Management of Bent Grass Lawns
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MANAGEMENT *of* BENT GRASS LAWNS

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Management of Bent Grass Lawns

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Bent grasses have been used for lawns in the eastern states for many years, but interest in them in Michigan for lawn making purposes is recent and was aroused largely through the utilization of creeping bent grasses for putting greens on golf courses. The beautiful, velvety, carpet-like turf on well-kept putting greens led many people to attempt to produce similar turf around their homes. Seedsmen, realizing the possibilities of using bent grasses for lawn purposes and the interest aroused in them, began offering bent grass seeds and stolons to their customers.

Bent grasses produce a beautiful, short-statured, thick, velvety turf when properly maintained; but they are very susceptible to injury from several diseases, the most common of which are dollarspot, brownpatch, and snow-mold. Furthermore, they require intensive care and management, including frequent mowing at a low height, fertilizing, watering, topdressing, and treatments for disease control. *Therefore, these grasses are recommended for lawns for only those people who are willing to study carefully their management, or who have the means to hire a gardener who understands their care.* Kentucky bluegrass remains the most suitable grass for general lawns, and rough-stalked meadow grass and Chewing's New Zealand fescue the best grasses for shady lawns.

Many of the early plantings of bent grass in this country were South German or German mixed bent, which was composed of the four kinds of bent grass—colonial, creeping, velvet, and hybrid.

The creeping bents are characterized by their long, creeping stems or stolons which extend over the surface of the soil and send down roots from the joints or nodes. With the exception of seaside creeping bent, which is grown for seed purposes on the Pacific coast and in Canada, creeping bents are reproduced commonly by the stolons cut into short lengths, since the turf grown from seed produced by the different strains varies greatly from the parent in its vegetative characteristics. Many strains of creeping bent have been selected from old plantings, but of these the Washington and Metropolitan creeping bents, chosen for their disease resistance, have proved to be the best. Seaside creeping bent reproduced from seed is almost as good as Washington and Metropolitan, but is more susceptible to disease injury. Metropolitan is slightly susceptible to injury from brownpatch but resistant to dollarspot; Washington is resistant to brownpatch but susceptible to dollarspot, and Seaside besides being susceptible to injury from dollarspot and brownpatch, is susceptible to injury from snowmold. In order of their desirability for lawn purposes they rank: *Metropolitan, Washington,* and *Seaside.*

Colonial bent grows upright, has fine stems and leaves, short stature, and very short stolons or creeping runners. This grass is reproduced by seed and many strains are named for the region in which they are grown, such

as Rhode Island, Prince Edward Island, Northwest, Astoria, New Zealand, and New Brunswick. There is little if any difference between the turfs produced by the various so-called strains of colonial bent; choice between them is largely a matter of the purity, viability, weight per bushel, and price of the seed. Colonial bents are tolerant of adverse soil conditions and resistant to dollarspot, but very susceptible to brownpatch.

The velvet bents produce a dense, fine turf that is velvety in appearance and feel, but it is easily injured and recovers slowly because of its slow-growing habit.

The hybrid bent usually forms a turf about as coarse as that produced by redtop but is variable.

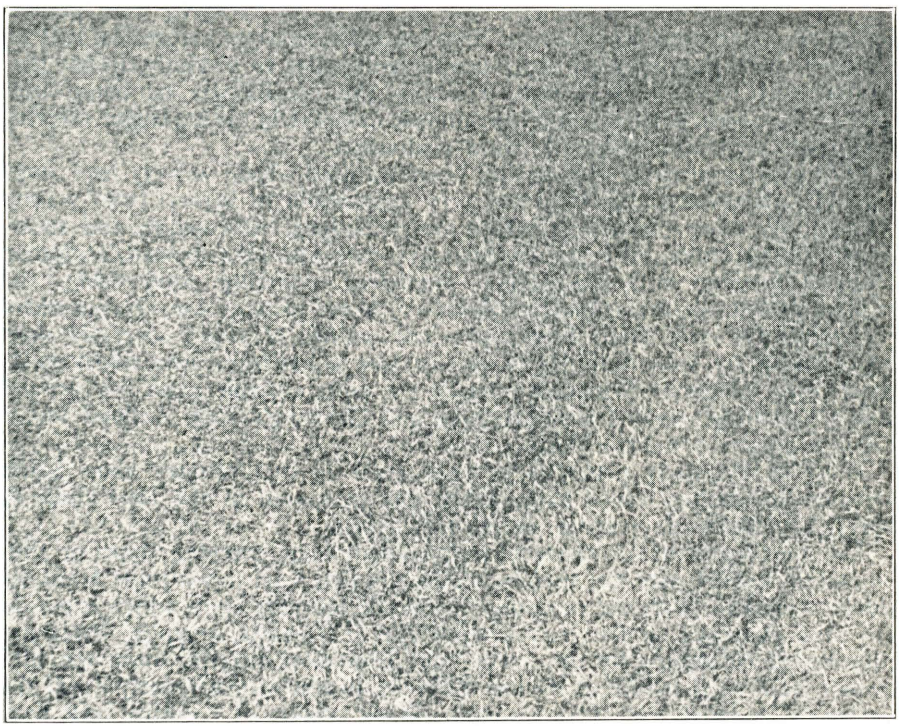

Fig. 1. Bent grasses produce thick velvet-like turf.

