THIS MATTER OF SOIL TESTING

By O. J. NOER

SOIL ANALYSIS has engaged the attention of chemists since the beginnings of scientific agriculture. At first the problem of determining soil deficiencies seemed simple. It was only natural to suppose that plant analysis would disclose the elements needed for growth, and then a soil analysis should indicate deficient elements. In practice this apparently simple procedure failed for two principal reasons.

Plants are less selective in the absorption of nutrients from the soil solution than is generally supposed, and as a result some of the elements found in plants are not necessarily needed for normal growth. Furthermore, the quantities vary with the amounts present in the soil solution with the season, and also with the stage of growth or maturity of the plant; so plant analysis does not disclose exact information regarding nutrient requirements.

In early methods of analysis, soils were either digested with strong acids or total quantities of the various elements were determined. Segregation of fertile from infertile soils was impossible by these methods, because both fail to differentiate between the readily soluble and difficultly soluble mineral elements required by plants.

Plats Tell Most

Following the failure of these methods, agronomists turned to field methods. Even today, fertilizer test plats furnish the most trustworthy data and remain the surest method for determining the fertilizer needs of a particular soil. Unfortunately, most of a growing season must elapse before information is available. Then too, the fact that a particular fertilizer ratio produces best growth does not prove that this is the best ratio for all time. In other words, when need for phosphoric acid is acute, heavy initial rates to encourage deeper penetration and to build soil reserves may be best practice on fairways but after that, rates can be reduced to a bare minimum which will suffice to maintain the supply.

Aside from nitrogen, the mineral plant food elements of the soil can be grouped into three classes based upon solubility.

1. Water Soluble Nutrients
2. Easily Soluble Nutrients
3. Difficultly Soluble Nutrients

The first class embraces the nutrients dissolved in the soil moisture and is the principle source from which plants derive needed mineral nutrients. Since the soil solution is extremely weak at all times, the supply must be replenished rapidly by solution from the class of easily soluble nutrients when plants grow vigorously. So ability to maintain a supply of nutrients in the soil solution is the distinguishing characteristic of a fertile soil.

During recent years soil analysis has undergone revolutionary changes. The newer methods attempt to differentiate between the readily soluble and the difficultly soluble soil constituents, and thus endeavor to determine the plant food which can be classed as available in a relatively short period of time.

The underlying principle for all the methods is the same. Except for the determination of soil reaction a solution of the various plant food elements is obtained by shaking a small quantity of soil with a weak extracting solution for a definite period of time. The primary difference between the several methods is in the strength and type of the extracting solution and accounts for the different results obtained.

Soil reaction is determined on a separate sample of soil, and differences between methods are in details of manipulation rather than principle. Complex dyes, which develop distinctive colors depending upon reaction, are used as indicators and appropriate color comparison charts are supplied so reaction can be determined by a simple color comparison. Results are reported in terms of pH. According to this method the figure 7 represents a neutral soil, smaller figures denote increasing acidity, and those above 7 increasing alkalinity. The methods are simple and no especial skill is required, so tests can be made out on the fairways and greens. In fact, field testing is often preferable for it enables the operator to quickly detect any difference in reaction based on depth. Obviously less lime is needed where strong acidity is confined to the surface inch or two of soil, and larger quantities where strong acidity persists in the deeper soil.

Most of the rapid methods for determining nitrogen measure the amount which exists in the form of ammonia or nitrates. Such methods are of questionable value on turfed areas, particularly during the growing season, because the dense mass of grass roots quickly absorbs most of these forms of soil nitrogen. However, anyone experienced in turf maintenance can quickly judge need for nitrogen by simple inspection of the grass. When moisture and temperature are favorable for growth, thin turf, slow rate of growth, light color, prevalence of weeds and moss are unmistakable signs of nitrogen need.

With phosphoric acid and potash the situation is somewhat different. It is not so easy to diagnose need for these elements by simple inspection of the grass. Previous experience with similar soil types in the locality is helpful, but dependable methods for determining available soil phosphorus and potassium would simplify the task of prescribing need for fertilizers containing these elements.

Correlation with Field Tests Advised

Since the rapid methods are more or less arbitrary, their usefulness depends upon correlation of results with fertilizer experience in the field. Progress along this line has been made in agriculture, but the tendency is to use the tests on golf courses without discrimination. In many instances such tests serve as the sole basis upon which fertilizer recommendations are made. It is about like placing a gun in the hands of a blind man and demand that he hit the bulls eye during target practice. Except for acidity and alkalinity, only experienced operators who are familiar with local soils and the problems of golf turf maintenance should test soils. Final judgment on the value of soil testing must wait until further studies have been made. Besides a comparison of the several methods on different soil types, tests must include soils of known fertilizer treatment, and growth response to the different fertilizer constituents.

