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LAWN MANAGEMENT

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A SMOOTH GREEN LAWN is desired by all men and women who own or care for a home. Often they come to the Station for help in improving lawns and building new ones. In many cases the soil conditions are far from ideal, and in dry summer periods the turf is damaged severely, particularly when it is not well fertilized or watered. In addition, there is the problem of protection against Japanese and Asiatic beetles and other insects, and against plant diseases that have caused frequent injuries in recent years.

To provide in concise form the best available information, the Station has prepared the instructions given in these pages. This circular supercedes circulars 48, 77 and 83 which are now out of print.

SOIL CONDITIONS

No desirable species of lawn grass, regardless of fertilizer treatment, rolling, watering, etc., can be produced satisfactorily on sand, gravel or raw subsoil devoid of humus. In the excavating attendant to the construction of new houses, the area upon which the lawn is built is frequently left in an unsatisfactory condition in this respect. There should be a depth of at least four inches of surface loam, containing a sufficient amount of organic matter to give it a rich, dark brown color. Solid rock, gravel or "hardpan" should be at least 20 inches below the surface.

Many lawn soils in the vicinity of our larger cities are excessively sandy. These should be built up by the addition of loam of moderately heavy texture and favorable humus content, or by working in liberal amounts of organic matter. The following rates of application of organic materials are suitable in such cases:

| | Per 1000 square feet of area |
|---|------------------------------|
| Stable manure, rotted for several months to destroy weed seeds..... | 1/2 cord |
| Granulated moss peat, dry..... | 4 bales |
| Native moist peat..... | 2 cubic yards |

Lime

A moderate degree of soil acidity is not harmful to grasses predominant in lawns of this region. In fact, it appears to help check the invasion of numerous weed species, such as dandelion, broad-leaved plantain and chickweed. However, strong degrees of acidity have been found in many lawn soils, as indicated by pH tests below 5.0. Under such extremes of acidity, the vigor of the turf is reduced and moderate liming is beneficial. An application of 100 pounds of limestone per 1000 square feet is desir-

able when it is worked into the soil for new seedings. One-half of this amount, when applied as a top-dressing to established turf, is usually ample. This treatment should not be made more than once in five years.

Fertilizers

Until recent years the materials most commonly used in fertilizing lawns were dried sheep manure and bonemeal. Both were safely used in indiscriminate amounts. However, they were slow in their action, and there is evidence that the delayed availability of nitrogen supplied from these sources is apt to prove stimulating to midsummer weeds, such as crab-grass, at the expense of the desirable species.

Many types of fertilizer materials and "complete" factory-mixed fertilizers are now on the market. The following table gives suitable amounts of a number of these, when they are applied as an early spring top-dressing:

| Material | Nitrogen | Percentage of Phosphoric acid | Potash | Rate of Application per 1000 sq. ft. |
|--|----------|-------------------------------|--------|--------------------------------------|
| Organic, used chiefly as sources of nitrogen | | | | |
| Tankage | 7.5 | 9 | 0 | 25 |
| Cottonseed meal | 6.5 | 3 | 2 | 30 |
| Castor pomace | 5 | 2 | 1 | 35 |
| Soybean oil meal | 7 | 1.5 | 2 | 25 |
| Milorganite | 5 | 2 | 1 | 35 |
| Dried cow manure | 1.8 | 1 | 2 | 100 |
| Dried sheep manure | 1.9 | 1.5 | 2 | 100 |
| Organic, used chiefly as sources of phosphorus | | | | |
| Bonemeal, steamed | 3 | 24 | 0 | 35 |
| Bonemeal, raw | 4 | 22 | 0 | 30 |
| Chemical, supplying nitrogen | | | | |
| Nitrate of soda | 16 | 0 | 0 | 5 |
| Sulfate of ammonia | 20.5 | 0 | 0 | 4 |
| Calnitro | 16 | 0 | 0 | 5 |
| Urea (floraid) | 46 | 0 | 0 | 2 |
| Chemical supplying both nitrogen and phosphorus | | | | |
| Ammophos "A" | 11 | 48 | 0 | 6 |
| Ammophos "B" | 16.5 | 20 | 0 | 4 |
| Chemical supplying phosphorus | | | | |
| Superphosphate | 0 | 16 | 0 | 10 |
| Precipitated bone | 0 | 40 | 0 | 4 |
| Chemical supplying potassium | | | | |
| Muriate of potash | 0 | 0 | 50 | 3 |
| Sulfate of potash | 0 | 0 | 48 | 3 |
| Factory-mixed fertilizers | | | | |
| Garden type "5-8-7" | 5 | 8 | 7 | 20 |
| General purpose type "4-12-4" | 4 | 12 | 4 | 25 |
| Lawn top-dressing type | | | | |
| "10-6-4" | 10 | 6 | 4 | 10 |
| "10-5-5" | 10 | 5 | 5 | 10 |
| "8-6-6" | 8 | 6 | 6 | 12.5 |
| "7-6-6" | 7 | 6 | 6 | 15 |

In preparing the soil for new seedings, fertilizers of the garden or general purpose types are satisfactory, and should be applied at about one and one-half times the rates recommended for top-dressing. If the separate materials are used, they should be made up to supply: $\frac{1}{2}$ pound of organic nitrogen, 1 pound of inorganic nitrogen, 2.5 pounds of phosphoric acid and 2 pounds of potash per 1000 square feet.

