

The Use of Fertilizers on Putting Greens

One of the most important problems in maintaining golf course turf is that of determining the kind and amount of fertilizer to be used on the putting greens. The general appearance of any grass can readily be changed by the application of the right kind of fertilizer. A yellow, unthrifty putting green can within a few days be given a dark green color and a vigorous growth of grass simply by the use of some quickly available fertilizer. On the other hand, the injudicious use of any fertilizer may as quickly ruin turf.

The need for certain fertilizing elements in the growth of plants is too well appreciated to call for elaboration here. Careful fertilizer experiments, checked by countless practical tests under farming conditions, have shown the need for specialized fertilizer formulas for different agricultural crops. It is well known, for instance, that a fertilizer which may be generally desirable for grain crops, such as wheat or rye, may be quite different in character from one necessary in the production of crops harvested for their leaves or stems, such as tobacco and certain forage crops. Therefore in producing turf, where the main object is to get a growth of leaves, the greenkeeper need not expect to get the most favorable results by following some fertilizing program which may have proved valuable in some other kind of agricultural work. The fertilizing elements which are most generally considered essential are nitrogen, phosphorus, and potassium. Nitrogen is the element which is most frequently deficient in putting green soils and thus likely to be needed in largest amounts. Some soils are deficient in phosphorus, and this deficiency may be the limiting factor in producing turf on those soils. Deficiency in phosphorus is much more apt to be apparent in fairways than putting greens. In some cases potassium is deficient; then an application of potash is likely to give striking results. However, on the big majority of courses there is very little evidence of a deficiency in potassium in putting greens. Calcium, an ingredient of lime, although not regarded strictly as a fertilizer, is used frequently for agricultural purposes. To get the best growth of any plant it is desirable to have a favorable balance in the soil of all these fertilizing elements. If one or more is missing, the addition of any of the elements already present in abundance will be of little or no help in improving the crop. Practically every soil has a certain amount of all of these elements in addition to a large number of other elements necessary for plant growth. Also they are usually all present in manures and certain other products derived from animals or plants. To supply any deficiency in his soil, the modern greenkeeper or farmer has a wide choice of highly concentrated or of low-grade fertilizers both natural and artificial, as shown in the April number of the Bulletin.

The ever-growing multitude of fertilizers and fertilizer mixtures, each with its advocates claiming superior qualities as compared with all other mixtures on the market, makes the fertilizing problem increasingly confusing. Undoubtedly a large number of the fertilizers now on the market are suitable for putting green use. It must, however, be borne in mind that any fertilizer which may be most desirable on a green where there is a deficiency of a certain fertilizing element may prove injurious if used in excess on that green. Unfortunately there is no simple rule that can be laid down for ferti-

lizing putting greens. There are, however, certain general principles that can be used as a guide in determining the fertilizing program for the greens on any golf course.

In making plans for the fertilization of most agricultural crops, due consideration is given to the natural seasonal developments, but on golf courses seasonal developments in many respects are ignored, particularly on putting greens. The grasses growing on putting greens are forced into a more or less unnatural condition, and efforts are usually made to bring them into the best of condition for special tournaments, regardless of whether or not it is the particular time when grass naturally would be at its best. Therefore the fertilizing program for putting greens must be modified to some extent to try to bring about the best growth of turf at the time of the most important tournaments. Fertilizers which are quickly available, therefore, have come into much favor for putting green use because they are able to affect the growth of grass within a few days after they are applied. In order that they may produce quick results, however, it is desirable that the regular fertilizing program provide for well-balanced feeding of the grass throughout the entire season and without the excessive use of any one fertilizing element.

In planning a program of fertilizing putting greens it must be remembered that the maintenance of a putting green constitutes a very intensive form of plant production. Few realize the large amount of plant material removed each year in the clippings from the greens. In the days before the grass catcher came into use this material was allowed to return to the soil, but under present conditions it is lost unless it is used in compost. In order to obtain an estimate of the amount and composition of this material, the grass clippings were weighed and analyzed from some of the better-treated putting green plots at the Arlington turf garden in 1930 over the period June 1 to November 1. The results obtained from these observations at Arlington would indicate that the amount of field-dry material removed from 18 greens totaling 90,000 square feet would be about 4 tons, containing approximately the following equivalent amounts of plant foods: nitrogen as obtained in 2,000 pounds of sulphate of ammonia; phosphoric acid as obtained in 200 pounds of 20 per cent superphosphate; and potash as obtained in 400 pounds of 50 per cent muriate of potash. These figures should not be used as a basis for building up a complete fertilizer for putting greens, as various conditions, such as soil, climate, and season, would influence the results; however, they are valuable as indicating the importance of a careful program in using fertilizers. They also show the importance and value of saving the clippings so that the fertility removed may be, in part at least, returned in the form of compost.

