor of agronomy*

Revised 5/68—20M

The Ohio State University cooperating with the U. S. Department of Agriculture. Cooperative Extension Service, Roy M. Kottman, Director, Columbus, Ohio 43210. Printed and distributed in furtherance of Acts of May 8 and June 30, 1914.

# Starting Your Lawn

You can obtain a good lawn if you follow the basic rules for seeding or sodding. Certain things you can do will make the difference between success and failure. Listed below are steps for making a new lawn:

1. Rough grade the lawn area. Allow fills to settle and regrade if necessary.
2. Have soil tested. Apply lime if needed.
3. Plow, rototill, disc, or otherwise work the soil 3 to 6 inches deep.
4. Allow soil to settle, or firm with a heavy roller.
5. Apply fertilizer and rake it in while removing stones, trash, and other foreign material. Fill in any small depressions which are present.
6. Seed or sod—if sod, ignore items 7 and 8.
7. Rake lightly—let some seed remain on surface.
8. Mulch.
9. Roll lightly.
10. Water.

## SOILS

Subsoil taken from the basement of a new house—often containing plaster cement, lumber, and other debris—is a poor soil for a lawn. Every house-building contract should provide for all topsoil to be piled separately for the final grading and for debris to be removed—not buried on the site.

For most home owners, the problem will be one of using the soil they have. Soils are generally poor because of lack of plant nutrients. This lack can be cured by applying fertilizer. Poor physical makeup of the soil is a much more serious matter.

Soils of the average graded lawn contain a high proportion of clay. They dry into hard crusts. They are sticky and impervious when wet, slow to absorb water when dry, and furnish little water to plants. Drought quickly affects plants growing on these clay subsoils.

Lawns can be grown on clay, even subsoil clay, but they will be less vigorous and satisfactory. They will require more skill and more work than lawns on soils of good physical makeup.

Even on good soils, a lawn requires work and care. You can't sit back and expect a perfect lawn to appear!

## Improving Lawn Soil

If you are not satisfied with your soil, what can you do about it?

**Buy Topsoil?**—This is expensive, and much so-called topsoil is little better than the soil you have. If you buy topsoil, insist on good loamy texture—or don't buy it. It need not be black. *Also insist on getting soil with no quackgrass or Johnsongrass rhizomes.* These perennial grass weeds cannot be killed in the lawn without killing all the lawn grass.

How much topsoil is needed? The more the better—from 3 to 4 up to 6 to 8 inches.

**Add Sand or Calcined Clay?**—A small amount of sand may do more harm than good. Enough coarse sand to make up 50 to 80 per cent of the resulting mixture will improve the physical condition of a clay soil, if uniformly mixed with it.

Calcined clay, the name given to clay granules fired at a high temperature, can be used the same as sand. Calcined clay is more expensive than sand, volume for volume. The needed quantity of either will be more expensive than most home owners are willing to pay.

**Add Organic Matter?**—This is one remedy for fine textured soils. The difficulty lies in doing it. Manure is out of the question, except on the farm where lawn soils are usually best. Compost could be used, but supplies are usually small.

In starting a new lawn, add peat to fine textured basement soil. This will greatly improve its physical makeup—if you use enough peat. Get fibrous peat (baled sphagnum peat is best) rather than muck, which contains a large amount of clay. Mix the peat with the upper 3 or 4 inches of soil, or with less soil if you use only a small amount of peat. Apply at least a 1-inch layer of peat or compost and work it into the soil.

**Grow Green Manure Crops?**—A green manure crop (such as rye or soybeans to be plowed under) usually takes too long for the results obtained, unless the area is not yet ready for making a lawn.

The best way to build up the organic matter content of poor soils is to grow grass. Grow the best lawn you can with what you have. If this “best” is poor enough to need tearing up and reseeding later, keep the surface layer at the surface. Do not work over 3 inches deep.

**Improve Drainage?** — Good surface drainage, so that water does not stand on the lawn, is essential. Plenty of organic matter and large amounts of sand or calcined clay will improve the under-drainage (that is, the speed with which water moves through the soil).

Tile underdrainage is desirable, but its effect is slow if the tile is covered with basement soils. Considering the difficulty of obtaining outlets for tile, it is doubtful that tiling adds enough to the average lawn to justify the expense, as long as good surface drainage is provided.

## FERTILIZER AND LIME

All new lawns should have fertilizer applied before seeding. Many of them will also need lime. The best way to determine lime and fertilizer needs for a particular lawn is to have samples of the soil tested. Your county Cooperative

Extension Service office can furnish information on how to take samples.

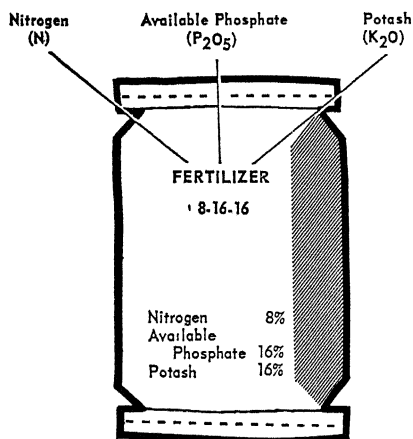
### Lime

Apply enough lime to bring the soil reaction to a pH of 6.0 to 6.5, where a soil pH test indicates that lime is needed. Work into the soil to a depth of 3 to 6 inches. A soil test is essential to determine the specific soil reaction and amount of lime to apply. Lime will not replace the need for fertilizer.

### Fertilizer

The needed fertilizer may be raked into the soil surface for most new lawns. Where the soil test shows extreme lack of phosphorus, work the soil deeper, as described for lime. When a soil test is made, use the amount and analysis suggested for the specific location. In the absence of a soil test, the following amounts should be adequate:

For common Kentucky bluegrass or a bluegrass mixture, apply 40 to 50 pounds per 1,000 sq. ft. of a high phosphate analysis fertilizer, such as 6-24-12, 8-16-16, 6-10-4, 4-12-4, 5-10-5, or similar analysis.



For Merion Kentucky bluegrass, use the same amount of 15-15-15, 12-12-12, 10-10-10 or similar analysis. For an explanation of fertilizer analysis, see pages 9 through 11.

## SEEDING THE LAWN

### Seeding or Sodding?

The only time a sodded lawn looks better than a seeded lawn, provided both are done properly, is during the first few weeks. A sodded lawn may be good or poor depending on the quality of the sod and the skill with which it is put down. Sod has an advantage on steep terraces and areas subject to unusual abuse, as between the walk and the street. Another advantage of sodding is that it may be successfully done anytime the ground is not frozen, if properly watered.

A potential home buyer should consider the sod or turf around a home before he buys. If grass has failed because of shade, poor soil, or cutting too closely, sod will not correct this situation. It, too, will fail unless the cause for failure is corrected. Sod does not eliminate the need for good soil, adequate fertilizer, and proper management.

If you do not like dandelions, crabgrass, quackgrass, and other lawn weeds, be careful not to buy them when you purchase sod. Often, if you do not buy sod from reputable dealers you will buy trouble. Some of these weeds will be costly and take years to eliminate—if you are even lucky enough to get rid of them.

### Lawn Grasses and Mixtures

Many lawn problems result from seeding grasses incapable of making a nice lawn. When you buy lawn seed, think of more than the size of the package and its price.

Lawn seed mixtures are sold which contain large percentages of coarse-leaved annual or perennial grasses such as tall fescue, ryegrass, redtop, and timothy. Mixtures containing these grades are not suitable. Lawns planted with such mixtures do not have a uniform appearance. The broad-leaved grasses grow more rapidly than the fine-leaved grasses and "stand out" in the lawn. Also, these coarse grasses often fail because they are not adapted to standard lawn main-

#### 5. Apply mulch of straw or peat moss.

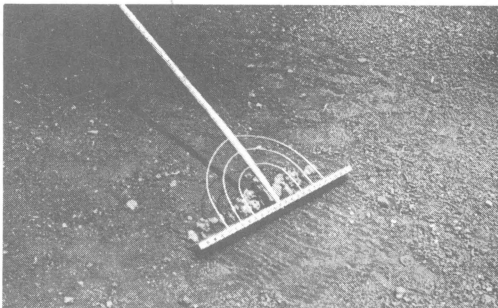
*Photos courtesy Better Lawn and Turf Institute*



1. Plow, rototill, or disc the soil 3 to 6 inches deep.



2. Apply fertilizer.



3. Rake in fertilizer while you remove stones and trash.



4. Apply seed evenly with a spreader or by hand.



tenance practices such as close cutting. (Unwanted grasses are "weeds" that cannot be taken out of the lawn with selective chemicals.)

A straight seeding of Kentucky bluegrass or a blend of bluegrass varieties gives the best results in full sun. Red fescue should be used with bluegrass for shaded areas. No grass can be expected to persist under dense shade. Recent experiments have shown that red fescue gradually dominates a bluegrass-fescue mixture, even in full sun. Don't use this mixture in the sun unless a red fescue sod is not objectionable.

Always buy *clean* seed with a *high* germination per cent. By law, all seed sold in Ohio must be labeled correctly. The label is to provide you with information concerning the seed. Read it! Ohio law allows Kentucky bluegrass seed to contain some seeds of annual bluegrass (*Poa annua*) and bentgrass. Both are serious weeds in Kentucky bluegrass. It is possible to obtain seed free of these unwanted plants if the buyer is persistent and willing to pay the premium price.

Never use a mixture containing bentgrass, unless you want a bentgrass lawn. A small amount of bentgrass will crowd out the other grasses. Bentgrass can make an excellent lawn, if it gets the extreme amount of care it needs.

From Table 1 select one of the grasses or mixtures capable of producing the quality you desire. Remember that grasses which make the best lawns need the most care. If you can provide no more than average care, don't plant bentgrass or a demanding variety of Kentucky bluegrass.

Perennial ryegrass or redtop is often used in mixture with other lawn grasses for areas which are likely to erode, or when a late spring seeding is made because they are fast growing and "quick" to establish. Research at the Ohio Agricultural Research and Development Center indicates that these grasses are persistent and may remain as a part of the lawn mixture. When present, they give the lawn a coarse texture. Perennial

ryegrass or redtop grasses should not be used in most lawn grass mixtures. If you use them do not seed more than one pound of ryegrass nor more than two ounces of redtop per 1,000 square feet, along with the other grasses. You can expect to have redtop in your lawn for many years. Domestic or annual ryegrass will not persist as long as perennial ryegrass.

Clover in a lawn is a matter of personal taste. If you want clover, seed one to two ounces of clover per 1,000 square feet in the spring. When the lawn is seeded in the fall, as it should be, the clover may be broadcast on the frozen ground the following March.

### Varieties of Lawn Grasses

**Kentucky bluegrass**—The majority of Kentucky bluegrass seed used for lawn seedings in Ohio is still common Kentucky bluegrass. "Common" is not a variety, and any Kentucky bluegrass seed which meets the state requirements concerning germination, weed seed, etc. can be called "common." Common Kentucky bluegrass from Kentucky is an acceptable lawn grass in Ohio. Common from the West Coast or from Europe is often not adapted to Ohio conditions.

Kentucky has recently released a variety called "Kenblue" which is a Kentucky-grown common Kentucky bluegrass. When it reaches the market it will insure the purchaser against buying unadapted bluegrass.

A number of varieties of Kentucky bluegrass have been tested in Ohio and some of the results are shown in Table 2. The two varieties which were outstanding in the Wooster test were A-20 and Pennstar. Pennstar has also performed well in tests at Columbus and the OARDC Southern Branch at Ripley. A-20 can be purchased only as sod. Pennstar will be sold as seed, but not before 1969.

Other varieties have been released but have not been adequately tested in Ohio. Among these are Fylking and Belturf.

Blending of Kentucky bluegrass varieties is considered a desirable practice.

Table 1—SELECTED LAWN GRASSES

Grass or Mixture	Potential Quality of Lawn	Sun or Shade	Amount of Care and Cost of Upkeep	Seed per 1000 Sq. Feet	
Varieties or Blends* of Kentucky Bluegrass	100%	Good to Excellent	Sun	Average to Above Average	1-3 lb.
Kentucky Bluegrass	40%-50%	Good	Shade	Average	1½-4 lb.
Red fescue**	50%-60%				
Red fescue**	100%	Fair	Heavy Shade	Below Average	3-5 lb.
Tall Fescue***	90%-95%	Poor	Sun	Below Average	6-8 lb.
Kentucky Bluegrass	5%-10%				
Bentgrass	100%	Excellent	Sun	Much Above Average	½-2 lb.