Soils

Heavy sandy loam or loam soils are the most desirable types for lawns. These are soils which contain 40-65 per cent sand and less than 20 per cent clay. A large proportion of the sand should be medium and coarse sand with a smaller proportion of fine and very fine sand.

Organic Matter Necessary

The surface soil on the lawn should contain a high percentage of organic matter. Organic matter can be supplied to soils, in the form of well-rotted manure, green manure crops, peat, or muck. The terms muck and peat are

used with slightly different meanings occasionally and in different sections of the country. The term *muck* is used here to mean the surface of organic soil deposits, which has become thoroughly decomposed into a dark brown to black, finely-divided organic material that may contain a few fibrous remains of plants and considerable mineral soil material. The amount of clay or sand that muck contains naturally will influence its value for soil improvement and must be considered. The best muck to use for supplying organic matter is one that contains little, if any, mineral material. *Peat* is the term used to designate less decomposed layers in an organic soil deposit and consists predominantly of organic material that may be partially decomposed but is highly fibrous and contains easily recognizable plant remains. Raw peats decompose more rapidly when mixed into mineral soils than do mucks. Local peats and muck when properly prepared by shredding or screening through a quarter-inch mesh gravel screen are as satisfactory as commercial peat products. *Peat and muck, however, unless mixed with mineral soil are not suitable surface soils for lawns.*

Modify Soil Conditions

Heavy clay, clay loam, and silt loam soils, can be lightened by mixing sand and peat or muck with them, using approximately one-fourth to one-half of each constituent by volume. Sandy soils can be made more coherent and moisture retentive by adding clay soil and peat or muck, using approximately the same proportions as in the case of the clay soil. Suitable soil mixtures may be made as follows:

1 bu. clay soil, 1 bu. peat or muck, 2 bu. sandy soil; or
1 bu. clay soil, 1 bu. peat or muck, 1 bu. sandy soil.

Soils made in this manner must be thoroughly screened and mixed so as to form a uniform material.

Seed Bed Preparation

The depth of topsoil needed varies with the nature of the subsoil. If the subsoil is friable and easily penetrated by roots and yet contains sufficient clay to be retentive of moisture, 4-6 inches of topsoil is sufficient. If the subsoil is clay, from 8 to 12 inches of topsoil is needed, and a sand subsoil should be covered with 10-15 inches of good topsoil. It is not good practice to put a layer of clay over sand to prevent the percolation of water downward, because of the dangers of poor drainage which may occur. Tile drainage systems should be installed in clay soils and under any other condition which results in poor drainage.

The surface soil, after it has thoroughly settled, should be rolled and raked until a firm, smooth seed bed is obtained.

Seeding

A bent grass lawn may be obtained by sowing either South German mixed bent, seaside creeping bent, colonial bent, or velvet bent seed. The velvet bent seed is scarce and expensive, and unless the source and strain are known its value is questionable. The German mixed bent produces a variable turf since it contains many strains of bent grass. Pure seaside creeping bent and colonial bent seed can be obtained from reliable seedsmen. Early fall is the most favorable time to plant grass, but good results can be obtained with spring and summer plantings.

Rake the surface soil very lightly so as barely to scratch it. The pure bent seed may be sown by itself, or it may be mixed with redtop, using half bent seed and half redtop. Sow one and one-half to two pounds of seed per 1,000 square feet of lawn. This may be broadcast with a seeder or mixed with dry soil and broadcast by hand. Use a pail of dry, screened soil to one-half of the seed. Broadcast this, going from north to south, so as to cover 1,000 square feet. Mix the other half of the seed with another pail of dry screened soil and broadcast going from east to west over the same area. After covering the area in both directions, rake once more, being careful barely to scratch the surface; otherwise the seed may be buried too deeply. Roll once to firm the soil around the seed.

Stolons

The soil preparation for planting stolons is the same as for planting seed. The stolons, which are portions of the live plant, must be obtained fresh and planted before they dry out. Washington and Metropolitan are the two best strains of creeping bent on the market at present. The stolons, cut into one to one and one-half inch lengths, are shipped by the growers when the lawn is ready for planting. The right amount for the planting is furnished, usually one square foot of bent sod for 100 square feet of planting. The stolons should not be planted too thin, but if there are thin spots they will be filled in quickly when the grass begins to grow. Do not try to plant the entire lawn before covering the stolons as they would dry out before the work was finished. Mark off the lawn in areas of 200-300 square feet. Sprinkle the stolons evenly over one of the areas. Roll once to firm the stolons into the surface. Cover with one-fourth to one-half inch of finely screened topsoil. Roll once more to firm the soil around stolons. Continue the operations until the entire lawn is planted.