The fertilizing program for any putting green must be based on the fundamental principle that a vigorous production of healthy leaves is desired. Fertilizers that are designed chiefly for the production of grain or certain other agricultural crops are therefore not most suitable for putting greens even though sold at an attractive price. It is known that fertilizers containing a good proportion of nitrogen are most likely to stimulate a vigorous growth of leaves. However, too vigorous a growth may produce leaves which may suffer from diseases or other injuries. Therefore, although nitrogen is distinctly desirable as the chief ingredient of putting green fertilizers,

its use can be easily overdone and great damage result. It is important to realize that nitrogen can be supplied to the turf in compost or mushroom soil. Frequently greenkeepers apply large quantities of mushroom soil or compost without realizing that they are thereby adding fertilizers to their turf. When large quantities of these materials are used, it is necessary that a proportionately less amount of the more concentrated nitrogen fertilizers be used. It is not unusual to apply a ton of mushroom soil or compost to a green. Such material usually contains about 1 per cent, or 20 pounds of nitrogen. It takes 100 pounds of sulphate of ammonia, or 333 pounds of 6 per cent cottonseed meal, to carry the same amount of nitrogen to the green. The nitrogen, however, in sulphate of ammonia is more quickly available to the plant than is the nitrogen in cottonseed meal, compost, or mushroom soil. It is well to have part of the nitrogen applied to a green in a form that is quickly available and some that is only slowly available. Experience has shown that if too much nitrogen is stored in the soil in a slowly available form there is apt to be damage to the turf at any time when weather conditions are most suitable for rapid disintegration, which changes the nitrogen from a slowly available to a readily available form and thereby produces an over-fertilization with nitrogen.

As indicated in articles appearing in this number of the Bulletin, contributed by five different greenkeepers located in different parts of the country, there is no standard fertilizing program for putting greens. It is indeed unlikely that a standard fertilizing program will be developed in the future, for the simple reason that different soils and climatic conditions require different fertilizing programs. It will be noted in these discussions by greenkeepers that the favored method of determining the need of putting green grasses for additional food supply from fertilizers, is careful observation of the color and general appearance of the grass. When the grass is being starved, it shows certain general symptoms which may be extremely difficult to describe, but which are, nevertheless, readily recognized by anyone who is a close observer of growing grass. Unfortunately every golf course does not have some one who is a close observer of grass who is able to recognize the symptoms which indicate the various needs of grass. This absence of discriminating observation undoubtedly is responsible for a great wastage of club funds in a number of instances. Frequently clubs will endeavor to improve greens by some expensive rebuilding program, tiling, or other procedure, when the poor turf can be very simply explained on the basis of available plant food. In the latter cases the cheapest and least inconvenient method is to apply the required amount of fertilizer. On the other hand, there are undoubtedly a great many golf courses where the fertilizing program has led to the application of excessive amounts of fertilizer, with the result that putting green problems have arisen calling for large outlays for repair work. In such cases the sensible and by far the least expensive solution is to reduce the budget allowance for fertilizers. The old appeal of Aristotle for moderation, as quoted on the back page of this number of the Bulletin, applies equally as well to the fertilizing of putting greens as to the purpose for which he intended it.

A general recommendation for fertilizing putting greens might be about as follows:

Well-prepared and weed-free compost, or mushroom soil, to which sand has been added, should be applied liberally to the greens at the beginning of the growing season. When compost prepared from a mixture of manure and soil is used, or when mushroom soil is used, the top-dressing will be of considerable fertilizing value.

One of the most important purposes of applying top-dressing is to fill in slight depressions in the turf and thereby improve the putting surface. A sifted soil, preferably sandy loam, may be used for this purpose. If the top-dressing has not been produced by composting the soil with various manures, it may be of comparatively little fertilizing value.