It is frequently desirable to make an additional top-dressing in the early fall, especially if the turf has deteriorated during the hot summer months. The fall application should be at about half the rate recommended for spring top-dressing.

Chemical fertilizers may easily cause injury to the grass if applied too heavily, or if not uniformly spread. Therefore, whenever possible, the fertilizer should be mixed with screened loam before spreading. It is also a good practice to water the lawn thoroughly after the treatment.

MAKING NEW SEEDINGS

Spring seeding, between April 1 and May 15, is the common practice in this section. At this time moisture conditions are most favorable. However, more difficulty with weeds may be experienced during the first year or so, if seeding is made in the spring. Early fall, during the month of September, is an especially good time, since annual weeds offer less competition, and the sod is older and more resistant when the adverse conditions attendant to the midsummer months are encountered.

The ground should be carefully prepared, fertilized, limed if necessary, and rolled thoroughly before the seed is sown. The seed should be lightly covered by scratching the surface with an iron rake or by sifting loam over it.

The choice of seed depends upon soil, shade conditions and the type of lawn desired. There are many good grades of commercial seed mixtures available to meet varying requirements in these respects. However, the buyer should insist on being supplied with seed of high purity, (free from chaff, light seeds and weed contamination) and of high germination test. Good seed is not obtained at bargain rates and one should remember that good seed, at a necessarily higher price, is the most economical in the end.

Many persons prefer to prepare their own seed mixtures. In such cases the following formulae should meet most of the requirements:

| | Percentage of mixture, by weight | Quantity (lbs.) of mixture required per 1000 sq. ft. |
|---|----------------------------------|--|
| Formula "A", on acid soils, where a fine-leaved turf is preferred | | 3 |
| South German or Astoria bent | 40 | |
| Kentucky blue grass | 35 | |
| Red top, re-cleaned | 25 | |
| Formula "B", for average conditions, on lawns not likely to receive special care | | 4 |
| Kentucky blue grass | 50 | |
| South German or Astoria bent | 25 | |
| Red top, re-cleaned | 25 | |
| Formula "C", on very sandy soils, or on lawns exposed to much wear | | 5 |
| Red or Chewing's fescue | 60 | |
| Red top, re-cleaned | 40 | |
| Formula "D", on heavily shaded areas | | 5 |
| Rough stalked meadow grass | 40 | |
| Red or Chewing's fescue | 40 | |
| Red top, re-cleaned | 20 | |

If clover is desired in the lawn, White Dutch Clover seed may be added at the rate of 4 ounces per 1000 square feet.

SPRING RENOVATION

Most lawns present a rough appearance after the frost is out of the ground in early spring. After the customary raking to remove dead leaves and the usual accumulations of over-winter rubbish, foot marks and other depressions should be smoothed with screened loam, the spring top-dressing of fertilizer applied, and bare patches should be re-seeded. The lawn should then be rolled thoroughly. This is best done while the soil is still moist, but not so wet as to show a film of water on the surface when passed over by the roller.

MOWING

Very close mowing reduces the vigor of the turf, especially when practiced in early spring. Blue grass is especially injured by short clipping. The first spring mowing should be deferred until the grass is at least two inches high. The height after cutting should be approximately one inch, if the lawn contains much blue grass. When bent grasses or fescues are predominant, the height after cutting may be one-half inch, if the lawn is smooth and properly graded. If mowing is done regularly when the grass is not more than two inches high, the clippings may well be left on the ground.

DISEASE CONTROL

Brown spot. This disease occurs most frequently on newly seeded lawns in damp weather and on golf greens where heavy fertilization and

frequent waterings have promoted luxuriant growth. It is characterized by the development of the fungus as a white, mold-like growth on the ground which rots the base of the grass stems in a definite, roundish, brown spot. Spraying with Bordeaux mixture or commercial forms of organic mercury compounds will probably prevent or lessen the injury if started in time. If spots of grass have already been killed, the turf should be replaced with fresh soil and re-seeded.