\* See page — for best varieties and suggested blends.

\*\* Red fescue alone or in mixture with Kentucky bluegrass may also be used for low maintenance lawns in sunny areas.

\*\*\* Use tall fescue only where coarse grass is not objectionable.

The objective is to blend two or more varieties which have different strong points so that they can compensate for each other.

Fescues—In tests at the Ohio Agricultural Research and Development Center, there have been no clear-cut differences among varieties of red fescue. Common creeping red, Pennlawn, Chewings, and Illahee have all performed satisfactorily. Some midwestern states report that Pennlawn does exhibit some superiority over the other types or varieties of red fescue. Rhode Island No. 6, a new variety, has shown no superiority in Ohio tests.

Tall fescues are coarse grasses and should not be confused with red fescue. Kentucky 31 and Alta are common varieties of tall fescue. These grasses will survive heavy traffic and can be used in those areas which receive abuse. Never use them as a minor part of a mixture with fine-leaved grasses such as bluegrass or red fescue where a fine, even-textured lawn is desired. When used alone, or with a small amount of Kentucky bluegrass, seed tall fescue at a heavy rate to provide adequate sod cover for the area and to avoid a clumpy sod.

Bentgrasses—Any of the bentgrasses will make a nice lawn if given proper care. Do not use them in mixtures with other grasses. The colonial bentgrasses have creeping types in them, so they spread by both stolons and short rhizomes. Colonial bentgrasses are likely to be easier to manage on a lawn than creeping bentgrass.

Astoria and Highland are common seeded strains of colonial bentgrass. Seaside and Penncross are varieties of creeping bentgrass which can be propagated from seed. Many varieties of creeping bentgrass are also planted vegetatively (stolons).

Table 2  
KENTUCKY BLUEGRASS VARIETIES

Variety	Resistance to			Weed Inva- sion Density
	Leafspot (melting out)	Stripe Smut	Weed	
Merion	E	P	E	E
Common (Ky. grown)	P	E	F	F
Windsor	G-E	P	E	E
Pennstar	E	E	E	E
Newport	P-F	G	F	F
Prato	E	E	G-E	G
Delta	P	E	P	P
Park	P	E	P	F
A-20*	E	E	E	E
Cougar	P	E	F	F

E = Excellent, G = Good, F = Fair, P = Poor

\* Tested only at OARDC, Wooster

## Time and Rate of Seeding

The best time to seed a lawn in Northern Ohio is between August 15 and September 15. In Central and Southern Ohio, the entire month of September is good. Lawns seeded later in the fall may fail because the young grass does not get enough growth to survive the winter.

If seeding cannot be done by October 1 in Northern Ohio or before October 15 in Southern Ohio, postpone the job until winter or spring. The earlier in the spring a seeding can be made (preferably March) the better the chances for success. Winter seedings made after November 15 in Northern Ohio and after December 1 in Southern Ohio will not germinate until spring. Lawns seeded during the winter usually start earlier than spring seedings can be made.

All lawns cannot be seeded at the best time. Summer annual weeds (crabgrass, foxtail, ragweed, pigweed, and many others) are always a problem with spring and winter seedings. These weed seeds are seldom found in lawn grass seed, but some of them are always in topsoil. Summer weeds are usually avoided with early fall seeding made properly, since a good sod develops before the weed seeds germinate.

Herbicides are not recommended for weed control on a newly seeded lawn until it has been mowed 2 or 3 times. Even then, use herbicides at *minimum rates* and with caution. If you pull weeds by hand, you may damage the new lawn.

Most people sow much more seed than is needed. The lower rate suggested in Table 1 is adequate if the seed is distributed evenly. The higher rate will do no harm, but will not assure success.

## Seeding and Mulching

Sow the seed evenly with a spreader. Plan to go over the area to be seeded twice, preferably in a different direction each time. With a low seeding rate, it is easier to get good distribution if something is added to the seed to make more

bulk. Several materials, such as sand or corn meal, may be used, or the seed may be mixed with a part of the fertilizer. Pelleted fertilizers do not work well for this purpose. If some fertilizer is mixed with the seed, make sure that you mix no more than can be seeded the same day. Prolonged contact with the fertilizer will damage germination of grass seed.

Rake the seed lightly into the soil. If you can still see some seed after raking, you have not covered the seed too deeply.

Apply a mulch at once after seeding. Perhaps the best mulch is an eighth of an inch of ground sphagnum peat. Wet the peat 24 to 48 hours before applying to prevent wind from blowing it away. Straw applied in a thin layer is also satisfactory. When the job is finished you should see half soil and half straw when looking directly down on it. One 50-pound bale spread over 1,000 square feet of seedbed area is about right. Most people apply straw too heavily. It is not necessary or desirable to remove a mulch when you have spread the proper amount evenly. Piles of mulch caused by wind should be respread or removed to prevent smothering the young grass.

On terrace slopes which may wash, stake down cheesecloth, special netting, or other very thin cloth through which the grass can sprout. You do not need to remove this cloth.

Roll as soon as the mulch is applied, if the soil is not wet. Use a regular lawn roller. Then water the surface and keep it moist until the seedlings are established. This usually means that you will need to sprinkle the new seeding lightly at least twice a day, sometimes more often, depending on how hot the weather is and how often it rains.

## Cutting After Seeding

Cut at recommended height as suggested in the section on "Caring for Your Lawn" (Page 12). It is important not to allow the grass to get so tall that it falls over and mats down.



# Caring for Your Lawn

## BLUEGRASS AND BLUEGRASS MIXTURES

Given proper cutting on good soil with adequate fertilization, bluegrass is nearly indestructible by anything short of continued tramping. In fact, getting rid of bluegrass which is growing when you do not want it is a real problem.

### FERTILIZER AND LIME

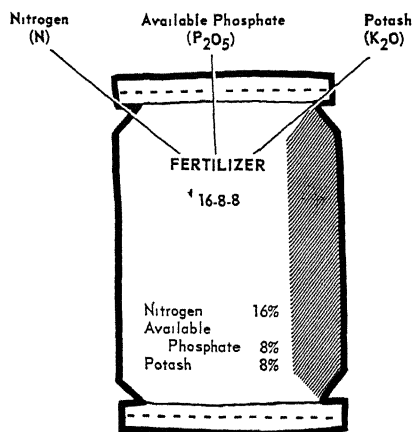
Lawns need regular fertilization. A reliable soil test can be helpful in planning your turf fertilization program, particularly where low levels of phosphorus and/or potassium occur. The fertilizer program described in this section will normally provide enough phosphorus and potassium.

Choosing a fertilizer program will depend on your soil, the type of grass present, and the amount of effort you are willing to expend. Several different plans, as well as kinds of fertilizers, will produce the desired results. Buy fertilizer by analysis. For most lawns, the proper use of nitrogen is the most important phase of the fertilization program.

Either specialty lawn fertilizers, or farm brands may be used with good results. The forms of nitrogen in farm brands are more likely to burn the grass than are some specialty fertilizers, but with reasonable care burn is not a serious problem. Some farm granulated or pelleted fertilizers are hard to get through some lawn spreaders; they may work better in the spinner types of spreaders.

The figures on the fertilizer bag, or on the tag, tell you the per cent of nitrogen (N), phosphate ( $P_2O_5$ ), and potash ( $K_2O$ ) in the fertilizer. This is called the analysis. State law requires that all fertilizers be properly labeled. The analysis is always listed, although it may

be very inconspicuous, even on the bottom of the bag in small print. Additional information, such as the source of nitrogen and other nutrients claimed, is often included. READ THIS INFORMATION. It tells you whether or not you are getting the fertilizer you want.



### Fertilizer Program for Bluegrass

Table 2 lists some examples of six major groups (similar ratios) of fertilizer from which to choose fertilizer for the lawn maintenance program. The rates of nitrogen given are for sources readily available to the grass. Double the suggested rate if you use all Urea-Form nitrogen.

#### A. Annual Treatment for Common Kentucky Bluegrass and Mixtures

1. Apply 3 to 4 lb./1,000 sq. ft. of actual nitrogen during the year.

Table 3—EXAMPLES OF LAWN FERTILIZER GRADES\*

A	B	C	D	E	F
15-15-15	20-10-10	15-10-5	20-5-5	10-3-7	20-0-0 (Ammonium sulfate)
12-12-12	16-8-8	20-10-5	20-8-8	12-5-7	33-0-0 (Ammonium nitrate)
10-10-10	14-7-7	23-12-6		15-5-5	45-0-0 (Urea)
	12-6-6	16-8-4			38-0-0 (Urea-Form)
	10-5-5				5-5-0 (Activated sewage sludge)
	10-6-4				

\* To determine the rate needed, divide the per cent nitrogen (which is the first number in the fertilizer analysis) into pounds of nitrogen to be applied per application. For example: 20% nitrogen divided into 2 lb. nitrogen/1,000 sq. ft. = 10 lb. of 20-10-5/1,000 sq. ft.

This may be done by:

- (a) Selecting one of the fertilizer analyses listed under A, B, C, D, or E in Table 3, or other similar analysis.
- (b) Applying the fertilizer at the rate of 2 lb. of nitrogen per 1,000 sq. ft. during September. (See footnote at bottom of table for procedure to determine the amount of fertilizer to apply.)
- (c) Applying 1 lb. of nitrogen per 1,000 sq. ft. after the rapid spring growth is over. Repeat about July 1 to 15.

You can maintain a sod with less fertilizer than suggested above. However, you should always use the recommendation given in "b" above.

2. Unless a soil test indicates otherwise, apply a complete fertilizer (containing nitrogen, phosphate, and potash) such as given under A, B, C, D, or E in Table 3 annually in September. For the spring and summer applications, one of the straight nitrogen materials as listed under F in the table may be used.

#### B. Annual Treatment for Merion Bluegrass or Mixtures Containing It

1. Apply 5 to 7 lb./1,000 sq. ft. of actual nitrogen, during the year.

This may be done by:

- (a) Selecting a high nitrogen fertilizer, such as one listed under A, B, C, D, or E in Table 3. See the footnote for calculating rate.

(b) Applying the fertilizer at the rate of 2 lb. of nitrogen/1,000 sq. ft. during September.

(c) Applying 1 to 2 lb. of nitrogen/1,000 sq. ft. March 15 to April 15.

(d) Applying 1 lb. of nitrogen/1,000 sq. ft. June 1 to 15, and July 15 to August 15.

2. Suggestions made under Section A-2 regarding the use of complete fertilizers or nitrogen materials for common bluegrass apply also for Merion bluegrass.

#### Choosing a Nitrogen Fertilizer

You can buy nitrogen fertilizers which contain neither phosphoric acid nor potash. Some are soluble in water, while others are quite insoluble. Some contain only organic nitrogen, some have ammonia nitrogen, and others contain nitrate nitrogen. Some will burn green foliage if left in contact with it, and others will not injure the finest turfgrass, even when applied while the grass is wet.

The choice of the nitrogen material to apply where "nitrogen only" is being used depends, therefore, on the conditions under which it is to be used. Table 4 describes four general types of nitrogen fertilizers that are useful under the various conditions described.

#### Fertilizer Burn

It is safe to broadcast all types of fertilizers on lawns at recommended rates early in the spring, if you apply them before green growth has started. Under

these conditions, even without sprinkling, there is no danger of burning the grass. A light burn is unsightly for a week or more but does no permanent damage. Severe burning can kill lawn grasses.

Fertilizers differ in the amount of burn they cause. Ammonium sulfate, ammonium nitrate, urea, and "farm grade" high-nitrogen complete fertilizers are most likely to cause foliage burn.

To avoid fertilizer burn:

1. Do not apply more than 2 lb. nitrogen (N) per 1,000 sq. ft. at one time.
2. Spread evenly.
3. Do not overlap or spill fertilizer.
4. Apply fertilizer only when foliage is dry.
5. Remember, pulverized materials are more likely to stick to foliage, thus causing burn, than granulated or pelleted materials.
6. Water immediately after application. This helps to insure against burn.
7. Use insoluble organic forms of nitrogen or complete fertilizer with the nitrogen composed of these forms.

### Liquid Fertilizers

Many brands and formulas of liquid fertilizers and soluble powders are available. These produce no better results

than the same quantities of plant nutrients supplied from dry fertilizers. Liquids may be more convenient for you to apply; however, they may be more expensive than dry fertilizers.

### Liming Program

Where needed, applications of lime greatly improve the growth and appearance of lawn grasses. The only way to be sure whether or not your lawn needs lime is to have the soil tested. Lime will not reduce the need for fertilizer.