When a top-dressing of natural soil or soil mixed with sand or peat is used, a complete mixed fertilizer should also be used occasionally to provide the nitrogen and mineral elements, such as phosphorus, potassium, calcium, and other elements contained in manure. Although the mineral elements will have to be applied only occasionally it will be necessary to keep up the nitrogen supply; this is best done by making frequent light applications of some soluble nitrogenous fertilizer, such as sulphate of ammonia.

If the fertilizing is not being done by means of top-dressing with compost or mushroom soil, only enough top-dressing should be applied to keep the putting surface true throughout the playing season.

Close cutting, brushing, raking, and even light rolling of putting greens, in many instances, tend to make frequent or heavy top-dressing unnecessary.

An application of one cubic yard of top-dressing at one time is ordinarily sufficient to true the surface of a putting green of 5,000 to 6,000 square feet. Often such a top-dressing in the spring and fall is sufficient on some greens, while on others several top-dressings may have to be made during the season.

Top-dressings during the playing season should be much lighter than the spring and fall top-dressing in order to interfere as little as possible with play.

Top-dressings should be worked in with a mat or some device which will rub the material from the high spots and deposit it in the lower areas.

The amount of top-dressing to apply will depend largely on the needs of the turf from the playing standpoint and to less extent on the needs of the grass for growth. When the putting surface is not true, top-dressing should be applied. Frequent light applications are better for this purpose than infrequent heavy applications.

The cost of application must also be considered on many golf courses, and from the standpoint of cost it is inadvisable to top-dress more frequently than necessary. When large quantities of compost or mushroom soil are used on greens they may in themselves add enough of the fertilizing elements to provide for adequate growth of the grass. Good compost is, however, more costly than it was many years ago, and therefore the use of compost is becoming more and more restricted to the actual need for providing a true putting surface. Commercial fertilizers, on the other hand, have been greatly reduced in cost as compared with compost in recent years, and are therefore coming more and more into general use on golf courses. It is therefore advisable to supplement the compost with sandy loam

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rate of $\frac{1}{2}$ yard to the green. Beginning in 1928 we used 15 pounds of sulphate of ammonia in April and October in 1 yard of mushroom soil. Between these months we used $\frac{1}{2}$ yard of mushroom soil with 25 pounds of an 8-5-4 fertilizer regularly each month. All told, each green accordingly received for the year 125 pounds of the 8-5-4 fertilizer and 30 pounds of sulphate of ammonia, in addition to the mushroom soil.

In 1929 we changed our program of top-dressing and watched the condition of our greens more closely. In April we applied 10 pounds of sulphate of ammonia with 1 yard of mushroom soil. For the rest of the season we top-dressed only when need seemed to be apparent. In other words, if a green looked "hungry"—and by that I mean very much off color and of stunted growth—we gave it 1 yard of mushroom soil and 25 pounds of the 8-5-4 fertilizer. This practice has done very well with us up to date and it is our plan to continue with it.

My experience seems to indicate that in mushroom soil we have a fertilizer of lasting effect and a resultant steady, uniform growth. We buy our 8-5-4 fertilizer already mixed. The top-dressing is applied by hand, from pails; it is smoothed with a steel mat and lightly watered.

For brown-patch, both small and large, we apply calomel and corrosive sublimate every other Monday during the season when the disease is prevalent, at the rate of 3 ounces to 1,000 square feet. In this way we have escaped all injury from the disease.

In Farmers' Bulletin 1397-F, issued by the United States Department of Agriculture, methods are described for controlling field mice, including the destruction of mouse shelters, treating trees with repellent washes, inclosing trees with mechanical protectors, trapping, and poisoning. Where field mice are destructive to trees or turf their control should be undertaken at regular intervals. Inspections should be made, especially in fall and early spring, for mouse signs, and protective measures taken if necessary. The bulletin may be obtained free from the United States Department of Agriculture.

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for making the putting surface true, and with fertilizers for providing the food necessary for the growth of the grass. For this purpose the greenkeeper has available a large choice of thoroughly tested commercial fertilizers. There has been in the past some prejudice against the use of commercial fertilizers on the part of many who have clung to the preference for so-called natural fertilizers, which were practically the only ones available at the time of our great-grandfathers. The modern farmer and greenkeeper have learned to recognize that plants are not influenced by prejudices and are satisfied to get their food from any source that is available. The important question is the matter of availability, which means, as a rule, whether or not the plant food can become soluble in the soil and thus in condition for the roots to absorb.