Lawn rot. This trouble has appeared in recent years on lawns and golf courses, where it has caused more serious injury than the brown spot. It is especially serious on bent grasses or where mixtures of these are used with other species. This disease develops in periods of warm, humid weather and is characterized by a sudden rotting of the grass in irregular spots scattered over the lawn. These spots have a characteristic, water-soaked appearance, quite unlike the brown spot. Frequent spraying with Bordeaux mixture (4-4-50), wherever weather conditions favor the disease, will check the spread. On new seedings it is best to anticipate the trouble and spray in late May before any disease appears. Lawn rot kills the top of the grass first and if the lawn has a chance to dry out before the grass is entirely dead, it will usually recover and re-seeding will not be necessary.

PEST CONTROL

Japanese and Asiatic beetle grubs. These grubs cause a very typical injury to lawns during late summer and early fall. The grass dies and lies loosely on the surface of the soil, the roots having been eaten off, and the surface of the soil is soft and loose. Usually such injury first appears on small areas, but eventually extends over the entire lawn unless control measures are undertaken. In any locality where either the Japanese or Asiatic beetle is abundant, the lawn should be treated with lead arsenate before it is damaged.

On lawns that are well established and not severely injured, the treatment should be made early in the summer, that is, before August 1. Apply a mixture of lead arsenate in water at the rate of 3 pounds of arsenate to 9 gallons of water for each 100 square feet of lawn. Then sprinkle the lawn lightly with water in order to wash the insecticide off the grass and into the soil. Care should be taken that no run-off occurs. The area treated should extend 3 feet beyond the limit of that known to be infested. If the area is large and proper equipment for using lead arsenate in water is not available, a dry mixture may be substituted. Mix the arsenate with about five times its weight of fairly dry, sandy loam and distribute it over the lawn in an amount necessary to supply 3 pounds of lead arsenate to 100 square feet.

If the grass is killed and re-seeding is necessary, the procedure to be followed depends on the time of seeding. In the case of fall seeding, the lead arsenate powder (3 pounds per 100 square feet) should be worked into the soil to a depth of three inches with an iron garden rake, and the area seeded at once. Fertilizer should not be applied until after two or three weeks, or until the following spring. In the case of spring seeding, fertilize the ground and sow the seed as early as possible. Apply the lead arsenate in water, as described above, after the grass is an inch or two high.

The quantity of lead arsenate recommended is sufficient to kill practically all the grubs in the lawn and will be effective for a long time. Quantities in excess of this amount may injure the lawn, and after one treatment of 3 pounds to 100 square feet, no more lead arsenate should be used on the same area for several years, and then only when grubs again become injurious. If it becomes necessary to re-treat a lawn, the arsenate should be applied at the rate of one-half pound to 100 square feet.

Chinch Bug. Chinch bugs sometimes become injurious to lawns in late summer and early fall, particularly after a period of dry weather. Bent grass lawns appear to be more susceptible to injury than do those containing other species. The grass may die in spots, or the entire lawn may be killed. The reddish nymphs and black and white adult bugs are abundant around the crowns of the grass plants and on the surface of the soil. This insect is about one-eighth of an inch long when fully grown. It may be killed by applying the following mixture at the rate of 25 to 30 gallons per 100 square feet: nicotine sulfate, 1 quart; soap, 4 pounds; water, 100 gallons. The application should be made on a clear, warm day when the temperature is above 70° F. Late fall applications may not be efficient because the bugs may have become adults and gone into hibernation. The large amount of insecticide recommended is necessary because of the density of bent grass turf.

Sod webworms. Sod webworms are small, whitish caterpillars about three-quarters to one inch long when fully grown. They live in small burrows, covered with bits of dirt and lined with silk, close to the surface of the soil. These caterpillars cut off and eat the grass blades, working a tortuous course for a short distance. The injury is not usually discovered until they are fairly well grown; hence, treatment should not be delayed.

Of the insecticides used by different workers for controlling sod webworms, two appear easy to handle and efficient: commercial pyrethrum extract and lead arsenate. The pyrethrum extract should be diluted in water at the rate of 1 part to 600, and 111 gallons of the mixture should be used on 1,000 square feet of lawn. Lead arsenate should be used at the rate of 2 pounds in 20 gallons of water for each 1000 square feet. Either material should be sprayed under pressure with the spray nozzle close to the grass. The lead arsenate is by far the cheaper of the two treatments. Because mixtures of soap and lead arsenate usually injure vegetation, insecticides containing soap should not be sprayed on a lawn previously treated with lead arsenate for grub control.

Earthworms. Earthworms are not generally abundant in a lawn that has been treated with lead arsenate for grub control. Where this insecticide has not been used, corrosive sublimate is very effective. Dissolve 2 or 3 ounces in 50 gallons of water and sprinkle this over 1000 square feet. Do not use a higher concentration or a larger quantity. This substance is not only a dangerous poison but is very corrosive to metals.