Care After Planting

New plantings, either from stolons or from seed, must be carefully watered so as not to allow the young plants to dry out before they are thoroughly established. Sprinkle with a fine spray as often as is necessary to keep the surface soil moist around the seed or stolon until the new plant has become thoroughly established. When the roots have penetrated approximately three inches into the soil the planting may be considered well-established. Until this time the soil may need to be sprinkled two or three times a day. Afterwards the lawn should be watered as directed under "Maintenance of Bent Grass Lawns".

Lawn Fertilizers

Nitrogen, which is largely concerned with the production of vegetative or green parts of plants, is the dominant element in lawn fertilizers. Inorganic nitrogenous materials, such as calcium nitrate, sodium nitrate, and ammonium sulfate, carry nitrogen in a soluble form which is quickly available to the plants. Materials of this nature applied to lawns in the early spring help the grass to get an early growth ahead of the weeds. Nitrogen in organic materials like dried blood, cottonseed meal, tankage, castor pumace, soybean meal, Milorganite and other sewage sludges, is unavailable to plants until the material decomposes and nitrification takes place. This process is very slow during the cool spring weather, and there is usually little, if any, effect upon the growth of the grass in Michigan until about June 1.

Phosphoric acid is the next most important element, especially in the growth of new plantings, as it has a decided effect in producing a larger, more vigorous root system and, therefore, a better turf. An abundant supply of nitrogen must be available or the phosphoric acid will be of little benefit to the grass.

Potash is important because it helps produce a healthy, vigorous, and disease-resistant turf.

Fig. 2. Fertlized. Dense turf and few weeds. Unfertilized. Thin turf and many weeds.

There are a large number of special turf fertilizers on the market. In these, the percentage of nitrogen is higher than the percentage of either phosphoric acid or potash. A few typical analyses of special turf fertilizers are:

10-6-4 10-8-6 12-6-4 9-7-3 8-6-6 7-5-2

The first number in the fertilizer analysis expresses the percentage of total nitrogen, the second the percentage of available phosphoric acid, and the last the percentage of water soluble potash in the fertilizer. The analysis of the fertilizer does not give the availability of the nitrogen, or the type of material used to supply it, and there is no way in which the layman can conveniently determine this important point.

Fertilizers with analyses, such as, 4-16-4, 4-16-8, 2-12-6, 4-12-4, and similar ratios, contain too high a percentage of phosphoric acid in proportion to the content of nitrogen to be used as the only source of plant food for lawns, but if they are used to supply the phosphoric acid and potash needed and the nitrogen supply is supplemented by using some good form of nitrogenous fertilizer the results are excellent. These fertilizers, without

the supplementary nitrogen, are suitable fertilizers for flowers and vegetables. Equal parts of ammonium sulphate and certain commercial fertilizers may be used to make mixtures having suitable analyses for turf, thus:

		Mixture 1	Mixture 2
5 lbs. Ammonium sulphate:	analysis:.....	20- 0-0	20- 0-0
5 lbs. Commercial fertilizer:	analysis:.....	2-12-6	0-14-6
10 lbs. Mixture:	analysis:.....	11- 6-3	10- 7-3

Fertilizing the New Planting

The standard application of fertilizer on a new planting, no matter which fertilizer is used, is one which supplies one pound of nitrogen per 1,000 square feet of lawn. Thus, standard applications would be as follows:

	Analysis	Lbs. per 1,000 sq. ft.
Ammonium sulphate.....	20- 0-0	5 lbs.
Other fertilizer.....	0-14-6	25 lbs.
Milorganite.....	6- 2-0	17 lbs.
Other fertilizer.....	0-14-6	25 lbs.
Special turf fertilizers.....	8- 6-6	12.5 lbs.
	10- 6-4	10 lbs.
	12- 6-4	8.5 lbs.
	10- 8-6	10 lbs.
Regular agricultural fertilizer may be used for first application.	4-12-4	25 lbs.
	4-16-4	25 lbs.
	4-16-8	25 lbs.
	6- 8-6	17 lbs.
	4-10-6	25 lbs.

The fertilizer for new plantings is broadcast evenly over the surface and worked in by the alternate raking and rolling necessary to produce a firm, smooth seed bed. The fertilizer may be broadcast a week in advance or applied the same day the seeding is to be made, depending upon when the seed bed preparations are in progress.

Fertilizing Established Lawns

Open Sunny Lawns—Several applications of nitrogenous fertilizer are needed during each growing season to maintain a thick, velvety turf. The first application should be made as early as it is possible to get on the ground in the spring after the snow has melted and the frost has gone out of the soil. The nitrogen in the spring fertilizer, in order to be effective immediately, must be soluble and quickly available. Ammonium sulphate is a good form to use on turf, having the advantages of being quickly available to plants, economical, clean, easy to obtain and to apply. Since the grass

also requires phosphoric acid and potash, materials carrying these two ingredients should be added. Thus, a good application of fertilizer in the early spring would be:

Ammonium sulphate ..... 5 lbs. per 1,000 sq. ft.
0-14-6 or 2-12-6 .....25 lbs. per 1,000 sq. ft.