Many simple "quick-tests" are available; however, for a more complete and accurate test take a sample of the soil to your county Cooperative Extension Service office.

There are great variations in the native lime contents of Ohio soils. East of a line from Sandusky to Columbus and Chillicothe, and south of a line from Chillicothe to Hamilton, soils are acid unless they have been limed. North and west of these lines the soils are derived from limestone and are less likely to need lime.

Finely ground or pulverized limestone can be easily applied, is effective, and does not irritate the skin as does hydrated lime. Soil tests, every 3 to 5 years, determine the lime needs and serve as a check on the liming program. Lime may be applied at any time; however, the best times are late fall or early spring.

Table 4—SOME FORMS OF LAWN NITROGEN FERTILIZERS

Type of Fertilizer	Common Name	Approximate Nitrogen Content	Pounds Needed to Supply 1 Pound Nitrogen
1. Soluble, inorganic*	Ammonium sulfate	20%	5
	Ammonium nitrate	33%	3
	Nitrogen solutions	24-32%	3-4
2. Soluble organic forms*	Urea	45%	2.2
3. Insoluble organic forms**	Urea-form	38%	2.6
	Soybean meal	5-10%	10-20
4. Activated sewage sludge**		5%	20

\* These soluble and inorganic forms are more effective than organic and insoluble forms when the soil temperature is below 60° F. They will burn foliage, if left in contact with it.

\*\* The nitrogen in these insoluble organic forms is not readily available unless the soil temperature is above 60° F. They may be broadcast on lawns at any time—at the recommended rates—without danger of burning the foliage. Insoluble organic nitrogen fertilizers usually cost more than soluble organic nitrogen or soluble inorganic nitrogen fertilizers.

## RESEEDING BARE SPOTS

Grass seedlings have little chance in old sod. Much seed is wasted every spring in attempts to seed in established grass. Do not reseed unless there are bare areas of at least one square foot. The best method of "thickening" a sod is to use proper fertilization and mowing practices. In most instances, the addition of seed to a thin sod has little effect on improving the turf.

If there are bare spots that need reseeded, use the same mixture of grass as is prevalent in the rest of the lawn. Follow directions given in section "Starting Your Lawn" on page 3. Plugs of sod taken from inconspicuous places and put in small bare spots are better than seed.

## MOWING

### Mow High

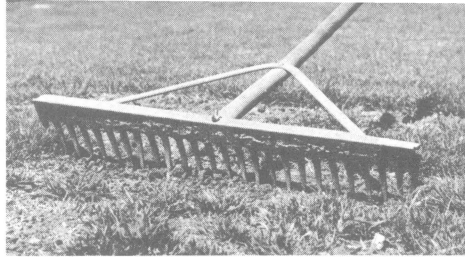
Kentucky bluegrass lawns should be cut 2 to 2½ inches high. Plant foods are produced in the leaves through the action of sunlight; the more leaf, the more food, the more roots, and the stronger the plant. The depth and strength of grass roots are proportional to top growth. The Merion variety of bluegrass can be cut shorter (1 to 1½ inches).

Rotary or reel type mowers can be used to cut bluegrass; however, if Merion bluegrass is to be cut short, a reel type mower should be used. No matter what type you use, be sure you can set it to the recommended cutting height.

Set the mower on a flat surface when you are adjusting it in order to obtain the correct height. Many reel type mowers cannot be adjusted to cut at a 2-inch height. When the grass is cut too short, the beauty and vigor of the lawn will be reduced.

### How Often to Mow

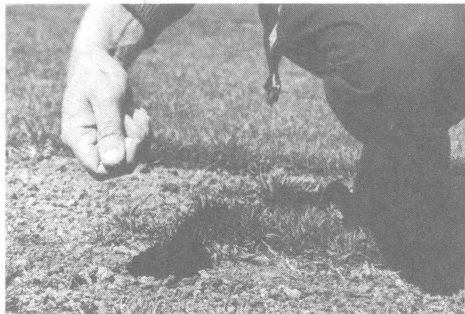
"Cutting high" does not mean to let the grass get tall before you cut it. You should cut often enough that not more than one inch of blade is removed at one time. This means cutting the grass at least twice a week during periods of



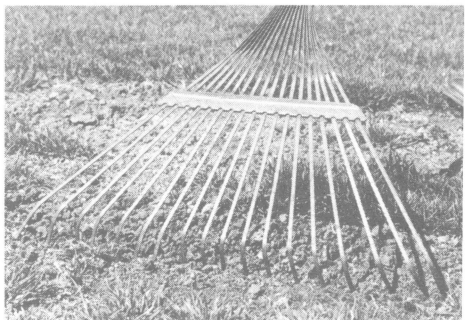
1. Prepare seedbed.



2. Apply fertilizer and work into surface of soil.



3. Sow seed of same mixture of grass as is present in rest of lawn.



4. Rake lightly; just cover seed.



5. Firm soil and apply mulch of straw or peat moss.

rapid growth. Never allow the grass to become so long that two inches of growth is removed. When grass is cut after being allowed to grow too tall, the lower part will be bleached and unsightly.

Mow as early in the spring and as late in the fall as the grass grows tall enough to need cutting.

### **Mowing Shaded Areas**

Mow grass in heavy shade less frequently than the rest of the lawn. Mowing only a few times a season will permit grass to live on many areas where it would die if cut more frequently.

### **Should Clippings Be Removed?**

Allowing the clippings to remain benefits thin stands of lawn grasses. The clippings conserve moisture, keep the soil cooler, and permit re-use of the fertilizing materials in the grass. However, clippings are of little benefit to a thick stand of grass and may hinder it by increasing disease problems, contributing to build-up of "thatch" (see discussion on thatch, page 18), and marring its appearance.

Clippings are left on most lawns because of the time and effort required to remove them. Frequent mowing will reduce to a minimum any problem created by clippings since the short pieces of grass can disappear among the grass blades. If the lawn has gone unmowed until there is a windrow of hay behind the mower, these clippings should be removed.

It may be necessary or desirable to remove clippings after very heavy fertilization. A grass catcher does this with much less work and with less injury to the grass than raking. Power or pushed sweepers also do a good job of removing clippings.

Merion bluegrass makes a dense sod that leaves little place for clippings to disappear. It is not essential to remove the clippings from Merion lawns which are mowed frequently; however, these lawns look better when clippings are removed.

## **WEED CONTROL**

Producing a dense healthy stand of turfgrass is the most satisfactory method of controlling many lawn weeds. Weeds will not be a serious problem, if the recommendations in other sections of this bulletin are followed. However, to have a completely weed-free lawn you may have to use herbicides. Herbicides are chemicals which kill or reduce plant growth. They do not eliminate the need for good lawn management, but if properly used they can be another tool for obtaining a good lawn.

Herbicides are sold commercially under various trade names in several package sizes. It is more important to consider the proper active ingredient in the herbicide than to consider the specific trade name.

Herbicides are manufactured in different forms or formulations. Granules are designed to be applied in the dry form. Wettable powders and liquids are designed to be mixed with water and applied as a spray. The label on the herbicide container gives directions for mixing and applying the various formulations.

Many types of commercial equipment are available for applying turf herbicides. It is important to get uniform distribution of the correct amounts of herbicide. One of the best sprayers for home use is the hand-operated, compressed-air sprayer with a capacity of one to three gallons.

The simplest way to apply the desired amount of material as a spray is to add that amount to a relatively large quantity of water (1 gal. to 200 to 300 sq. ft.). Then go over the lawn repeatedly until all the solution is used. After the first coverage, it is best to go crosswise to the previous spray pattern each time.

Hand-operated push-type spreaders are satisfactory for applying granular herbicides. Follow the calibration directions furnished with the spreader or the directions on the herbicide label. The setting with one of the smallest openings is often required for applying granular herbicides. To be sure the setting is

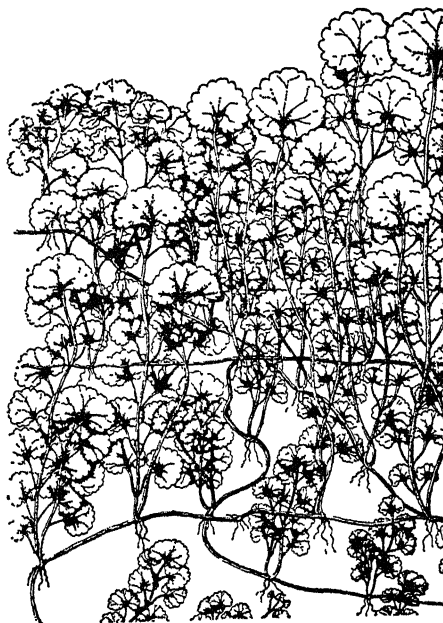
correct, apply a given amount of granules to a small area before treating the entire lawn.

Lawn herbicides are useful and relatively safe but must be handled with respect. *Keep them away from children, and out of eyes and food. Avoid drift while spraying.* ALWAYS READ DIRECTIONS AND PRECAUTIONS ON THE LABEL AND FOLLOW THEM CAREFULLY.

### Broadleaf Weeds

For control purposes, weeds in lawns may be divided into two general classes—broadleaf weeds and undesirable grasses. *Dandelions, plantains* (common and buckhorn) and many other broadleaf weeds in lawns can be eliminated with 2,4-D (2,4-dichlorophenoxyacetic acid). For greatest effect, apply 2,4-D to the foliage of weeds. It works best if applied during periods of ample moisture when the weeds are growing well.

Fall is the best time for general treatment with 2,4-D. When the weeds are killed in the fall, lawn grasses will fill the vacant space before crabgrass germinates the following spring. Also, desirable plants susceptible to 2,4-D injury (most flowers, vegetables, shrubs and trees) are less likely to be injured in the



**GROUND IVY**

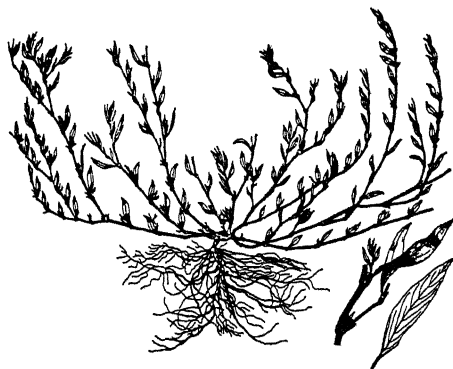
A perennial weed that reproduces by seed and creeping stems. Stems are square-shaped and flowers are purplish color. Commonly found in moist, shaded areas near buildings and shrubbery.

fall than in spring or summer. However, you must use care to prevent 2,4-D injury, regardless of when the weeds are treated.

When using a spray, use the amine, not ester, formulations since esters are more volatile. Spray only when the wind is quiet. Avoid direct contact with all flowers, vegetables, shrubs, or trees.

All lawn "2,4-D products" do not contain the same quantity of 2,4-D per unit of the concentrate. *Follow the directions on the label of the product.* A standard lawn solution is one tablespoon of 4-pounds-per-gallon amine formulation in 1 gallon of water. Apply this to wet the weeds to a point of runoff. On large bluegrass or fescue lawns, use 1 pound of 2,4-D per acre in enough water to cover the area. Use ½ pound per acre on lawns containing bentgrass.

Mixtures of 2,4-D and fertilizer are available for use on lawns. Granu-



**KNOTWEED**

An annual plant that reproduces by seed. Commonly found along walks and driveways and in other compacted areas. It often forms dense closegrowing mats.

lar forms of 2,4-D on inert carrier are also available. These do a good job when properly used.

Sprays may be more effective than dry materials on hard to kill weeds. Formulations for spraying are generally less expensive than those for spread application. "Shaker-cans" or "cans" containing 2,4-D are convenient for spot treating a few weeds missed by the general



### COMMON CHICKWEED

This succulent, fine-stemmed annual weed reproduces by seed and by trailing stems which take root at the lower joints. Leaves are arranged in pairs on the stem. Flowers are small with five deeply-notched petals.

treatment. Wax bars containing 2,4-D are effective on some of the more susceptible broadleaf weeds.

2,4-D will *not* kill some broadleaf weeds commonly found in lawns. Ground ivy, common chickweed, meadow chickweed, mouse-ear chickweed, white clover, wood sorrel, and yarrow are more sensitive to silvex [2-(2,4,5-trichlorophenoxy) propionic acid] than to 2,4-D.

Use the rate suggested on the label. For large areas, use 1½ pounds of silvex per acre in enough water to cover. Repeat applications will likely be needed on some stubborn weeds. This rate will not harm bluegrass, but may seriously injure bentgrass.

