

What Fertilizer Study Is Doing to Improve Course Standards

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THE importance of commercial fertilizers as an aid to plant growth has been recognized by agricultural authorities for many generations, but only during the past decade or so has any serious thought been given to the actual fertilizer requirements of the fine turf grasses under the artificial conditions prevailing on the golf course. Authorities long have agreed that nitrogen, phosphorus, and potash are the principal plant food elements required for the development of plants and that each of these elements has a different function in this work. Consequently the use of fertilizers containing varying proportions of each of these elements has been in general practice for many years. In the matter of grass fertilization these fertilizers were originally used with the object of producing increased yields of hay or forage crops, and this practice was pressed into service in the pioneer days of greenkeeping without regard for the different purposes for which grass was grown or the different conditions to which it was subjected. These methods have fallen by the wayside during the past few years, however, to make way for the modern methods of today.

Began Fertilizing Experiments

Along about 1905 or 1906 the Rhode Island Experiment station started a series of experiments with fertilizers on bent and fescue grasses. The primary object of these tests was to determine the effect of acid-reacting and alkaline-reacting fertilizers on the growth of these grasses. These plots were not kept as closely clipped as our modern putting greens but they were kept so as to fairly approximate modern fairway turf. These experiments, so far as available records show, were the first steps taken in this country toward the solution of the problem of grass fertilization. The striking results of these pioneer experiments attracted the attention of some of the officials of the United States Department of Agriculture and led to the

establishment in 1921 of a series of experiments at the Arlington Experimental farm where various fertilizers were to be tested on different grasses kept in putting green condition. This project was really the beginning of actually serious investigation of turf fertilization.

The knowledge gained through these pioneer undertakings served as a stimulus for further and more thorough investigation in this field, which has resulted in the establishment of numerous experimental projects in various parts of the country which are being conducted under the supervision of scientists and trained investigators. It also fostered the development of a widespread interest in the importance of proper fertilizers and fertilizing methods for the golf course among progressive greenkeepers, green-committeemen and fertilizer manufacturers. Progress achieved during the few years' duration of this campaign, to date, has been such as to merit much satisfaction and a great improvement in results obtained from the employment of its achievements.

It would be a difficult assignment to apportion credit where it justly belongs in the origin and progress of this educational campaign, but this observer feels justified in apportioning the major share equally among the trained investigator, the fertilizer manufacturer and the greenkeeper. The trained investigator (which includes many of our progressive greenkeepers) began his contribution to this work by "putting the bug in our ear," as it were, that is by conceiving the idea and putting it into action, and he followed it up by being instrumental in the enlistment of the fertilizer manufacturers' interest, and by engineering the gradual demise of the fake fertilizer trade.

The fertilizer manufacturer contributed greatly to its progress by his cooperation with the investigator and greenkeeper in an effort to determine the materials best suited to golf course purposes and to fur-

nish the greenkeeper the material required for his particular course. The greenkeeper, last but by no means least, has made his valuable contribution by relentless co-operation in the matter of investigation and open demonstration on the golf course of the results of the combined efforts of all three parties, or by actually presenting the finished article to the consumer.

What Has Been Learned?

So much for HOW we have learned, but, WHAT have we learned? First we have learned that for turf fertilization we need turf fertilizers. There was a time when a man with a good line of sales talk could catch an unwary green-chairman or greenkeeper napping and sell him most anything that had a high sounding name and was recommended as the ideal fertilizer for the golf course, lawn, shrubs, flowers and truck garden. This time is fast passing; the wide awake greenkeeper of today has learned that when he is purchasing fertilizer for turf he does not want a fruit or flower producing material. He knows that what he needs is something capable of developing a dense and vigorous growth of foliage and roots, inasmuch as these two parts of the grass plant form the turf. He knows that the principal element needed for foliage production is nitrogen and that since the foliage must be clipped closely, and often in order to facilitate a dense covering and a firm and true surface, it requires an abundance of its favorite food. Consequently he buys a fertilizer with a predominating nitrogen content. During the past few years ammonium sulfate, a purely nitrogenous fertilizer, has been used almost exclusively by many clubs, chiefly because it produced the desired foliage growth and fairly weed-free turf, but as we progress and learn more about the importance of root development the progressive greenkeeper finds a need for phosphorus. This does not mean that there is no longer a place in the turf fertilization program for ammonium sulfate. It is recommended as an ingredient of the complete fertilizer, or as an occasional alternate application. The general trend is toward the use of a complete fertilizer with a high nitrogen content, and a liberal phosphorus content.