Later, applications of the nitrogenous fertilizer should be repeated every four to six weeks with the precaution that the amounts should be reduced to approximately half in hot weather. Thus, the applications would be:

Application May 1	Ammonium sulphate	5 lbs. per 1,000 sq. ft.
" June 1	" "	3 " " " " "
" July 1	" "	2 " " " " "
" Aug. 1	" "	2 " " " " "
" Sept. 1	" "	5 " " " " "

One of the special turf fertilizers may be substituted for the above treatments, using equivalent amounts of nitrogen, but the fertilizer used in the early spring, that is previous to June 1, should be one which contains a large percentage of its nitrogen in a soluble, quickly available form. Soils which contain a high percentage of nitrogen will not require as much nitrogen during the summer, and at least one application may be omitted.

It is unnecessary to supply the nitrogen in a quickly available form during the entire season, and many people prefer to use a more slowly available form than ammonium sulphate, at least part of the time, since fewer applications are necessary. It must be borne in mind, however, that the nitrogen in organic fertilizers is available only during warm weather and is unavailable in the early spring and during cold weather in the fall. There is danger, also, of the nitrogen becoming available during periods of warm weather in the fall, resulting in a renewed growth of the grass when it should be hardening for winter. Winter injury is likely to occur in this case. Nitrogenous fertilizers of any kind should not be applied later than Sept. 1 on bent grass lawns and organic nitrogenous fertilizers not later than Aug. 1. If one desires to use an organic nitrogenous fertilizer the following fertilizer program is suggested:

Application Apr. 1	Ammonium sulphate 0-14-6	5 lbs. per 1,000 sq. ft. 20 " " " " "
" May 1	Ammonium sulphate Milorganite	5 " " " " " 18 " " " " "
" July 1	Milorganite	10 " " " " "
" Aug. 1	Milorganite	10 " " " " "
" Sept. 1	Ammonium sulphate	5 " " " " "

In the above fertilization system complete commercial fertilizer, such as a 4-12-4, 4-16-4, 5-10-5, 5-9-7, 6-8-6 or similar analysis, may be substituted for the combination application in the early spring, using 25-30 pounds of the complete fertilizer per 1,000 square feet of lawn. Likewise, calcium nitrate or sodium nitrate may be substituted for ammonium sulphate; and dried blood, cottonseed meal or tankage for Milorganite.

Calcuim cyanamid should never be used as a lawn fertilizer, because the grass may be completely killed, due to the toxic action of the chemical when first applied.

Many people, misled by advertising, use only an organic nitrogenous fertilizer on their lawns. This will do very well if the lawn is good enough

not to require spring nourishment, but one should remember that organic nitrogenous fertilizers are available only in warm weather.

This precaution should be remembered:

Apply soluble fertilizer materials such as mixed commercial fertilizers, superphosphate, muriate of potash, ammonium sulphate, sodium nitrate, calcium nitrate, and urea when the blades of grass are dry and wash the fertilizer into the soil with a heavy spray immediately to prevent burning of the foliage.

Do not walk over the area which has just received an application of fertilizer until it has been watered thoroughly. Materials such as cottonseed meal, dried blood, and Milorganite will not burn the foliage.

Fig. 3. Weeds in lawn come largely from weed seed in soil.

Maintenance of Bent Grass Lawns

Spring—Remove all leaves, sticks, and other debris which may have accumulated during the winter. Since the stolons that are produced each year tend to form a thick mat between the growing parts and the soil, which causes the turf to lose its vigor and in many cases to die, it is necessary (a) to rake the lawn vigorously with a short-tined steel rake to raise the matted stolons, (b) to mow closely, using an attachment on the mower to remove the clippings, (c) to roll with a fairly heavy roller to firm the soil around the roots of the plants, and (d) to top-dress with some good loam or sandy

loam soil. This soil should contain enough organic matter to make it friable and retentive of moisture, but not enough to allow it to become soggy, wet and poorly drained. *The author does not recommend top-dressing with peat, muck, or manure,* but these materials are valuable to mix with sandy loam or loam soils as a source of organic matter, or to mix with clay soil and sand to form a sandy loam or loam top-dressing soil.

Approximately one-fourth inch of top-dressing is necessary. This is approximately one cubic yard per 1,000 square feet of lawn. Spread the soil evenly over the lawn area and work it into the turf with a rake, or more conveniently, by dragging a steel mesh doormat back and forth across the lawn. Roll the lawn after top-dressing and then water the entire area, using a nozzle which throws a fairly heavy stream to wash the top-dressing in among the roots and stolons. Top-dressing should be repeated one or two times during the summer on creeping bent lawns, but colonial, German mixed, and velvet bent lawns do not require this frequent treatment. With some strains of creeping bent that are especially vigorous stolon-producers, raking before top-dressing should be repeated at least once during the summer. Immediately after the bent lawn has been raked and top-dressed it will be considerably off-color in appearance; however, the new shoots will come up within a few days, and the health and vigor of the lawn will be greatly increased.

Mowing—The bent grasses, especially the creeping bent grasses, must be clipped very closely if a beautiful, velvet-like turf is to be maintained. The height of cut should be approximately one-half inch. The turf should never be allowed to grow more than one inch in height before mowing. With a healthy, vigorously growing turf this means the lawn should be mowed at least every three days and very likely every other day during the spring. The mower should be of a type which will mow smoothly at this low height. Systematic mowing to maintain the turf always at the same height is very important in properly maintaining any type of lawn. If the clippings are short they may be left on the lawn, otherwise they should be removed.