Do not use a sprayer used for silvex or 2,4-D for other spraying. If you must

use the sprayer for other purposes, clean it thoroughly with strong ammonia or trisodium phosphate solution (¾ ounce to the gallon). Where silvex has been used, rinse the sprayer with gasoline or kerosene before using the cleaning solution. (Caution—*gasoline and kerosene can be explosive.*)

Red Sorrel (sour dock) and knotweed can be controlled with dicamba. These two species can not be effectively controlled with 2,4-D or silvex. Take extra care when dicamba is used near shrubs and trees.

Materials containing a mixture of 2,4-D and dicamba are available. They will control most broadleaf weeds found in lawns. Be sure to follow directions on the labels for application.



### RED SORREL

A perennial that reproduces by seed and underground rootstocks. Also known as sheep sorrel and sour dock. Leaves have a characteristic arrow shape and usually have a reddish cast at maturity. Very small flowers are also reddish color.

Table 5—SOME COMMON LAWN WEEDS AND CHEMICAL CONTROL

Weed	Annual or Perennial	Chemical to Use	Time of Application	Degree of Control
Black medic	annual	silvex	early spring	good
Carpetweed	annual	2,4-D	spring	good
Carrot, wild	biennial	2,4-D	spring	good
Chickweed, common	annual	silvex	spring or fall	good
Chickweed, mouse-ear	perennial	silvex	fall or spring	good
Chicory	perennial	2,4-D	spring	good
Cinquefoil	perennial	2,4-D	fall or spring	good
Dandelion	perennial	2,4-D	fall or spring	good
Dock, curly	perennial	2,4-D	fall or spring	good
Garlic or onion	perennial	2,4-D ester	late fall-early spring	fair
Grass weeds (See text of bulletin, pages 16 to 18)				
Ground Ivy	perennial	silvex	summer, fall or spring	fair to good
Heal-all	perennial	2,4-D	spring	good
Henbit	annual	silvex	spring	good
Knotweed	annual	2,4-D dicamba	spring or early summer	fair good
Mallow roundleaf	annual	silvex	spring	fair
Pigweed	annual	2,4-D	summer	good
Plantain, buckhorn	perennial	2,4-D	fall or spring	good
Plantain, common	perennial	2,4-D	fall or spring	good
Poison ivy	perennial	2,4,5-T or silvex	spring or summer	good
Red sorrel	perennial	silvex dicamba	spring, summer or fall	poor to fair good
Speedwell, thyme-leaved	perennial	endothal or silvex	fall or spring	poor to fair
Speedwell, annual	annual	endothal or silvex	spring or fall	fair to good
Spurge, spotted	annual	silvex	spring	good
Thistle	perennial or biennial	2,4-D	spring or fall	fair to good
White clover	perennial	silvex	spring, summer or fall	good
Wood sorrel	annual	silvex	spring	fair to good
Yarrow	perennial	silvex	spring	fair

### Grass Weeds

Annual grasses are those which must grow from seed each year. Crabgrass, foxtail, barnyardgrass, and goosegrass are annual grasses found in lawns. Crabgrass is the most common. Herbicides that control crabgrass usually give some control of the other annual grasses.

There are two basic ways of controlling crabgrass with herbicides. One method is to treat the lawn in the winter or spring before crabgrass seeds germinate (pre-emergence). The other method is to apply herbicides after the crabgrass is growing (post-emergence).

Pre-emergence herbicides should be applied before crabgrass first germinates. To be sure you apply the materials in time, apply them before April 1

in Southern Ohio and before April 15 in Northern Ohio.

Many crabgrass pre-emergence herbicides are available, and most are in a dry granular form that must be applied with a two-wheel push-type fertilizer spreader.

Materials containing Azak, Bandane, Benefin, Betasan, Dacthal, and Tupersan have controlled crabgrass in several years of study at The Ohio Agricultural Research and Development Center and The Ohio State University. Betasan is the safest of the materials to use on bentgrass turf. Tupersan is the safest material to use on a new turfgrass seeding. Bluegrass can be seeded at the same time Tupersan is applied.

Post-emergence crabgrass herbicides





**NIMBLEWILL**

**Nimblewill**—A shallow-rooted perennial grass that spreads by seed and underground stems. Stems are weak, branched, and spread along or near the soil surface. Leaf blades usually are less than ¼ inch wide and not more than 2 inches long. Tops die in autumn, leaving a dense brown mat in the lawn during winter and early spring.

**Crabgrass**—An annual grass that reproduces by seed. In Ohio, first germinates from late April to mid-May but may continue to germinate throughout summer, if moisture conditions are favorable. Stems are erect or arise from a



**CRABGRASS**



**TALL OR MEADOW FESCUE**

creeping base and usually form mats. Plant produces seed below mowing heights. Usually is purplish color toward end of growing season.

**Tall or Meadow Fescue**—A forage grass often used on roadsides, playgrounds, and other areas where a tough turf is desired. Commonly found in cheaper seed mixtures. When mixed with bluegrass or other desirable fine-turf lawn grasses, fescue is quite objectionable. It grows in clumps and seldom produces seed under proper mowing practices. It looks much like Kentucky bluegrass but is much coarser.

should be applied about as soon as the crabgrass is seen in the turf. In Ohio studies, at least two and sometimes as many as six applications have been needed to control crabgrass for the summer. Make applications about a week apart until the crabgrass is killed. If additional crabgrass germinates after the application, apply another series of treatments.

The two most effective and widely used post-emergence herbicides are DMA (disodium methylarsonate) and AMA (octyl-dodecyl ammoniummethyl-arsenate). These materials may slightly discolor Kentucky bluegrass, but no serious injury should result if used at the recommended rate. Several experimental

organic arsenicals have given results equal to DMA and AMA but no better.

**Perennial grasses** are those that come back from roots or stems each year. Most lawn grasses are perennials, but there are several perennial grasses which are objectionable in lawns. **Nimblewill** is a summer grass that is quite troublesome in Central and Southern Ohio. This grass is brown and dead appearing from October through April, hence spots of it give a bare appearance to the lawn in the fall, winter, and spring. In summer it is much like bentgrass.

**Tall fescue, velvetgrass, orchardgrass, timothy, redtop, and quackgrass** are also undesirable perennial grasses often found in lawns.

## OTHER LAWN PRACTICES

### Controlling Thatch

Thatch is a tightly intermingled layer of living and dead stems, leaves and roots of grasses, which develops between the layer of green vegetation and the soil surface. Too much thatch keeps water from penetrating the soil, makes some disease problems worse, and apparently prevents the grass from putting down a deep root system. The reasons for its build-up and the reasons why its presence often causes trouble are not well understood. Thin, unfertilized lawns do not have a thatch problem. Thatch is an ailment of "good lawns."

Grasses differ in their inclination to develop thatch. Bentgrass, Merion Kentucky bluegrass, and red fescue are likely to develop a thatch problem unless steps are taken to control it. Common Kentucky bluegrass is less likely to have a serious thatch problem.

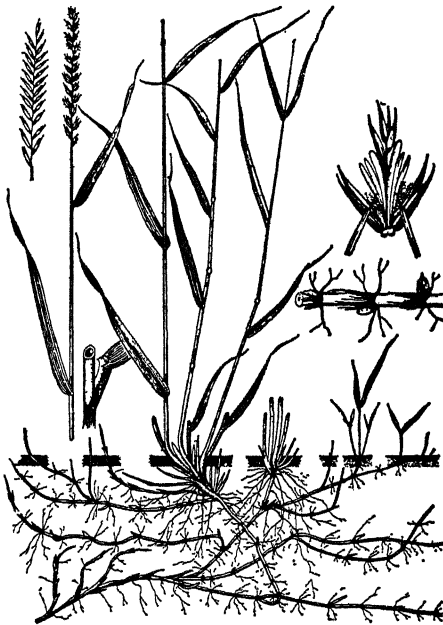
What factors encourage the build-up of thatch? High mowing (but you should not mow shorter than recommended), heavy fertilization, returning clippings, excess soil acidity and clay soil appear to make contributions.

How can you control thatch? The proper use of powered machines (rakes, vertical mowers, etc.) designed to remove the thatch is probably the best solution. You can prevent a serious thatch problem with the annual use of such machines. This operation should be done during the cool season of the year.

Limited experience indicates that early spring, about the time the grass starts growing, is the best time for removing thatch. September is also a good time for this operation, providing the soil is moist. In most cities, you can buy or rent machines for removing thatch. Joint purchase by a group of neighbors is a logical approach to making a thatch removing machine available. For small lawns, special hand thatch rakes may solve the problem.

You can also control thatch with an annual topdressing of about one-eighth inch of good topsoil. The soil buries the

In lawns with sparse infestations, where these perennials are in scattered clumps, the best solution is to remove each clump with a spade and replace it with a similar amount of desirable sod taken from a less noticeable place in the lawn. An alternative procedure would be to fill the dug-out area with soil and then seed a desired turf species. In lawns with heavier infestations where hand removal of the clumps is not practical or where the undesirable perennial grass is not in definite clumps (usually the case with quackgrass), a complete renovation may be the only solution. See "Renovating an Old Lawn" on page 35 for information about chemicals and procedures for renovation.



### QUACKGRASS

A perennial grass that reproduces by seed and a network of underground stems. It forms a dense sod and thrives under the same management practices recommended for a good lawn. Lower leaves, sheaths, and stems are quite hairy. Quackgrass is much coarser than Kentucky bluegrass and is objectionable in a lawn. It cannot be controlled by a herbicide without killing the desirable turf grasses.

thatch and causes it to decompose. Don't topdress with peat or other organic material; this merely adds to the problem. Other maintenance practices which discourage thatch are short mowing (but not too short for the grass), adequate but not excessive fertilization, removing clippings, and liming, if needed.

### **Rolling**

Rolling will not make an uneven lawn smooth. It will bring the surface of a thin lawn to its original level by pushing down bunches of grass which were heaved out of the ground by winter freezing and thawing. This may make the first mowing easier. If rolling is needed, roll the lawn once a year just after the frost has come out of the ground and when the soil is moist but not muddy. A water-weighted roller without the water has sufficient weight. Good sods do little heaving and are not likely to need rolling.

### **Aerating**

The rate of water intake and penetration on some lawns may be improved by using some type of mechanical aerator. This permits more water to soak into the soil. Areas with tight soils are most likely to be benefited. Aerators are of particular benefit on steep slopes and on paths that receive a great deal of traffic.

If you use an aerator, use one that removes a plug of soil. Moist soil is necessary for the satisfactory operation of an aerator.

### **Watering**

In Ohio, bluegrass, growing in good soil and cut at the proper height, will not likely be killed by dry weather. Unwatered lawns may turn brown but will recover when the drought is over. Thus, if you want a green lawn during dry summers, you will have to water it.

You may water whenever the lawn needs it, whether the sun is shining or not. Wet the soil to a depth of 6 to 8 inches. This may require that the sprinkler remain in one place for several hours.

Do not apply water faster than the soil will absorb it. Water that runs down the gutter does not help the lawn. Sprinkling with hose in hand may cool you, but it does little for the lawn. During rainless periods, you should expect to water the lawn every week to 10 days.

During dry summers, crabgrass is more likely to be a problem on watered than on unwatered lawns.

## **BLUEGRASS DISEASES**

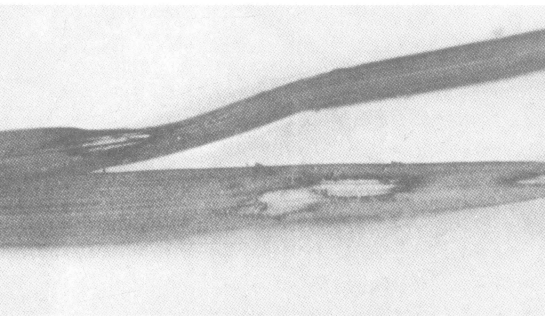
Diseases can attack your lawn suddenly and unexpectedly, causing severe damage to your well maintained grass. Here are some facts about the more common diseases found on bluegrass:

Suggested rates are given for most fungicides. Where no rate is given, follow the manufacturer's directions on the package. Fungicide rates given are to be mixed in 3 to 10 gallons of water and applied on 1000 square feet of turf unless otherwise stated in the directions.