In order to obtain some information regarding the value of the various methods, soil samples were collected from fairways in the Milwaukee and Chicago districts during the late fall of 1935. In most instances these were taken from test plats of known fertilizer treatment. The soils varied in texture from loam to silt loam, and ranged in reaction from moderately acid to slightly alkaline. Available phosphorus was determined by the Truog, Purdue, original and revised Simplex Methods; and for available potassium the Purdue, and the original and revised Simplex Methods were used.

Some interesting results were obtained, but final conclusions must await further tests on a wider range of soils from more districts. Details were presented in a series of ten tables and charts. These can be obtained in mimeograph form by addressing the writer in care of the Sewerage Commission, Milwaukee, Wisconsin.

The results show the necessity for careful sampling, and on fairways sampling depth should not exceed 3 in. In many instances it would be better to confine samples to the first 2 in. Because available phosphorus and potassium often decrease with depth, samples should consist of a uniform core or column of soil.

Lead Arsenate May Block Tests

The Truog, Purdue and revised Simplex Methods for available phosphorus appear to give promise, provided lead arsenate has not been used for grub or worm control. They seem to differentiate deficient soils from those which contain a reasonable supply of this element.

When soils contain 50 lbs. by the Truog Method, and doubtful by the Purdue Method and medium by the revised Simplex Method, comparative light rates of phosphate appear to maintain the supply of available phosphorus on the plats subjected to test, but none of these soils are more than slightly acid. The original Simplex Method did not extract appreciable quantities of available phosphorus from any of the soils tested, except when excessive quantities of phosphate fertilizer had been used. The method does not seem to be suited to the heavier textured fairway soils.

Downward movement of applied soluble phosphate is slow. Sixty days after applying 20% super phosphate at 600 lbs. per acre the increase in available phosphorus was confined to the surface inch of soil.

Data seems to indicate that where the available phosphorus is low, one or two generous applications of phosphate, fol-

Greenkeepers Club of New England at the Massachusetts State College annual recreational conference had this display, showing their idea of the country club as an all-year operating proposition. Winter sports maintenance work in New England has become an important part of the year's program.

lowed by the use of a fertilizer containing not more than one unit of phosphoric acid for each two units of nitrogen, actually increases the supply of available phosphorus to a depth of 2 in. or more.

None of the present methods for available potassium compares with the better methods for phosphorus.

Since available potassium may also decrease with depth, careful sampling to a depth not exceeding 2 to 3 in. is important.

The Purdue and revised Simplex Methods are more reliable than the original Simplex Method. In fact, the latter usually shows acute potassium deficiency on most fairway soils even though growth response does not occur following the use of potash fertilizer. None of the potash methods are sufficiently delicate to detect single applications of 50 lbs. of actual potash to the acre with absolute certainty.

Harbert Passes Two Hot Ideas On to the Pros

E. W. HARBERT, pro at Marywood CC, Battle Creek, Mich., is using to profitable advantage a couple of ideas that deserve wider application in pro golf.

Harb bases his use of the stunts on the idea that the average pro has quite a little time he spends around his shop when he might be out increasing golf interest and sales. He maintains the greatest retardant to pro profits is the time element; that the usually short enough season makes it vital that each possible working minute be devoted to developing income.

Says Harbert:

"On both men and ladies' day I play nine holes with three members and switch to three other members on the second nine. The only requirement for the members is that they pay about 15c apiece for my caddie. That means that they will receive a nine-hole playing lesson for 15c apiece. The second nine, I play with three other members. Start in at the letter A of the club membership and work down. Of course, there will be some times when one or possibly two will not be able to enjoy this privilege.

"I also issue a value ticket to each member upon the purchase of anything pretaining to golf. In other words, if a player buys a 75c golf ball, he will receive a 75c ticket. When he accumulates $15 worth of these tickets, I will give him one golf lesson. I realize that some clubs can boost this $15 rate to $20 or $25, whichever they feel they can do. Fifteen dollars isn't a lot but at the same time, you are going to draw business that sometimes goes elsewhere. I think that most pros realize that they can set the time for these lessons at their advantage so they won't get their fannies sore sitting around.

"Another way to look at this is that the pro is going to improve the class of golf played at the clubs, because there are some members who never take lessons and if such a member can get one for nothing, he will probably play a better game. It is to be understood that there is no obligation and he doesn't have to take the lesson unless he cares to and such being the case, the pro isn't out anything anyway."

Macpherson to Make Film. — Duncan Macpherson, author of "Golf Simplified," has been signed by Bell and Howell to do a sound instruction film on Golf Simplified for the B&H Home Movie library of reels.