Watering—Watering the bent grass lawn properly is an important step in maintaining a good turf. The sprinklers or sprinkling system should apply the water evenly and in such a manner as to allow it to be absorbed by the soil without having water standing on the surface. The water should be allowed to run in each place until the soil is soaked to a depth of 5-6 inches. It should be necessary to water the lawn only two or three times a week during dry weather if the soil is thoroughly soaked each time. A deep-rooted drought-resistant turf is produced by this watering system wherever soil conditions are good. Hand sprinkling, which is commonly done every evening, usually wets only the surface inch of soil, resulting in a shallow-rooted turf which suffers more from drought than deep-rooted turf. There is some question whether to water the lawn in the morning or in the evening, but this point has not been definitely settled by experiments which have been conducted. Experiences with experimental plots lead to the conclusion that the proper time to water the lawn is when it is most convenient, whether morning or evening. The main objective is to supply the soil with sufficient water to maintain a vigorous growth of grass, but unless the soil is well-drained, great care must be used not to produce a saturated soil.

Soil Reaction and Liming

A soil reaction range between medium acid and alkaline is desirable for good lawn turf, but good lawns are produced on strongly acid soils, as well as on soils that contain large quantities of free limestone, when all other conditions are favorable to the growth of grass. It is a good practice to lime lawn soils which are strongly acid in reaction in order to produce as nearly optimum conditions as possible. Bent grass growing on a soil that is strongly acid in reaction, and which does not supply sufficient calcium and magnesium to meet the requirements of the plant, is susceptible to disease injury and does not respond properly to fertilizer or disease control treatments. Liming the soil regardless of reaction, as practiced by many people, is useless and wasteful. Lime should be applied only after the soil reaction has been tested and the soil found to be deficient in lime. Many simple soil testing outfits are available for determining soil reaction, or the samples may be taken to the local county agricultural agent or sent to the soils department of Michigan State College for analysis.

Liming Materials

Ground limestone is one of the best sources of lime for correcting soil acidity in lawns and is easily obtained. It can be broadcast on the lawn at any time without injury to the grass. A normal application for a lawn is 100 pounds per 1,000 square feet.

Hydrated lime, sometimes called agricultural lime or builder's lime, is equally good to use, but *precaution must be taken never to use it at the same time ammonium sulphate or fertilizer containing ammonium sulphate is applied.* The reaction between these materials liberates ammonia, resulting in severe injury to the turf. Sixty to 75 pounds of hydrated lime are equal to 100 pounds of ground limestone.

Oxide of lime or quicklime is not desirable for use on lawns because of its caustic properties.

Marl and waste lime, such as sugar factory refuse, are excellent sources of lime for lawns but not as convenient to use as ground limestone and hydrated lime. Approximately one-sixth cubic yard of marl or sugar factory lime per 1,000 square feet of lawn is needed. These materials can be broadcast at any time without danger of injury to the grass.

Lime or marl may be mixed with the top-dressing soil. This is an excellent way to use marl or sugar factory lime. The mixing and screening of the top-dressing and marl breaks up all lumps and makes even distribution possible.

Care of Shady Lawns

Bent grasses, especially creeping bent, make a good turf for shady locations; however, if air drainage is poor, the injury from diseases is greater than in the open. Maintenance methods under shade conditions are different from those used under open, sunny conditions, mostly because trees remove enormous amounts of plant food and water and the filtered sunlight causes grass to grow taller and more spindling than where grown in full sunlight.

Fertilizing—The shady lawn should receive the same fertilizer in the spring as the open lawn. As soon as the leaves begin to appear on the trees, however, the lawn should receive small amounts of nitrogenous fertilizer at short intervals. Two pounds of ammonium sulphate per 1,000 square feet

every 10 days to two weeks is the recommended treatment. An equivalent amount of any other nitrogenous fertilizer, except cyanamid, will do equally well; thus, one might use either seven pounds of Milorganite, five pounds of dried blood, three pounds of calcium nitrate, or three pounds of sodium nitrate per 1,000 square feet every 10 days or two weeks. The last nitrogenous fertilizer treatment should be no later than September 1 and the last application of organic nitrogenous fertilizer not later than August 1.

Watering—The shady lawn must receive considerably more water than the open lawn. The same type of sprinkler and same method of applying water is advisable, but it will be necessary to water the shady lawn more frequently. Many times the lawn will require daily watering to supply sufficient water for the needs of the grass in addition to the enormous amount which is removed by the trees.

Mowing—Grass growing in shade or partially filtered light should not be mowed as closely as grass growing in full sunlight, because the leaves and stems of such grass tend to grow longer and more spindling than those growing in full sunlight. This is true of the bent grasses as well as of the bluegrasses and fescues, making it advisable to cut at a slightly greater height in shade than in the open. The creeping bents, since the leaves grow almost parallel to the surface of the soil, however, will withstand closer cutting under trees than grasses with leaves that grow upright.