When spraying fungicides, use pressures as high as possible (up to 300 PSI) to insure good penetration and distribution of the material. Using a wetting agent will help to give better coverage of the plants. Some materials such as the mercury compounds should not be used during hot weather. Be sure to read the directions on the label. **Mercury compounds are poisonous. Handle them with care.**

### **Helminthosporium Leaf Spot (Melting-out, Fade-out, Dying-out)**

**Symptoms**—A variety of symptoms may be present. Thinning-out of grass in scattered areas is one sign. A general brownish undercast caused by dead grass leaves accompanies the general thinning-out. Close examination reveals spots on the leaves which are usually brown or purple, or brown with a purple border. Most severe injury results when the leaf sheath is infected. Under moist conditions the disease progresses from leaf sheath to leaf sheath, killing the above ground parts of the plant. In hot weather, the disease may cause a sudden



**Helminthosporium Leaf Spot**

dying-out of large, irregular areas, particularly on Kentucky bluegrass.

**Cause**—This disease is caused by several species of *Helminthosporium*. The spores (fungus seeds) can be blown by the wind or carried by mowers, moving water, on shoes, etc. Infection occurs if free moisture is present on the surface of the plants. Excessive moisture and cool temperatures in early spring or late fall, for several days following infection, will allow the organism to develop rapidly and appear as a leaf spot. Further growth by the fungus in late spring and summer will kill many plants because of crown rot infection.

**Control**—No grass varieties are resistant to all of the melting-out fungi. Species of *Helminthosporium* will attack Kentucky bluegrasses, bentgrasses, fescues, ryegrass, and Bermudagrass.

Good protection against melting-out is possible by spraying with fungicides every 2 to 3 weeks from spring until fall. However, this is a costly procedure. When you can make only a few sprayings, apply them in the spring and one or two in the fall. Make one soon after the grass begins to grow, a second 3 to 4 weeks later, and a third a month after the second. This will protect the grass and keep the disease from building up too heavily. If you wait until midsummer to spray, the fungus will be well established and very difficult to control.

Fungicides that give control are Actidione-thiram (4 oz.), captan 50% (4-6 oz.), Dyrene 50% (4-6 oz.), Kromad (2-3 oz.), Ortho Lawn and Turf Fungicide (4 oz.), Fore (4 oz.), Daconil 2787 (4 oz.), Panogen Turf Spray (1½ oz.), 10% phenyl mercury (1 oz.), thiram 75% (4-5 oz.), and zineb 75% (2-3 oz.). Do not use mercury sprays on Merion bluegrass.

### TRUBLE SHOOTING FOR DISEASES

CONDITION	PROBLEM
1. Small, oblong, purplish to brown spots on leaves. Turf appears thin with reddish-brown undercast in the summer.	Helminthosporium Leaf Spot
2. Small yellow to orange or reddish-brown pustules on leaves. Rust color.	Rust
3. A fine, gray-white, flour-like deposit on grass blades.	Powdery mildew
4. A gray to black, soot-like mold, or white or yellow masses on leaves.	Slime Mold
5. Long, yellow-green streaks or gray to black color in the leaf tissue. Mainly on Merion bluegrass.	Stripe Smut
6. Dark green grass in a circular pattern.	Fairy Ring
7. Patches of whitish, dead, bleached areas of grass. May be several feet in diameter. Whitish pink or dirty gray to black mold growth often present in spring.	Snow Mold
8. Small spots—3 inches in diameter, straw color, often within 30 to 40 feet of the house or in certain areas of the lawn.	Dog Injury
9. Large round areas with frog-eye appearance—not found in shaded areas.	Fusarium Blight
10. Thin, black, or green-black crust on surface of soil.	Algae
11. Turf lacks color and grass is dying and does not respond to cultural practices, insect control, etc.	Nematodes

## Rust

**Symptoms**—Reddish brown or orange spots on the grass blades. The rusty material will rub off easily onto fingers or shoes. It is most likely to become a problem in August and September following extended hot, dry periods. Severely rusted lawns may winter-kill more easily. Merion bluegrass and ryegrass are particularly susceptible.

**Cause**—Caused by rust fungi. The spores are carried on air currents. When moisture is present, they germinate and cause new infections.

**Control**—Lawns containing pure stands of Merion Kentucky bluegrass are especially susceptible to attack by rust. Damage is less severe if a mixture of bluegrass varieties are used or bluegrasses and red fescue.

Keep the grass growing vigorously by adequate fertilization and watering during dry periods but do not rely on this entirely. If rust begins to appear, use a fungicide such as Acti-dione-Thiram (4 oz.) zineb 75% (2-3 oz.) or Fore (4 oz.) Other materials such as Dyrene, Kromad, sulfur, and Tersan give some control.

## Powdery Mildew

**Symptoms**—Isolated wefts of fine, gray-white, cobwebby growth mainly on the upper surface of the leaf blade. The growth becomes more dense, and the leaves appear to have been dusted with flour or lime. Infected leaves usually turn yellow and wither. Found more commonly on bluegrass (especially Merion) in the spring and the fall when nights are cool.

**Cause**—Mildew is caused by a fungus which grows on the surface of the leaf. Sucker-like structures grow into the outer leaf cells from which the fungus obtains its nourishment. Mildew is most severe in shaded areas or where air circulation is poor.

**Control**—Keep the lawn vigorously growing by fertilizing and maintaining adequate moisture in the soil. Improve air circulation to remove humidity pockets by pruning trees and shrubs where possible. Merion bluegrass is more susceptible

than common Kentucky bluegrass, but Helminthosporium disease should be considered when selecting varieties.

Spraying with wettable sulfur (1 tbsp. per gal.) or dusting with a fine sulfur, two applications 10 days apart will check the disease. Acti-dione-Thiram (4 oz.), Karathane ( $\frac{1}{4}$  oz.), Ortho Lawn and Turf Fungicide (4 oz.) or Fore (4 oz.) will give control. You may need two to three applications at weekly intervals for complete control.

## Slime Molds

**Symptoms**—Plant parts as well as the surface of the soil may be covered with a creamy white to translucent slimy growth. This changes to an ash-gray or black, sooty color, or occasionally to yellow. This is the fruiting stage of a slime mold that can be easily rubbed free from the grass blades. It appears most commonly in the spring but may occur during midsummer or fall following heavy rains, watering, or prolonged damp periods.

**Cause**—Slime molds are soil inhabiting fungi that live on decaying organic material in the soil. They do not live on the living grass itself. In humid weather the slime mold grows out of the soil onto whatever is available for support—in this case the grass blades—and produces its fruiting structure. Slime molds are spread by wind-borne spores and water.

**Control**—If left alone, the slime mold soon disappears. However, if its presence is objectionable, it can be removed by a forceful spray from a garden hose or by raking. Do not use the garden hose during periods of wet weather as this will spread the fungus and start new patches. Under these conditions, use a rake, brush, or pole to remove the spore masses. Use the same fungicides recommended for the control of Melting-out, Brown Patch, or other lawn diseases.

## Mushrooms (Toadstools, Puffballs)

**Symptoms**—Mushrooms, puffballs, and toadstools of various sorts grow in the lawn. These are unsightly on a well manicured lawn. Others are foul smelling and some are poisonous and a menace to children.



Toadstools on turf

**Cause**—These are fruiting structures of fungi growing on rotting wood or decaying organic material in the soil. They are often found where buried tree stumps, dead roots, logs, boards, and thatch are present. They often appear after a rainy period or after heavy watering.

**Control**—These fungi are difficult to control. Breaking them off with a mower often is sufficient. At other times, it is best to leave them alone until they complete the decay of the material on which they are growing. In some cases, you may want to dig up the pieces of buried wood. Sometimes you can get temporary control by applying Caloclor, Calo-cure, or Panogen Turf Spray in the area. However, as soon as the fungicide has dissipated, the mushrooms will come back and will require a repeat treatment. Follow the directions given under Fairy Ring.

## Fairy Ring

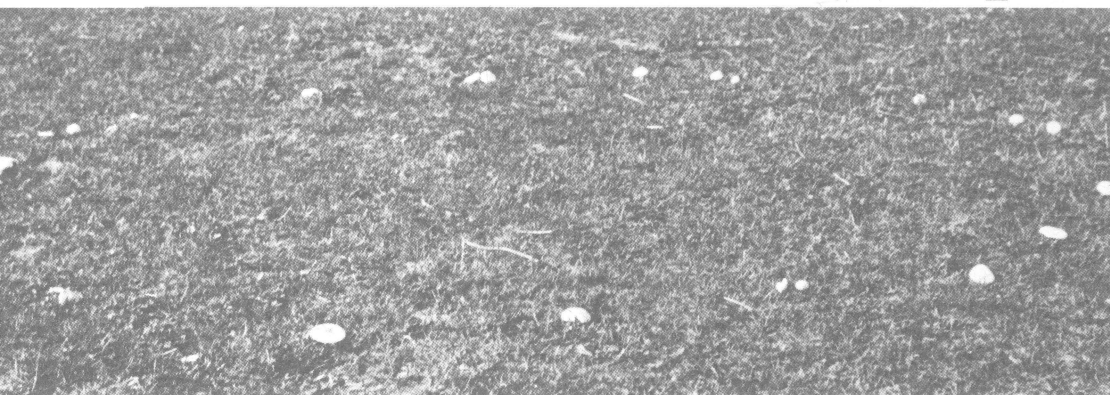
**Symptoms**—Continuous or interrupted bands or rings of fast-growing, dark green grass, often surrounding a ring of thin or dead grass. Mushrooms often appear in the area of dark green grass after rains or heavy watering. The rings often spread by increasing in diameter from 5 to 24 inches each year.

**Cause**—This condition is caused by many soil inhabiting mushroom types of fungi which grow very extensively in the area of the ring. Growth starts with a germinating spore at a central point and grows outward equally in all directions. The grass becomes dark green by using organic matter broken down by the fungus in the soil. Dead grass in the center may be due to temporary exhaustion of nutrients and water or toxic by-products of the fungus.

**Control**—Fairy ring is difficult to control because the soil in the area where the fungus grows is impervious to water, and it is very difficult to get the fungicide in direct contact with the fungus.

One way to control fairy ring is to remove the sod and sterilize the underlying soil with a soil fumigant such as methyl bromide, chloropicrin, Vapam, or V.P.M. soil fumigant. This involves considerable work and is costly. When using a soil fumigant follow the manufacturer's directions carefully.

Another method is to break up or perforate the soil in the fairy ring area with a spading fork or some similar



Fairy Ring

instrument. Make  $\frac{1}{2}$ - to 1-inch holes 4 to 5 inches apart and 6 to 8 inches deep both in the ring of stimulated grass and about 10 inches each side of the ring. Fill the holes with a solution containing a fungicide and a wetting agent. Use Cal-oclor ( $1\frac{1}{2}$  tbsp. per 5 gal. of water), a mixture of Calomel 2 parts, corrosive sublimate 1 part (at the rate of  $1\frac{1}{2}$  tbsp. per 5 gal.), phenyl mercury compounds such as PMAS 10% (1 fluid oz.), or Puraturf No. 10 (2 fluid oz. per 5 gal.). Use a battery filler or watering can with a spout to fill the holes and avoid spilling the solution on the grass. It may be necessary to repeat the treatment in one month.

Some control can be obtained by using the above materials at three times the foliage rates in 10 gallons of water and applying them as a drench to 25 sq. ft. of sod that has been aerified. Add a wetting agent to the solution. Then irrigate the area with no less than one inch of water. **Do not** apply phenyl mercury to Merion bluegrass, never apply these solutions when the temperature is above 70°F., and always irrigate the treated area after applying the material.

### Stripe Smut

**Symptoms**—Long yellow-green streaks develop in the leaves and later become gray in color. In advanced stages the leaf cells covering the streaks break and expose the underlying black spore masses of the fungus. Infected plants make slow growth.

**Cause**—The disease is caused by a fungus. This fungus over-winters in the infected plant, in the soil, or on seed. Symptoms are more apparent when extended periods of 50° to 60°F. temperatures prevail.

**Control**—A complete control program has yet to be established. Merion and Windsor bluegrass are the most susceptible to stripe smut. Other varieties vary in their degree of resistance (Table 2, page 7).

Some reduction in severity of stripe smut can be accomplished by applying nabam at  $2\frac{1}{2}$  pints of 22 per cent active



Striped Smut

formulation per 1,000 sq. ft. of turfgrass in sufficient water to wet the soil to a depth of 2 inches. Application may be made in late fall or early spring.

### Fusarium Blight

**Symptoms**—Light green patches appear first varying from 2 to 6 inches in diameter. After a few days of high temperatures, these patches fade to a dull-tan and eventually to a light-straw color. The patches may be elongate streaks, crescents, or circular patches. In the final stages of the disease distinct streaks and uniformly blighted circular patches of diseased grass will be scattered throughout the lawn. Centers of green, apparently healthy grass, may occur in patches of dead grass giving a frog-eye appearance to the area. The frog-eye pattern is a key diagnostic feature of the disease.