Ants. Ants may be controlled by the use of a poison bait, carbon disulfide, or pyrethrum powder. Several poison baits may be purchased, most of them consisting of a sweet solution or paste containing small amounts of poison. All of these materials are poisonous to man and domesticated animals, and should be used with care.

One of the most successful we have tried is a commercial preparation consisting of a paste containing 1 per cent thallium sulfate. This may be inserted in a short length of garden hose to keep it from animals and human beings. Thallium sulfate is a violent poison. Another mixture that has been used successfully consists of tartar emetic with about twice its bulk of sugar and enough water to make a thick syrup. This is also poisonous and should be placed where it will not be molested. Carbon disulfide may be injected into ant nests by using an oil can. About two tablespoonfuls are enough for a small hill, but greater amounts are required for the larger ones. In the latter case it is best to make a hole in the nest about 15 inches deep and pour in the carbon disulfide. In any case all openings should be closed after the material has been injected. Carbon disulfide is inflammable and should be kept away from fire. Pyrethrum powder has been used successfully against ants in a lawn. The powder should be dusted fairly heavily over and around the nest during dry weather. For small nests this may be a very useful control method.

Moles. Moles are best trapped. The directions for using a mole trap may be secured when the trap is purchased. Sometimes the moles may be driven away by opening the burrows every 10 to 15 feet and inserting a teaspoonful of flake naphtha or paradichlorobenzene, or a few moth balls. The holes should then be carefully covered with earth. It is possible in some cases to drown moles by inserting a garden hose and flooding the burrow with water.

WEED CONTROL

Crab grass. This is our most troublesome lawn weed. It is not present as an impurity in lawn seed mixtures, but this does not prevent it from appearing in abundance wherever it has a chance to grow. Unless the lawn sod is kept as dense and vigorous as possible, through adequate fertilization and good care, the crab grass will crowd out everything else during July and August. Vigilant removal of the crab grass plants as soon as they may be recognized, in early July, is the only effective control. If possible, all crowns of this species that have escaped earlier weeding should be cut out before mid-August in order to prevent the plants from re-seeding. Mowing the lawn closely after raking the prostrate stems to an erect position, with removal of clippings, is only a partial control measure.

Other weeds. Dandelions, plantain, chickweed and self-heal are at least partially kept in check by adequate fertilization, especially when the fertilizer contains the acid-forming sulfate of ammonia ingredient. When these weeds are particularly bad, some benefit is obtained by sprinkling the leaves with dry sulfate of ammonia when the dew is on them, or after watering. The weed-killing effectiveness of this material may be increased by mixing it with iron sulfate, at the rate of four parts of the former to one part of the latter chemical. Some damage will be done to the grass, but the fertilizing effect will cause a speedy recovery if there is a fair amount present. Commercial "weed killer" chemicals may be used in extreme cases. However, the only certain method of complete weed control is hand eradication.

WATERING

Many lawns, especially when situated on light sandy soils, suffer severely from lack of moisture during the frequent dry periods that occur in the summer months. Sprinkling with the ordinary garden hose, nozzle held in the hands, is laborious and is rarely effective. Much of the water runs off without soaking in, and the temptation is to water every day or so, without doing much more than wetting the grass leaves at any one time. If watering is to be worth while, it should leave the soil in a moist condition to the depth of at least two inches. This can best be accomplished by the use of mechanical sprinkling nozzles that distribute the water as a gentle shower for at least one-half hour over a single area. After such a thorough watering, there is no need for repetition within four or five days.

During hot "muggy" weather, sprinkling should be done only when absolutely necessary. At such times there are certain disease dangers induced by having the grass wet, especially on warm nights. Morning watering is desirable in these periods.

FALL REPAIR OF LAWNS

In September all patches where the turf has been destroyed by weed invasion, diseases or pests should be spaded up, fertilized lightly and re-seeded, using the same practices as for the seeding of a new lawn.

Thin turf, with no conspicuous bare spots, may be scratched deeply with an iron rake, all irregularities in the ground filled with screened loam, and seed scattered at about half the rate used for an initial seeding. Fertilizer used at this time should best be applied a few days beforehand.

LATE FALL TREATMENT

Mowing should be discontinued sufficiently early to permit the growth of two or three inches of grass before cold weather sets in. This means that under average weather conditions, the last cutting should be not later than October 15. Heavy accumulations of tree leaves must be removed, to avoid smothering the grass. Scattered leaves usually do no harm.

Some lawns in this vicinity are top-dressed with stable manure during the late fall. If the manure is sufficiently well rotted to destroy weed seeds, this is a good practice. Fresh manure should not be applied to the lawn. When available, tobacco stalks and stems are also spread over lawns for the winter. It is doubtful if the plant food thus obtained is sufficient to justify the labor of spreading and spring removal.

Soils deficient in organic matter may be gradually improved by top-dressings of peat made in the late fall, so that it becomes incorporated into the soil during the winter season.