Weed Control

The most practical method of weed control on a lawn is to produce a turf so dense and vigorous as to prevent weeds from becoming established. The procedure described in the preceding pages will accomplish the desired results if followed carefully.

Occasionally, a few weeds may get into the lawn. Crab-grass, chickweed, dandelions, and plantain are the most troublesome and should be stopped before they take over the entire lawn. Care should be exercised in choosing and preparing top-dressing soil to obtain material which is free from weed seeds. Barnyard manure is objectionable because of its high weed seed content.

Crabgrass is an annual, the seed of which germinates in the early summer, producing a coarse-leaved plant that develops very rapidly. The stems creep along the surface of the soil, rooting at the joints. Because the seed stalks have finger-like branches, the plant frequently is called fingergrass. Crabgrass is killed by frost, leaving a reddish-brown spot in the lawn.

The vigorous raking and subsequent mowing which has been recommended to remove matted stolons also will remove the creeping stems and seed-stalks of the crabgrass. The bent grass, since it grows later in the fall and earlier in the spring than the crabgrass, will fill the infested area and leave no room for the crabgrass for the next season.

Hand-weeding when the little seedlings appear and before they have time to reseed themselves, is a most effective method of control if the infestation is a light one.

There are no known chemical weed killers that are safe to use for the eradication of crabgrass in bent grass lawns.

Chickweed is another common weed pest in bent grass lawns. It is a perennial that produces seed during the entire growing season. It can be easily controlled by the use of certain chemicals. Lead arsenate dusted over

the infested area at the rate of five pounds per 1,000 square feet will remove chickweed. If only a few small areas are infested, a small amount of lead arsenate may be dusted on the affected spots only.

One-eighth to one-fourth pound of sodium chlorate mixed with the fertilizer for 1,000 square feet of lawn broadcast early in the spring will eradicate chickweed. The grass will be slightly injured as evidenced by the yellow coloring of the leaves, but it will quickly recover and fill the areas formerly occupied by the chickweed.

Dandelions and plantain, two broad-leaved perennials, can be easily eliminated from the lawn by placing a pinch of ammonium sulphate in the crown of the plant. The chemical is more effective if the plant is bruised in the

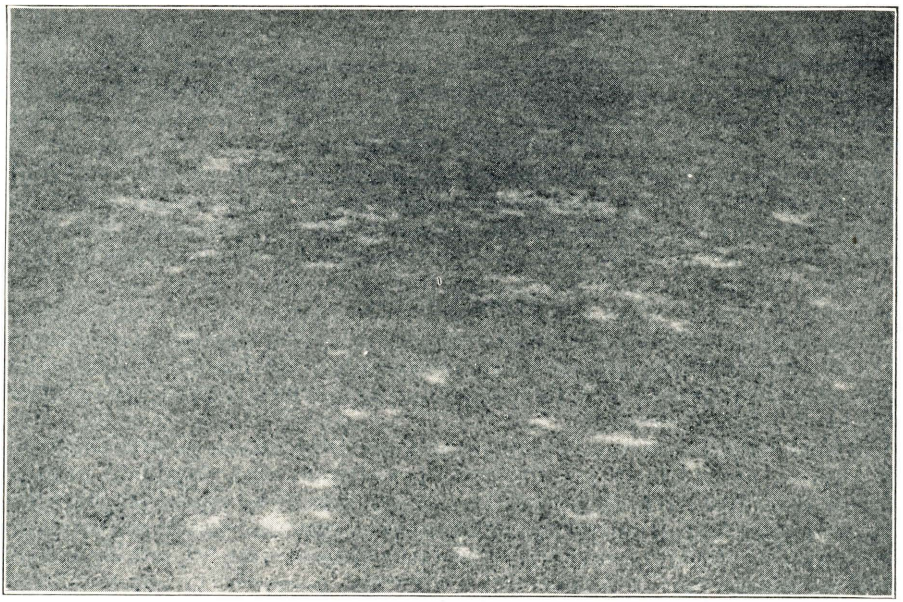

Fig. 4. General view of injury caused by dollarspot.

operation. The ammonium sulphate may be applied with the thumb and fingers or with one of the appliances made for this purpose. The areas treated should not be watered until the ammonium sulphate has killed the weeds completely, after which it should be washed into the soil. The nitrogen in the ammonium sulphate will become available to the grass, stimulating its growth, and the area soon will be covered with a thick turf.

Chemical sprays such as sodium chlorate, sodium arsenate, and iron sulphate, sometimes used to control weeds on Kentucky blue grass lawns are unsafe to use on bent grass lawns if used in strengths sufficient to eradicate dandelions and plantain.