**Cause**—This is a relatively new disease on turf caused by two species of fusaria. It is most common on Merion Bluegrass but attacks bentgrass, fescue, and ryegrass. Fusarium blight occurs when



**Fusarium Blight**

temperatures range from 75° to 95°F. with high humidity at the grass level. It is most often found in sunny locations rather than in shaded areas.

**Control**—Maintain grass in vigorous growing condition. Use strains other than Merion bluegrass. Dethatching and aeration of the soil is helpful. Apply nitrate nitrogen in the spring and fall when growth is most active. A protective spray program with Fore (4-6 oz.) or Tersan OM (4-6 oz.) will give some control. However, once the disease has become well established it may be difficult to control.

### **Algae, Green Scum**

A green or blackish scum may form on bare soil or thinned turf. This is most common in low, wet, shaded, or heavily used and compacted areas. The mass of algae (small plants) dries to form a thin, black crust, which later cracks and peels.

**Control**—Apply a spray of copper sulfate, 1 to 2 ounces in 3 to 5 gallons of water to 1,000 square feet of lawn. The fungicide Fore at 6 oz. per 1000 square feet at 7-day intervals has also given control.

For best control, the soil drainage should be corrected. Aerifying the soil with a hand aerifier or tined fork will help. It may be necessary to install drain tile if water-logged soil is a problem. Reduce foot traffic on the lawn by putting the area into a walk or patio or erect a fence.

### **Nematodes**

**Symptoms** — Turf lacks vigor, often appears off-color, yellow, bunchy, and stunted. Grass blades dying back from the tips may be interspersed with apparently healthy leaves. Injured turf may later thin out, wilt, and die out in irregular areas. The severity of symptoms varies with the quantity of plant parasitic nematodes feeding on and in the roots.

When bluegrass fails to respond to fertilizer and water in the fall and other problems do not exist, nematodes may be suspected. Nematodes can be identified by taking soil plugs of the suspected turf and sending them to the Plant Disease Clinic, 1735 Neil Avenue, Columbus, Ohio 43210. A two-dollar fee must accompany the sample.

**Cause** — Nematodes are microscopic, slender roundworms. They live in the soil where they penetrate into grass roots and suck sap from the root cells. Wounds caused by nematodes also allow disease producing microorganisms to enter which help to weaken the plant. Most nematode types are harmless and feed on decomposing organic matter in the soil. Some are beneficial to man since they feed on the parasitic types that attack plants.

**Control** — Keep grass growing vigorously by following proper watering, fertilizing and cultural practices outlined in this publication. If a nematode problem develops, apply 1½ to 2 pints of Nema-gon EC-2 or Fumazone 70 E with 10 to 15 gallons of water and drench 1000 sq. ft. of turf. Water turf immediately after application to insure penetration of the material into the soil and to prevent injury to the turf. Treat in the spring or fall when soil temperature is above 55°F. Aerifying turf before treatment improves results. Do not use on newly seeded areas. **For bentgrass use only 1 pint of chemical.**

Dollarspot, Snowmold, and Brown Patch are more likely to be problems on bentgrass and are discussed in that section.



# BENTGRASS

You can get a bentgrass lawn by planting it or by accident. Most homeowners are not willing or able to make the effort needed to produce a fine quality bentgrass turf.

You can obtain a bentgrass lawn by (1) sowing seed, (2) planting stolons or sprigs, or (3) sowing a lawn mixture that contains some bentgrass seed. Bentgrass in a mixture will crowd out other grasses.

The homeowner who plants bentgrass should understand that good management is needed to maintain it. Bentgrass is in many lawns where bluegrass is the intended and desired grass. Bentgrass in bluegrass often appears as spongy patches which usually become brown or unsightly in the summer. When bentgrass has invaded a bluegrass lawn, there are two courses of action:

1. Treat it as a bentgrass lawn.
2. Kill the bentgrass with chemicals and reseed.

## Removing Bentgrass from Infested Bluegrass or Fescue Lawns

To date no herbicide will selectively kill bentgrass in a bluegrass sod. Silvex, applied at six pounds active ingredient per acre in July and again in August, followed by heavy raking or vertical mowing and then reseeding, has offered some promise for selective control of bentgrass. Since varieties differ in their tolerance to silvex, do not treat the entire lawn without first trying it on a small scale.

Bentgrass can be killed by the proper use of a non-selective herbicide such as those described in the "Renovating an Old Lawn" section on page 35.

## Managing a Bentgrass Lawn

If you decide you want a bentgrass lawn after purposely seeding it or discovering that it has "taken over," you should manage it as explained in the following paragraphs.

## FERTILIZE AND LIME

Bentgrass requires a high level of fertilization for the carpet-like lawn that it is capable of making. Experiments have shown that bentgrass clippings contain about 3 parts of nitrogen (N) to 1 part phosphate ( $P_2O_5$ ) and 2 parts potash ( $K_2O$ ). Therefore, replace these fertilizer elements in about this ratio, once the soil is adequately supplied with phosphorous and potash. A soil test is advisable for determining specific fertilizer needs. See page 4.

## A Fertilizer Program for Bentgrass

Bentgrass needs 5 to 7 pounds of nitrogen per 1,000 square feet per season along with some phosphorus and potash. The nitrogen must be applied timely, but phosphorus and potash can be applied whenever convenient, providing the soil is kept well supplied with these elements. Nitrogen burns bentgrass easily, so apply soluble nitrogen with care. Any of many fertilizing plans can give equal results. Some possible plans are suggested below:

**Plan A**—Apply 12-3-6, 10-3-7, or similar analysis at the rate of 10 lb. per 1,000 sq. ft. (about 1 lb. of actual nitrogen) each month, April through October. If all the nitrogen is from Urea-Form, apply twice as much nitrogen using half the number of applications. Make comparable adjustments when only a part of the nitrogen is from Urea-Form.

**Plan B**—Apply soluble or readily available organic nitrogen at the rate of 1 lb. of actual nitrogen per 1,000 sq. ft. each month, April through October. If you use Urea-Form nitrogen, make three applications at the rate of 5 lb. of nitrogen (about 13 lb. of 38% material) per 1,000 sq. ft. each, one in early September,

one in April, and one in July. Supplement the nitrogen with 4 lb. of muriate of potash (0-0-60) per 1,000 sq. ft. in the spring and 10 lb. of 0-20-20 per 1,000 sq. ft. in the fall.

**Plan C**—Use the annual treatment suggested for Merion bluegrass on page 10. Take care not to burn the grass.

**Plan D**—Be satisfied with less than the best. Cut the fertilizer in the above plans in half and make fewer applications.

### Fertilizer Burn

Bentgrass is more sensitive to burning than bluegrass. It is advisable to water the grass immediately after applying fertilizer that may burn. If you apply inorganic fertilizer, do not walk over the area until the fertilizer has been washed off the leaves. More information can be found on page 10.

### Liming

The discussion on liming in the bluegrass section (page 11) applies also to bentgrass.

### MOWING

Bentgrass should be cut short. Cut  $\frac{1}{2}$  to  $\frac{3}{4}$  inch using a reel type mower. Some lawn mowers cannot be adjusted to cut this short. You may need to mow three or more times a week. It is desirable, but not absolutely necessary, to remove clippings.

### CONTROLLING THATCH

For a healthy lawn, prevent bentgrass from forming an extremely heavy thatch of unrotted stems, leaves, and roots which will give it a spongy feeling when stepped on. This thatch is heavier when bentgrass is mowed high; however, you will not avoid the difficulty by short mowing. See page 18 for more information on thatch.

### TOPDRESSING

A light (about one-eighth inch) application of good topsoil annually will

serve to level the lawn surface and will go a long way toward controlling thatch. You may apply some of the needed lime or fertilizing by mixing it with the topdressing. Use weed-clean soil for topdressing.

### ROLLING AND AERATING

For information on rolling and aerating, see the section under bluegrass on page 19. Aerators may be more beneficial on bentgrass than on bluegrass lawns. Use an aerator that removes a plug of soil.

### WATERING

Watering is necessary to have an attractive bentgrass lawn. During dry periods, this may mean watering three times weekly if the root growth is poor. Water thoroughly and as infrequently as possible to encourage a better root system. Unless you have a good water supply, you should not attempt a bentgrass lawn.

### WEED CONTROL

A bentgrass lawn, properly cared for, is so dense that weeds are not a serious problem. If broadleaf weeds are present, use 2,4-D at the minimum rate recommended on the container. Apply this weed killer during the cool weather of spring, or, preferably, fall. Some annual grassy weeds may also become a problem. Wise use of one of the arsenicals, applied as recommended on the container, has given moderate success for pre-emergence control of some *annual* grassy weeds in bentgrass.

### BENTGRASS DISEASES

Bentgrass lawns are susceptible to several diseases that may cause serious damage before and during the growing season. An active disease control program is a must to insure a perfect lawn. Listed below are some of the diseases more commonly found on bentgrass. Other problems that may be found in bentgrass, such as Fairy Ring, Slime Mold, Algae, Fusarium Blight, and Nematodes, are listed under the previous section on bluegrass lawns, pages 19 and 24.

## Brown Patch

**Symptoms**—Irregularly shaped brown spots, one inch to several feet in diameter, develop on the lawn. Leaves are at first watersoaked and dark, but soon dry, wither, and turn brown in color. On close-clipped bentgrass a dark, purplish smoke ring of wilting grass borders the diseased areas. This ring is not present when the weather is dry and is often more easily seen in the early morning. Brown patch occurs in hot, humid, summer weather when night temperatures are above 70°F. and when leaf surfaces are covered with free moisture for long periods of time. The turf generally recovers in 2 to 3 weeks, but the roots and crowns can be killed during severe outbreaks.

**Cause**—Brown patch is caused by a common soil-borne fungus. The fungus is present in most soils, and all lawn grasses grown in the Midwest are attacked. However, bentgrasses are more seriously injured than the coarser bluegrasses and red fescues. Colonial bents are more susceptible than creeping bents. Four conditions are necessary for the brown-patch fungus to attack grass blades:

1. The presence of the active fungus in the soil or turf mat.
2. A dense growth of a susceptible grass.
3. A prolonged dew or film of moisture on the foliage.
4. Temperatures of 70° to 95°F. for at least several hours.

If any of these conditions is lacking, brown patch will not be severe.

**Control**—Avoid overwatering and frequent late afternoon or evening sprinkling. Remove water on leaves by brushing or poling. Do not over fertilize. Following nitrogen application, apply fungicide more often. Less brown patch occurs when available nitrogen supply is low. Increase air movement by pruning trees and shrubs. Remove clippings if possible. Spray weekly with such fungicides as Kromad (2-3 oz.), mercury chlorides (1½ oz.), Dyrene 50% (4 oz.), 10% phenyl mercury (1 oz.), Acti-dione-Thiram (4 oz.), Ortho Lawn and Turf



**Brown Patch in Bentgrass**

Fungicide (4 oz.), Thimer (3 oz.), Tersan OM (4 oz.), Fore (4 oz.), Daconil 2787 (4 oz.).

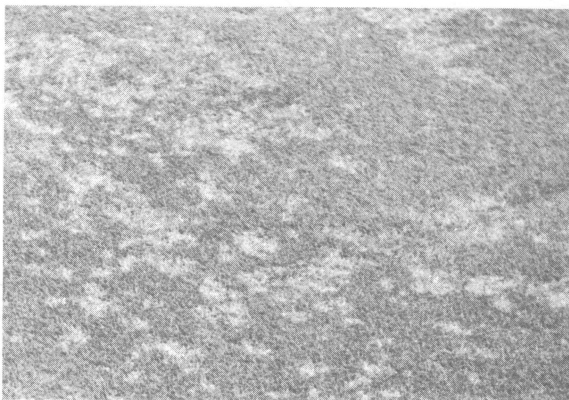
**NOTE**—Do not use mercury when temperatures are above 80°F.

## Dollar Spot (Small Brown Patch)

**Symptoms**—Appears as round, brown, or bleached spots the size of a silver dollar or somewhat larger. On bluegrasses and fescues, the spots may reach 4 to 6 inches in diameter. The spots often run together forming large, irregular straw-colored sunken areas. When the disease is active, you can see white, cobwebby growth on the grass leaves in the morning dew.