Functions of Roots

An idea of the importance of a strong healthy mass of roots in turf may be given by a brief description of the two major functions of grass roots under turf condi-

tions. First, they are the foraging organs of the grass. They serve, not only as mouths for the grass, but they go out and search for the food which they transport to the digestive system of the plant. To use the vernacular, "they bring home the bacon." Second, the roots have an important part in the formation of turf. The tangled mass of roots serve to bind the turf together and make it more resistant to wear, while at the same time they aid in the provision of that all-important resiliency so required of putting green turf. In order to maintain a dense root system a liberal supply of phosphorus is needed. The results of investigation and general observation indicate that nitrogen should predominate and phosphorus should have next consideration. Potassium has only minor functions in the development of the plant other than in the production of flowers and fruit, consequently a much lower percentage is required than of the other two. It has been the writer's observation that a fertilizer containing 10% to 12% nitrogen, 6% to 8% phosphorus, and 4% to 6% potash is a very satisfactory mixture for average turf fertilization. This may be partially organic or entirely inorganic without appreciable difference in value; however, as the inorganic form is more readily soluble, it is preferable when quick results are desired. Fertilizers bearing analyses in this proportionate range have, in fairly general practice given excellent results, and the apparent tendency of this formula to produce disease-resistant and drouth-resistant as well as a comparatively weed-free turf has greatly influenced its gain in favor with many of the observant greenkeepers.

Rate of Application

The rate of application must be governed by local conditions, and the observing greenkeeper is the best judge of the rate and frequency of application required to keep his turf in good condition. As a general rule it is better to fertilize lightly and frequently than heavily and at longer intervals. Such treatment furnishes the grass with a more continuous supply of food which in turn insures regularity in the health and vigor of the grass and the resultant uniform color and texture of turf. Putting greens should be fertilized at intervals varying from two weeks to a month during the growing season and the rate per application of the complete fertilizer mentioned above should vary from 4 to 6 pounds per 1000 sq. ft., depending on the

conditions obtaining locally. Fairways and tees should be fertilized once or twice a year and in the case of one application it should be done in the early spring. If two applications are to be made the second should be in the late summer. The rate of application should range from 300 to 500 pounds per acre annually.

The methods of applying fertilizer have a very important bearing on the results obtained, especially in the case of putting greens.

Much has been written in recent years about various methods of applying fertilizer but little has been said about the importance of where it should be applied. Naturally, broadcasting over the surface is the method generally used. In some instances the fertilizer is mixed with compost, in others it is applied alone either in a dry state or in solution. Either of these methods is satisfactory provided the treatment does not stop here.

Correct Placement of Fertilizer

In the writer's estimation, the most important factor in the matter of fertilizer application is to get the fertilizer where it is needed before leaving it, and by this I mean, get it down in the soil where the roots can make use of the plant food without having to come to the surface for it. We are aware of the necessity of a mass of roots near the surface which form an important part of the turf, but, we are also aware of the need for deep root growth to aid the grass to withstand the hardships to which it is subjected under golf turf conditions. Therefore it is good practice to provide a feeding ground for the roots, not only near the surface but ranging downward to a depth of several inches.

As stated above, the roots of grass are foragers and naturally their tendency is to grow in the direction best supplied with the food for which they are searching; hence the importance of getting the fertilizer well distributed through several inches of the top soil. The question arises as to how this may be accomplished. On light sandy soil or on the average lawn where trampling is prohibited the problem is simple. The fertilizer should be applied when the ground is fairly dry. It should be distributed as evenly as possible and immediately watered in thoroughly. If the fertilizer is of a readily soluble nature it is taken up by the water and the open pores of the soil readily receive the solution and allow it to pass freely down

through the surface layer and be distributed within convenient range of the feeding roots of the grass. The plant food is deposited in the form of a film over the particles of the soil and is taken up by the plant as needed.

On the average putting green, however, the surface becomes so closely packed as a result of constant trampling that it is practically impervious to both air and water and in such cases it becomes necessary to employ some artificial means of opening the soil so as to provide for the reception of water, air and plant food. To do this job successfully the surface layer should be closely perforated and the perforating instruments should penetrate entirely through the compact layer which usually ranges from one and a half to two and a half inches depending on the type of soil and the amount and character of usage. Regardless of the effort necessary to open up the soil it will pay in the long run for it serves other purposes of importance than that of receiving fertilizer, one of which is the aeration of the soil. Provision for air circulation through the portion of the soil containing the grass roots is very essential to the health of the plant; first, because a certain amount of oxygen is taken in through the roots, and second, because it carries off the toxic gases thrown off by the roots which if confined in the soil will ultimately result in a toxic soil condition that is extremely detrimental to turf.

To sum up the matter of successful turf fertilization one must first know what is best suited to the requirements of turf grass. When in doubt get the information from some recognized authority on plant food requirements. Familiarize yourself with the best practice in the matter of rate and frequency of application for your local conditions and then be sure to put the fertilizer where the grass can make the best use of it.

U. S. G. A. Rules on Sand-Wedge Types

THE following rule recently adopted by the Executive committee of the U. S. G. A. clears up questions of legality of niblicks intended for the "sand-wedge" class:

"Club faces shall not embody any degree of concavity, or more than one angle of loft."