Turf Diseases

Great damage is caused to bent grass lawns each year by turf diseases, and the control and prevention of these diseases is one of the many problems that confront the owners of these lawns. The damage caused by turf

diseases is evidenced by various shaped patches or spots of varied shades of brown. The injury to the grass in these areas may be superficial in the case of light attacks, or the grass may be killed, leaving unsightly scars to be filled. The brown spots and patches caused by diseases are often confused with other brown spots of injured grass caused by chemical burns from fertilizers, insecticides, fungicides, weed killers, and worm remedies, and also from either excess moisture in soil or from lack of water. Usually the brown patches or spots caused by common turf diseases have characteristic symptoms which permit easy identification of the disease. The three most

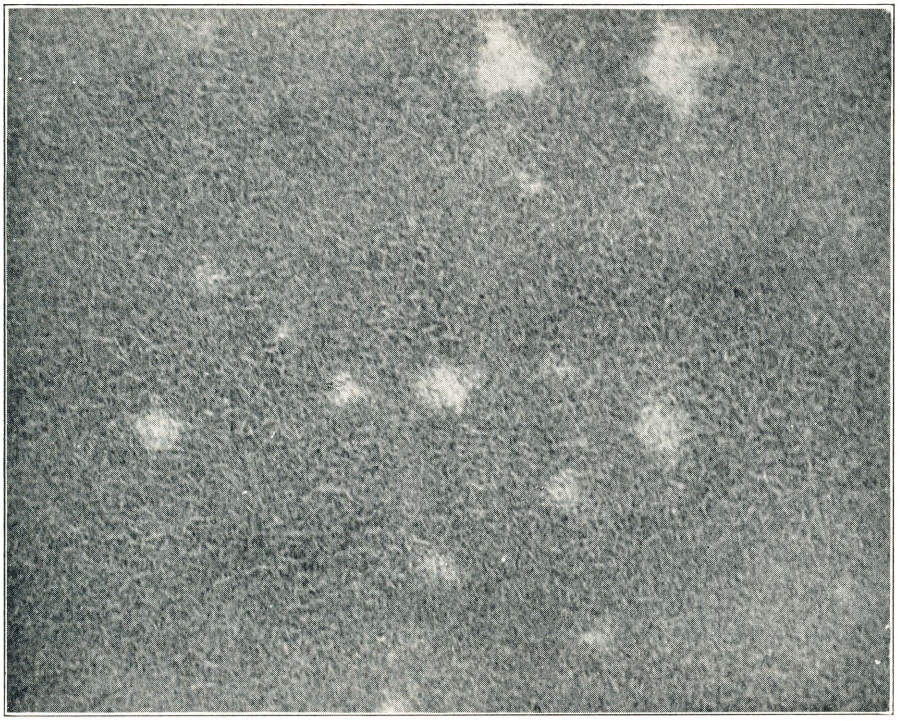

Fig. 5. Injury caused by dollarspot shown in detail.

common diseases that appear in bent grass lawns are popularly named brownpatch, dollarspot, and snowmold. Another disease, which sometimes injures bent lawns, especially newly seeded colonial bents, if drainage is poor and the temperature is high, is called spotblight or bloodstreak.

The most complete and authoritative investigation on the identification and control of turf diseases has been carried on by John Montieth, Jr., and Arnold S. Dahl of the United States Golf Association, Green Section. Results of this investigation with the description of control methods recommended were published in the Bulletin of the U. S. Golf Association Green Section, Volume 12, No. 4, August, 1932. A brief summary of the symptoms and control methods of turf diseases is given here since the above publication is not available to all home owners who have bent grass lawns.

Brownpatch and Dollarspot

Brownpatch is a fungous disease which attacks bent grass during the summer. High air and soil temperatures combined with high humidity are conditions favorable for its development. It occurs in irregular-shaped brown areas usually more or less circular, which vary in size from a few inches to three feet or more in diameter. The grass in the center is affected first, turning first dark and then a dirty brown color. A dark ring is usually present on the outer border of the affected area. The presence of this dark ring indicates the fungus is still active. Unless the turf is treated promptly, the grass may be killed in the patches. Colonial bents, German mixed bent, seaside and some of the inferior strains of creeping bent are very susceptible to attacks of brownpatch, but Metropolitan and Washington creeping bents are resistant to it.

Dollarspot is another fungous disease which attacks the turf during hot, humid conditions in the summer. The spots vary in size from one-half to two inches in diameter and are generally regular in size and shape. The fine thread-like strands of the fungus may be observed in the early morning when the dew is still on the grass. The grass when first affected appears dark-colored and water-soaked, but as soon as it dries it turns a bleached grayish brown color. Seaside, Washington and the inferior strains of creeping bents are attacked by dollarspot, but Metropolitan creeping bent and the colonial bents are resistant to it.

Control—Mercurial fungicides have been found to be the most effective in controlling brownpatch and dollarspot fungi. Many commercial mixtures are made for this purpose, which should be used according to the directions on the containers.

Either corrosive sublimate, calomel, or mixtures of the two are the most economical mercurials to use at the present time. Two to three ounces of either chemical or of mixtures of the two per 1,000 square feet of turf are required to stop the disease after it has appeared. This can be applied dry, mixed with soil or as a spray. If sprayed, use two to three ounces in 50 gallons of water per 1,000 square feet. A small amount of common table salt added with corrosive sublimate will cause the latter to dissolve more readily. The solution must be kept thoroughly stirred while spraying. Wash into soil with water soon after applying. During extremely hot weather use only one to two ounces per 1,000 square feet. The treatment must be repeated whenever the disease reoccurs, which may be within a week during weather that is favorable to it.