**Cause**—The disease is caused by a fungus which is most active during moist periods of warm (60° to 86°F.) days and cool nights in spring, early summer, and fall. All lawn grasses grown in the

**Dollar Spot on Bentgrass**



North Central States are attacked, but bentgrasses, especially certain strains of creeping bentgrass, are most susceptible.

**Control**—Follow the same cultural practices as for Brown Patch. Spray during spring, late summer, and fall months using Cadminate (½ oz.), Tersan OM (4 oz.), Thimer (3 oz.), Kromad (4 oz.), Caddy (1 oz.), Dyrene (4-6 oz.), Ortho Lawn and Turf Fungicide (4 oz.), Actidione-thiram (4 oz.), Fore (4 oz.), Daconil 2787 (4 oz.).



**Snow Mold**

**Snow Mold**

**Symptoms**—The disease appears as patches of whitish, dead, bleached areas of turf one inch to several feet in diameter. Several spots may run together forming large, irregular areas. The affected grass is often covered with a dense whitish-pink or dirty-gray to almost black mold growth. The disease is found in winter or early spring in wet, shaded areas, or where snow is melting. The bentgrasses are more severely attacked than coarser lawn grasses.

**Cause**—There are several fungi involved. In some areas, where summers are cool and moist, species of *Fusarium* are active throughout the summer. Snow is not necessary for the development of this disease. Snow mold damage often occurs where there are foot prints or some type of compaction.

**Control**—Avoid late fall fertilization with quickly available nitrogen. Avoid heavy mats of grass. Spray in late fall or early winter prior to the first snow with mercury chlorides (2-3 oz.), 10% phenyl mercury (1-2 oz.), Thimer (6 oz.), Tersan OM (6-8 oz.), Ortho Lawn and Turf Fungicide (4 oz.), or Dyrene (4-6 oz.).

**Pythium Blight (Grease Spot, Cottony Blight)**

**Symptoms**—Appears as small spots ranging from ½ to 4 inches in diameter. Water-soaked at first, these patches fade to a light brown color as the leaves shrivel. A greasy border of blackened grass blades intertwined with a cottony mass of fungus threads is often found. Streaks often conform to drainage patterns or mowing directions.

**TROUBLE SHOOTING FOR DISEASES**

CONDITION	PROBLEM
1. A gray to black, soot-like mold or white or yellow masses on leaves.	Slime Mold
2. Dark green grass in a circular pattern.	Fairy Ring
3. Grass killed in more or less circular patches. Light brown in color. Patches may expand to several feet in diameter.	Brown Patch
4. Grass killed in distinct patches 2 to 3 inches in diameter but may run together. Brown or bleached in color.	Dollar Spot
5. Patches of whitish, dead, bleached areas of grass. May be several feet in diameter. Whitish pink or dirty gray to black mold growth often present in spring.	Snow Mold
6. Dead areas of turf, often in streaks. A greasy border of blackened grass blades with white cottony fungus growth.	Pythium Blight
7. Small spots—3 inches in diameter, straw color, often within 30 to 40 feet of the house or in certain areas of the lawn.	Dog Injury

**Cause**—The disease is caused by two species of *Pythium*. Both species are capable of surviving in the soil and are favored by high humidity and high temperature (85° to 95°F.).

**Control**—*Pythium* blights are difficult to control. Proper lawn cultural practices provide the highest level of resistance. Spraying with zineb (2 oz.) at 5- to 7-day intervals, or 3- to 4-day intervals

when high temperature and humidity exists or with Dexon 35% (3 to 4 oz.) at weekly intervals will help to give control.

For further information and pictures of disease problems on turf obtain a copy of the North Central Regional Extension Publication No. 12, *Lawn Diseases in the Midwest*, available at county Cooperative Extension Service offices.

## Insect Control in Lawns

### WHITE GRUBS

Grubworms are the larvae of hard-shelled beetles. They are whitish, have brown heads, and usually lie in a C-shaped position in soil around the root area of grasses. In Ohio, there are three kinds of grubs which occur most commonly and cause the greatest damage. The three grubs are (1) June beetles, (2) Northern masked chafer, and (3) Japanese beetle. Damage in lawns by grubs appears as brown patches of dead grass which can be rolled back just like a carpet. In general, the damage should be noticeable from May on.

Active ground moles in a yard are a good indication that grubs are present, since moles feed on grubs. The best way to tell if you have grubs is to examine

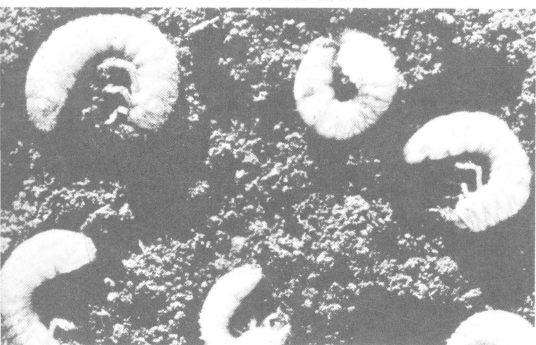
the soil from May to September by cutting a foot-square flap on three sides and rolling it back to observe the presence or absence of the C-shaped grubs. Do this in several places in the lawn. A treatment is needed when you find an average of one or more grubs per square foot.

### Japanese Beetle

Japanese beetle adults usually appear on the foliage about the third week in June. These beetles are about 1 inch long and  $\frac{1}{4}$  inch wide. The head, thorax, and abdomen are metallic-green in color, while the hard outer wings are coppery-brown. There are two tufts of white hair on the abdomen just behind the wing covers and five tufts along each side of the body. Adults are mid-day fliers, their period of greatest activity being from about 9 a.m. to 4 p.m. The female beetle feeds on foliage a few days after emerging before it enters the turf to lay from one to four eggs. It then emerges again, and, after feeding a few more days, returns to the soil to deposit another batch of eggs. This procedure continues until a total of from 40 to 60 eggs have been deposited. All eggs are laid about  $2\frac{1}{2}$  inches beneath the surface. The life time of the beetle is from 30 to 45 days.

Eggs are nearly spherical in shape,  $\frac{1}{16}$  to  $\frac{1}{8}$  inch in diameter, and white when first laid changing to cream color

White Grubs



before hatching. Eggs are deposited in the soil and hatch into tiny grubs in about 10 days.

Grubs immediately begin to feed on the humus in the soil and on the roots of various plants. As the grubs increase in size, they work their way close to the soil surface where they continue to feed on the roots of grasses, causing the grass to die out in small patches. By late September, or on the approach of cold weather, the grubs, which by that time, are about one inch long and are white to greyish-white in color, gradually move downward in the soil, where they spend the winter. The depth to which they migrate undoubtedly is affected by temperature, soil type, and soil moisture, but usually it varies from 6 to 14 inches. In late March or early April of the following year, the grubs again approach the soil surface to continue their feeding. In late May, they change into the pupal stage.

Pupa is cream-colored, bobbin-shaped, and about  $\frac{1}{2}$  inch in length. It is from this stage that the insect transforms into the adult beetle. The life cycle of this species requires one year.

### Northern Masked Chafer

The Northern masked chafer is chestnut-brown in color and is covered with fine hairs. Adult beetles emerge from the soil during the latter part of June and early July. Adults are night fliers in habit and remain in the soil during the day. Unlike the Japanese beetle, they are strongly attracted to light. Careful observations have failed to find adult feeding of any kind.

Female adults begin to lay eggs in the soil within a few days after they emerge from the pupal case. Eggs of this beetle, when laid, are pearly-white and egg-shaped. Most of them are laid between four and six inches below the soil surface. The eggs hatch into tiny grubs in about 20 to 22 days.

Tiny grubs begin to feed on the roots of plants and other organic material in the soil almost immediately after hatching. As the grubs increase in size they work their way close to the surface where they continue to feed on the roots of grasses. About the middle of October, or at the onset of cold weather, grubs begin to descend in the soil, where they spend the winter at a depth of 14 to 16 inches. When this occurs, the grubs are usually about  $1\frac{1}{4}$  inches long. In the following spring the grubs begin to move upward and by early May all are feeding close to the surface. In early June they again begin to move downward in the soil but only go to a depth of about 6 inches, where they transform to the pupal stage.

The pupa when newly transformed is creamy-white in color, gradually turning to reddish-brown. It spends an average of 18 days in this stage. It is from this stage that the insect transforms into the adult beetle. The life cycle requires one year.

### June Beetles

More than 30 species of June Beetles, *Phyllophaga* spp., are found in Ohio. The adults of the different species, which vary from light brown to nearly black in color, emerge from the soil during May and June. Adults feed at night on the foliage

Table 6—RECOMMENDATIONS FOR GRUB CONTROL

Insecticide	Formulation You Buy	Amount to Use per 1,000 Sq. Ft. Lawn	Instructions
Aldrin	4 lb. liquid conc. 20% granules	5 tbsp. 1 cupful	When using a liquid concentrate add the insecticide to enough water to get good thorough coverage of the area to be treated. Apply the granules as they come. Don't mix them with water.
Chlordane	72% liquid conc. 5% granules	4 tbsp. 2½ lb.	
Dieldrin	2½% granules 1.5 lb. liquid conc.	8 tbsp. 2½ lb.	
Heptachlor	2 lb. liquid conc. 20% granules	9 tbsp. 1 cupful	

of such trees as oak, hickory, walnut, birch, elm, willow, and many others. They hide in the soil during the day where the females lay eggs, usually in grass areas.

Eggs of these beetles, when first laid, are pearly-white and elongated, becoming swollen and almost spherical 6 or 7 days later. They hatch into tiny grubs in about 3 or 4 weeks.

The young grubs feed on the decaying and living vegetable matter in the soil during the first summer. As cold weather approaches, they burrow deeper into the soil, remaining there until the spring of the following year when they return near the surface to continue their feeding on the roots of plants. The grubs feed ravenously and grow rapidly throughout the second summer, causing most of the damage to turf during this year. About mid-October, they again burrow into the soil to pass the second winter. In the following spring they once more come to the surface and feed for a month or two on the roots of grasses and other plants. About the middle of June they move downward in the soil and change to the pupal stage. After spending a month as pupae, they change to adults but remain in their pupal chamber throughout the fall and winter and emerge as adults the following May and June. The female beetles begin to lay eggs in the soil shortly after emerging and thus start another cycle.

**Control**—Apply any one of the insecticides listed below in late March or early April or in the fall before the ground freezes. Water the lawn after treatment. Keep pets and children off of the lawn until it has had a chance to dry. One treatment lasts 5 years or more.

### **SOD WEBWORM**

The sod webworm is one of the more destructive insect pests of bluegrass. Damage to grass is caused by the feeding during the larval or worm stage. The adult moth does not cause damage.

Larvae are generally about 1 inch long when full-grown by  $\frac{1}{8}$  inch in diameter, a dirty, yellowish-white color with a light brown head and at least

four parallel rows of small dark spots running from head to tail. Larvae lie in a curled position in the thatch of the grass.

Adult webworms are about  $\frac{3}{4}$  inch long, cigar-shaped, and buff colored. There may be a small darker line on the top of each wing cover. Two small finger-like projections are visible at the front of the head. When at rest, the wings are wrapped around the body to form a half circle. Adult moths can usually be kicked up by persons walking through or mowing the grass. They usually fly up a short distance across the lawn in a zig-zag pattern and quickly dart back into the grass.

Sod webworms spend the winter as partially grown larvae several inches deep in the soil. At the approach of warm weather in the spring, the larvae move upward and begin feeding on the lush spring growth of grass. In the spring and summer, the sod webworm larvae live on the surface of the soil in small silken tunnels among the thatch of the grass. They chew grass blades off just above the thatch line, pull the blades into their silken tunnels, and eat them. Injury therefore appears as small brown patches of close-clipped grass about the size of a softball. When many larvae are present, the small brown patches run together and form large irregular dead patches. During June some of the larvae complete their development and change to the pupal or resting stage. By late June and early July adult moths emerge from the pupae, pair-up, mate, and soon begin laying eggs at random in the bluegrass for another generation. At least two generations, and possibly three, are produced in one year. The second generation, which appears in late July and August, may cause the most damage. When the temperature remains below 40°F. in the fall, most of the larvae have already gone down in the soil to overwinter. Where webworms are abundant, numerous small holes about the diameter of one's finger are often found randomly spaced in the dead patches. These holes generally extend down to near the soil line. The holes are made by

**Table 7—RECOMMENDATIONS FOR SOD WEBWORM CONTROL**

Recommended Insecticide	Formulation You Buy	Amount to Use per 1,000 Sq. Ft. Lawn	Amount of Water to Use Per 1,000 Sq. Ft. Lawn
Sevin	50% powder	2 cupfuls	3-5 gal.
Sevin	80% powder	1¼ cupfuls	3-5 gal.
Sevin	4 lb. liquid conc.	¾ cupful	3-5 gal.
Diazinon	25% liquid conc.	1 cupful	3-5 gal.
Dylox	50% powder	1 cupful	3-5 gal.

blackbirds seeking out the larger sod webworm larvae.

