If the compost pile is in the open, a hint as to possible economy in turning the material when ready may not be out of place. Often some contractor has a gas or steam shovel in the neighborhood of the club and will turn the pile at so much per hour or yard, doing it four or five times as cheaply as it can be done by hand. The shovel will move along the pile, dig into it and drop the compost in a large pile parallel to the old one. So as to better spread and separate the material, the operator can swing the bucket as he drops the load. The pile may also be turned with slip scrapers at one-half the cost of hand turning. For piles of four or five hundred yards, three teams can be used very economically. The teams should go up over the old pile to load the scraper and dump so as to build a new pile, thus turning and mixing the compost.

The above methods of turning the pile are mentioned, as the writer has seen the value of many well-built compost piles lessened to a great extent as a result of not being turned at all, or else not being turned at the proper time. This neglect is often due to the time required and labor entailed in turning by hand.

Gypsum (Calcium Sulfate) of Questionable Value for Turf Grasses

Recently considerable interest has been displayed as regards the advisability of using calcium sulfate, or gypsum, on golf courses. This is probably the direct result of the propaganda put out by those interested in selling the product. Some of the benefits claimed to follow its use are to the effect that it increases the acidity of the soil, thereby creating a condition more favorable to the growth of certain turf grasses such as the bents and fescues; furnishes calcium for the plant without increasing the alkalinity of the soil, as happens when ordinary lime is used; liberates plant food; supplies sulfur; and improves the physical character of the soil. Most of these claims are well answered in the Cornell University Agricultural Experiment Memoir 97, issued 1926. The author, M. H. Cubbon, goes into the history of the use of gypsum, discusses in considerable detail a large number of experiments that have been conducted at various times and places, and adds further evidence by describing carefully conducted experiments of his own. While turf grasses have received very little consideration in the tests, the conclusions reached with other crops apply to a greater or less extent in the growing of turf grasses. The following quotations are taken from the discussion and the summary of the Bulletin:

"In summarizing results from the various experiments reported herein, the conclusion must be drawn that calcium sulfate has not proved to be the active stimulant which it has heretofore been considered. Such results, it seems, might have been anticipated from the use of a single material whose constituents may or may not be essentially lacking in the humid sections of the country. Experience seems to show, too, that when a stimulating action is apparent, it is brought about by some unusual soil condition which, very likely, is not connected in any way with the lack of a particular element. It seems, further, that calcium carbonate produces a stimulation in many more cases than does calcium sulfate, and hence it must be

repeated here that the sulfate can not be logically recommended for as many different uses as can the carbonate.

"There is no good reason for thinking that gypsum produces or intensifies acid conditions in soils. The experimental evidence on this point is not so contradictory as one might suppose on first thought. It is true that some reports have been unfavorable to the use of gypsum, and these must be accepted as authentic even though they are based on work not carried out in the field. However, a review of the literature of the subject indicates that field experience does not show any detrimental acid condition due to the use of gypsum. When the soil becomes more acid under field conditions where calcium sulfate has been applied, it seems to be the result of rapid leaching together with an insufficient application of calcium to meet the leaching losses. If the leaching losses were always considered when the question arises as to the amount of gypsum to be added, there should be no pronounced acid condition resulting from the use of the material alone. Usually, however, such a small quantity of calcium sulfate is added that it can have but little influence on the potential acidity of a soil, and hence no effect in preventing the soil from becoming acid in accordance with the general tendency of soils to become acid. Furthermore, the use of acid phosphate, carrying as it does about 50 per cent of calcium sulfate, has not produced measurable soil acidity. * * *

"Data regarding the influence of calcium sulfate on bacterial activities in soils fail to indicate a consistent and regular beneficial effect. Other evidence than that reported here indicates just the opposite effect, namely, an unmistakable benefit. Since such variations occur, it is impossible to recommend the general use of calcium sulfate on soils. Soils that show increased nitrate production should give a response to gypsum in the field, and no doubt they do. The results obtained by growing a denitrifying (nitrate-reducing) organism in pure culture, help to emphasize the many and varied ways in which calcium sulfate may produce a beneficial effect. * * *

"The ordinary application of gypsum is not in sufficient quantity to produce a noticeable effect on the physical condition of the soil. Likewise, the moisture relations of soils do not seem to be affected materially. Here, again, the experience from field work is not sufficient for conclusions to be drawn. * * *

"Crop responses have been very uncertain, as has been pointed out. Experience would indicate that greater responses have been obtained when either calcium or sulfur was a limiting factor in the soil, than when the calcium sulfate functioned in an indirect way to stimulate other processes.

"Since most soils are low in sulfur, the question of supplying that element in some form is rather an acute one. It remains for the individual farmer to decide which carrier of sulfur he can use most effectively. * * *

"Calcium sulfate had no effect on the growth of pasture grasses. * * *

"Leaching various soils with saturated calcium-sulfate solutions did not result in a marked liberation of potassium. * * *

"Calcium sulfate had a very slight effect on the physical condition of the soil. The water-holding ability of various soils was slightly increased, while the hydroscopic moisture capacity was not

affected, by heavy applications of calcium sulfate in solution form. Wooster silt loam soil was influenced more strongly than any other of the soils leached."

It should be remembered that many of these tests were conducted with crops such as legumes that are frequently benefited by applications of gypsum, especially where the soil is low in sulfur. There is little evidence that turf grasses are actually benefited by applications of gypsum, except in very limited areas. Furthermore, gypsum has a tendency to encourage the growth of clover, which most greenkeepers and golfers regard as very objectionable. In some cases applications of sulfur have proved actually injurious. It is further shown by the results reported in the publication quoted above that gypsum has very little effect on the soil acidity; is of little consequence in releasing plant food; and in the amounts normally used, has little effect on the physical condition of the soil. In view of this situation any club considering the use of gypsum is strongly advised to try it out experimentally before spending money, which may be worse than wasted, in purchasing large quantities of the material.

Conditions Which Influence the Growth of Turf

By C. A. Tregillus

The study of soils and soil conditions and their effect upon turf growth; the study of grasses suited to varying conditions of soil and exposure; the study of fertilizers and their effect, and the study of chemicals for the control of pests and diseases, have within the last few years, greatly modified and regulated our methods of course maintenance. Greenkeeping is a development of the old art of gardening which, in those sections of the earth blessed with a suitable climate, has long reached a high stage of proficiency and has acquired results of outstanding merit. It must be remembered that while a great deal of credit is given to the climate and to the natural grass flora that lends itself to such practice, the early greenkeepers had evolved from custom and observation, a system on which rests the basis of modern golf course management. In recent years, due to the rapid expansion of the game of golf, the science and practice of greenkeeping has had to considerably widen its scope to embrace circumstances under which it was formerly thought impossible or at least uneconomical to grow and maintain grass of the quality demanded by the game. Extremes of climate and other natural phenomena bring up problems that are gradually being solved both by close study and analysis in the laboratory, and by trial and error in the experimental plot. This has been going on apace until there are very few regions left where it is not possible to produce at least a fair to medium turf.

Success in turf culture lies in thoroughly understanding the various influences, whether natural or artificially produced, that bear upon the life history of the grass plant and being able to eliminate or modify those that have an adverse effect and to promote those that are conducive to healthy development. It means that we should seek to acquaint ourselves as closely as possible with the intimate relation of the common circumstances under which turf will grow.

The early men possessed a vast amount of this information which, acquired by the long process of constant observation, and well served