The mercurial material may be mixed dry with soil and broadcast in the same manner as fertilizers. If corrosive sublimate or other lumpy material is used it should be mixed with a small amount of sharp sand on a piece of wrapping paper, rolled out with a rolling pin or large glass bottle to break up all lumps, and thoroughly mixed before mixing with the larger volume of soil for broadcasting. Be very sure to get the mercurial material evenly mixed through the screened soil and broadcast it evenly over the turf. *Do not give the affected areas a larger dosage than the areas of apparently healthy turf.* After broadcasting the fungicide, be very careful not to walk on the grass before it is thoroughly watered. Use a fairly coarse nozzle on the hose. Cover 500 to 1,000 square feet of turf and water immediately before treating the next area, or one man may apply the fungicide while the second waters it in with the hose.

Prevention—Beginning between May 15 and June 1, an application of one ounce of calomel, corrosive sublimate, or a mixture of the two applied every 10 days will ward off any except the most severe attacks of brownpatch or dollarspot, but in very humid hot weather attacks of the diseases may be severe enough to require an additional control application of two ounces per 1,000 square feet. The preventive application is made in the same way the control applications are made except the smaller amount is used.

The frequency and severity of attacks of brownpatch and dollarspot can be partially controlled through the management of the turf. Washington creeping bent is resistant to brownpatch but severely attacked by dollarspot,

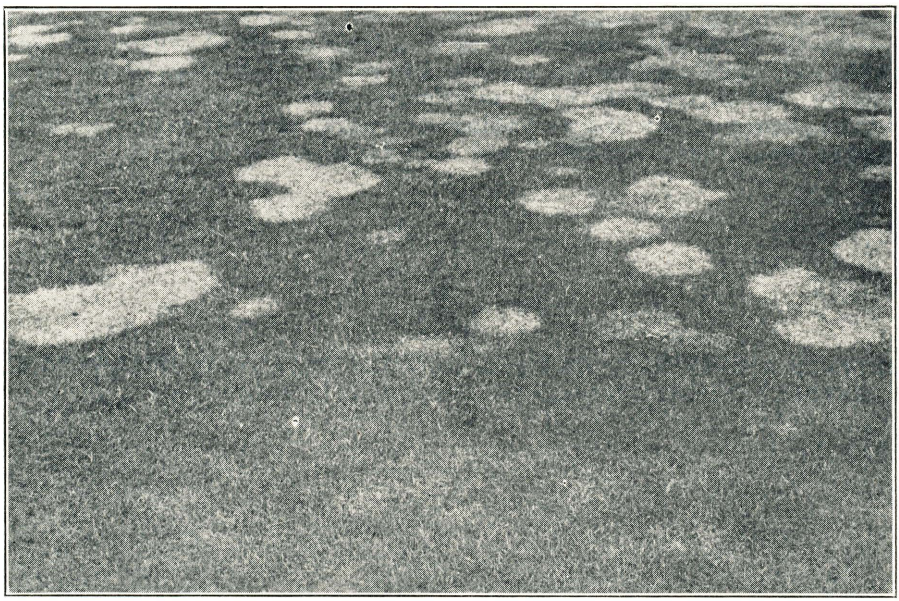

Fig. 6. Snowmold injury on seaside creeping bent turf. Foreground shows perfect control through the use of mercurial fungicide in the fall.

Metropolitan is resistant to both brownpatch and dollarspot, while colonial bents are almost immune to dollarspot but susceptible to brownpatch. The attacks of these two diseases are less frequent and less severe if the soil is well-drained and the grass is maintained in a slightly under-nourished condition during the hottest summer months—that is sufficient nitrogen should be present to maintain a vigorous but not too rapid succulent growth. Considerable skill in the management of the nitrogenous fertilizer program is necessary to keep the nitrogen balance in the soil at this level. Soils containing too much muck or peat, which liberate nitrogen during their decomposition, interfere with the nitrogen balance, causing the grass to be more susceptible to disease attacks. No matter how carefully the bent turf is managed, injury from brownpatch and dollarspot will result during extremely hot, humid weather conditions, except when treated with mercurial fungicides.

Snowmold

Snowmold is a fungous disease which is active in the winter and early spring, usually under the edge of melting snow or wherever the temperature is near freezing with a high moisture condition prevailing. The spots are circular in shape and vary in diameter from two inches to a foot or more. Sometimes the injury is only superficial and the grass recovers quickly in the spring, but very often the grass is killed, leaving bad scars which need to be reseeded or patched.

Prevention—Broadcast four ounces of corrosive sublimate, calomel, or a mixture of the two, mixed with dry soil per 1,000 square feet late in the fall, just before snow covers the ground. In the southern part of the state when winter thaws and rains occur it will be necessary to repeat the treatment during the winter before the ground is covered with snow again.

Late fall fertilization with nitrogen or a large supply of organic nitrogen in the soil, which may become available late in the fall in unseasonably warm weather, and covering the grass with leaves, straw or other materials as a winter protection, are factors making conditions especially favorable to the fungus which causes snowmold, and least desirable for the turf.

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