**Control**—Since control measures are directed at the larvae, the best time to treat is when the majority of the eggs have hatched and small larvae are present, but before excessive damage occurs. Most people want to do something when they see many moths flying at night or kick many up in the daytime. When you see moths, this means that the larvae have completed their development and are leaving the lawn. The time to treat is about two weeks after a sharp decline in the number of moths seen. At this time the eggs that were laid by the flying moths should have hatched and a new batch of larvae should be in the lawn feeding. Generations of the webworm do overlap, therefore, some adults and larvae will be present nearly all summer long. In Ohio, the best time to treat for this insect would be once in early June and again in late July or early August. If you treat for sod webworm use any one of the materials listed in Table 7.

### CHINCH BUGS

Hairy chinch bugs are serious pests of lawns in Ohio. They are likely to be more serious in lawns containing bent grass; however, bluegrass is also attacked. Damage to lawns by chinch bugs is caused by the young bugs or nymphs, which are about ¼ inch long, black with

a white spot on their back between their wings. The bugs suck juices from the grass, causing it to turn brown and eventually die. Chinch bug infested lawns may have many large irregular dead patches. The bugs will be found within a circle of grass which has turned yellow around these dead spots. There are two yearly generations of chinch bugs in Ohio with nymphs being present in the lawn the last half of June for the first generation and again the last half of August for the second generation.

**Control**—Two treatments are probably needed to keep the damage to a minimum in lawns where this insect is a problem. The first treatment should be applied in early June and again in early August. Since the bugs are usually concealed in the thatch, it is best to irrigate the lawn before applying a treatment. Use any one of the insecticides in Table 8 for control of this pest.

### CUTWORMS

Cutworms are the larval stage of night-flying moths. The caterpillars are smooth, nearly naked, dull-colored, and marked with spots and stripes. They vary in length from 1 to 2 inches when fully grown. Cutworms feed mostly at night and are present in the lawn from spring until late summer. Cutworms damage the grass by chewing off the blades, and sometimes the entire stem to the soil line,

**Table 8—RECOMMENDATIONS FOR CHINCH BUG CONTROL**

Recommended Insecticide	Formulation You Buy	Amount to Use per 1,000 Sq. Ft. Lawn	Amount of Water to Use Per 1,000 Sq. Ft. Lawn
DDT	25% liquid conc.	1 pint	30 gal.
Sevin	80% powder	2½ lb.	100 gal.
Diazinon	25% liquid conc.	6 oz.	25 gal.
Ethion	50% liquid conc.	½ pint	30 gal.



leaving deep, dead patches in the lawn.

**Control**—Where cutworms are a problem in a lawn, use any one of the materials listed for grub control. Apply the insecticide in the late afternoon for best results.

### MOLES

Even though the mole is not an insect, it does cause much damage to lawns. Moles infest lawns because they are there feeding on grubs. Getting rid of the grubs will get rid of the moles, too. Moles can be controlled with baits or traps, but the best method is to get rid of their food source—the grubs.

### ANTS

These insects build nests in the ground and usually form mounds around the openings. The anthills may smother the

grass under them as well as destroy the grass roots in the immediate area of the anthill.

**Control**—Chlordane, dieldrin, aldrin, heptachlor, or diazinon are insecticides which will control ants, if they are used as instructed on the container label where ant control recommendations are listed.

### EARTHWORMS

Sometimes earthworms become so numerous in a lawn that the lawn becomes full of small mounds or castings, becoming rough and unsightly.

**Control**—Any one of the insecticides listed for grubs will reduce earthworm populations the first year, but will not eliminate them completely. Earthworm populations will gradually increase after the first year of treatment.

## Diagnosing Lawn Problems

When a lawn problem develops, diagnose the trouble before applying corrective treatments.

### BROWN OR DEAD SPOTS

Many lawn problems make their first appearance in spots. The season of the year in which they appear and previous management practices may be clues to the trouble.

**Is it fertilizer burn?** When was fertilizer last applied? How much? What analysis? Look for brown spots or streaks where it was necessary to go around trees, shrubs, or other obstacles or where the spreader was turned at the edge of the lawn. A uniform brown cast may be fertilizer burn. A rather low rate may burn if applied when the grass is wet and the fertilizer is not washed off immediately.

**Is it a disease?** What species is affected? Bentgrass often gets *snowmold*

in winter or early spring. Other grasses may also be affected by snowmold. Bentgrass often gets *dollar spot* in May, June, September, and October. Common Kentucky bluegrass and many varieties get *melting out* (*Helminthosporium leaf spot*) most seriously in May and June. With serious attacks of this disease, the entire lawn may appear brown after mowing. Some areas of the lawn may be more seriously affected than others. How was the lawn fertilized in the spring? It will be more serious when a high rate of nitrogen was applied in the spring. Bentgrass may get *big brown patch* in July and August. It shows up during hot, humid weather. A black *slime mold* may develop on the grass during wet weather. See "Trouble Shooting for Diseases" on page 28. For positive identification of a disease problem, send a sample to the *Plant Disease Clinic*, the Ohio State Univer-

sity, through your county Cooperative Extension Service office.

*Is it insect damage?* The various types of white grubs (Japanese, May, or June beetle) may kill large areas of a lawn. Worst damage shows up in late summer. Affected areas have roots cut loose so that sod can be rolled up to expose grubs. Extensive bird feeding and skunk feeding are signs of grubs being present. Cutworms and sod webworms live in the sod and feed on the leaves and stems at night. The worms make a small brown spot by eating circular or irregular areas around holes in which they are hiding. This damage may be mistaken for **dollar spot** since the trouble often occurs on bentgrass. **Chinch bugs** give trouble on bentgrass some years when the weather is hot and dry. Large brown areas, usually circular, result in sunny areas.

**Are the dead spots annual bluegrass?** It is the nature of annual bluegrass (*Poa annua*) to die during the summer. This may occur suddenly. Dead annual bluegrass is often called "disease." **Redtop** has few basal leaves after it is 2 or 3 years old and may appear brown after mowing. Where it is concentrated, a "brown spot" will appear.

Local **dry spots** may cause brown spots. Punch the affected spots and the adjacent green area with a knife blade, screw driver, or similar instrument. If the brown spot is hard and the green area soft, a lack of moisture in the brown area is probably the difficulty. Local dry spots develop because of poor soil condition, thatch, fungus mycelium growth in soil, or other unknown causes. Bentgrass patches usually turn brown first in an otherwise Kentucky bluegrass lawn.

The improper use of pesticides or other chemicals may cause brown spots. Bentgrass spots may be browned with an application of 2,4-D or other chemical, since bentgrass is more sensitive to injury than other lawn grasses. Herbicide for controlling crabgrass, insecticide or fungicide can burn.

**Gasoline** or other petroleum products will kill grass where spilled. Small

brown spots may result from over-filling the gas tank on the mower and from gas sloshing out as the mower moves along.

**Mowers** in poor condition may be the cause of some browning on lawns. A **reel-type mower** that is dull or has the reel set too far from the bed plate, may crimp the grass instead of cutting it. The dead leaf tips will cause a general browning. A **rotary mower** that is dull, has some part of the blade other than the cutting edge hitting the grass, or has a blade turning too slowly will cause the grass to fray. The grass will show a white cast and then brown on the tips.

A **female dog** may cause green or brown spots on a lawn, depending on the time of year and the size of the dog. The larger the dog, the drier the soil, and the higher the temperature, the more damage will be done. In or around the affected spot, grass which is not killed will turn greener from stimulation by nitrogen in the urine.

## MOSS

Moss is not considered a lawn weed but is merely growing where the grass has failed for some reason. Some of the most frequent reasons for grass failing and moss showing up are listed below.

If **shade** is dense, or if the wrong species of grass has been used for shaded areas, moss is likely to be present. The red fescues—Pennlawn, Illahee, creeping red, chewings, etc.—are best adapted to shade.

**Inadequate fertilizer** will result in a thin lawn which leaves spaces for moss to grow.

If an area is **wet** to grow lawn grasses, moss is likely to be present. The problem can usually be corrected by filling the low area to improve surface drainage, or by putting in a drain tile.

**Extreme acidity** may be a contributing factor to the difficulty of growing grass in the acid soil areas. Lawn grasses are quite tolerant to acid conditions, but there is a limit beyond which they will not do well.

## THIN, UNTHRIFTY LAWN

If there is a uniformly thin stand of grass and the lawn has a general unhealthy look, consider the points below:

1. The lawn is probably not receiving enough fertilizer.

2. The lawn may be mowed too short. Mow most bluegrass varieties 2 to 2½ inches high; it will never make a thick sod under short mowing.

3. Perhaps you are using an unadapted grass. If you have used a mixture containing a high percentage of ryegrass, it will take time for the permanent grass to fill in after the ryegrass is gone. A good maintenance program should in time make a good lawn out of a thin stand of Kentucky bluegrass. If there is no bluegrass or other permanent grasses present, you have no choice but to start over.

## Renovating an Old Lawn

Many home owners are interested in chemically killing the old lawn sod and reseeded with a more desirable grass. Three years of experiments at the Ohio Agricultural Research and Development Center show that killing all the undesirable perennial grasses is the difficult part. It is fairly easy to establish new grass once the old vegetation is killed. The mat of dead sod must be broken enough to allow the seed to contact soil.

Experience has shown that the combination of a chemical and a tiller will give better kill of the unwanted plants than either used alone. Any renewing operation should be timed so that seeding can be done between August 15 and September 15.

Some of the chemicals used in lawn renewing experiments are discussed below:

**Methyl bromide**—This soil fumigant will kill all vegetation if properly used. It requires special applicators and a gas-tight cover. It cannot be used under trees or close to shrubs. New grass can be seeded about 48 hours after cover is removed.

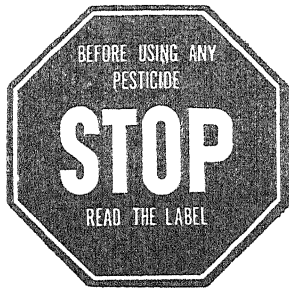
**SMDC (Vapam)**—This soil fumigant has not given quite as complete kill as methyl bromide. It is applied with a sprayer or sprinkle can and watered in.

Some cover over the treated area is needed but it need not be gas tight. A waiting period of about three weeks is necessary before seeding new grass. SMDC cannot be used under trees or close to shrubs.

**Amitrol or Amitrol-T plus dalapon**—This combination has given more complete kill than either used alone. Excellent results have been obtained when used ahead of cultivation. The kill is relatively slow and a waiting period of 4 to 6 weeks before seeding is advisable, due to the soil residual of dalapon.

**Amitrol-T**—The kill of vegetation is relatively slow but quicker than with amitrol. Some deep-rooted perennial grasses and bentgrass usually escape when only one application is used. There appears to be little soil residual, and seeding of Kentucky bluegrass made one week after treatment has been successful.

**Paraquat**—Since this is a contact chemical, the kill of vegetation is very quick, browning completely within 48 hours. Some broadleaf plants may escape. Paraquat is more effective in killing Kentucky bluegrass than quackgrass, bentgrass, and tall fescue. More than one application appears to be necessary for a good kill of these grasses. There is little or no soil residual from paraquat.



## *Use Pesticides Cautiously*

Protect yourself and your children, pets, bees, and birds by reading the label and following all directions and precautions.

1. Always read the label before using a pesticide. Note warnings and cautions each time before opening the container. *Read and follow directions for use.*
2. Keep pesticides away from children, pets, and irresponsible people.
3. Store pesticides in a secure place in their original labeled containers.
4. Do not smoke while using pesticides.
5. Do not breathe spray mist or dust.
6. Do not get pesticides in eyes, or skin, or on clothing. If spilled on skin or clothing, wash thoroughly with soap and water and change clothes.
7. Wash hands and face thoroughly before partaking of food.
8. Dispose of empty containers so they pose no hazard to humans, animals, or valuable plants.
9. Sweep dusts or granules from sidewalks and driveways.
10. Use a hose to thoroughly water-in any *insecticide* application so that residues do not remain on the grass blades or the granules or dusts remain on the surface of the ground. However, certain *herbicides* and *fungicides* should remain on foliage for effectiveness. Follow direction on label.