

course of time, we shall develop artificial inoculants that can be applied to greens as a means of accomplishing the various improvements that an active soil bacterial flora may make possible.

Stimulating Bacteria

The greenkeeper must remember that, when he uses sulphate of ammonia, urea, nitrate of soda or various mixed chemical fertilizers, he supplies raw material containing an important and essential constituent of plant food. But, whatever the kinds and amounts of these nitrogen salts that may be used for stimulating root development and top growth, we should not forget that bacteria, also, are stimulated by having these substances placed at their disposal. Being so stimulated, they effect a whole chain of transformations and changes that become evident in the rate of growth of the plants themselves.

The greenkeeper may overlook the fact

that the various chemicals employed may tend to make the soil more acid or less acid; that he may deepen the root zone or make it more shallow. Overemphasis has been laid in the past on the desirability of using such chemicals as would make the soil strongly acid; in consequence, there are many greens where lime or other materials possessing the same corrective action is needed. But, there are different kinds of lime and there are differences as to the amounts of lime that need to be used in establishing optimum conditions in the soil both for the bacteria and the plants. A uniform procedure cannot be recommended because conditions afield are not uniform. The best we can do is to acquaint ourselves with certain fundamental facts which hold true under all conditions. If these fundamental facts are well understood, practice may be so adjusted as to meet the needs of any particular place and time.

Rebuilding and Resodding Greens and Tees

By JOS. WILLIAMSON

HASTILY and inexpertly built greens in which there is faulty general construction or lack of drainage, Mr. Williamson blames for many apparently mysterious turf troubles. Before rebuilding he advises greenkeeper to learn past history of old green and why it did not function properly. Greenkeeper should satisfy himself about reasons of the green's failure so he may profit by mistakes that have been made.

Williamson expressed belief that life of a putting green is far overestimated, stating:

When we stop to consider what a green goes through during the years of its use and what we have done to it, it is only reasonable to admit that its life is gone and we must renew the soil which has become wornout, poisoned, and lifeless. So under these conditions it is only natural after a few years the old green should be torn up and rebuilt."

In rebuilding, select soil on which grasses will grow and thrive mostly from soil itself instead of by irrational use of high-powered fertilizers, Williamson counseled. He strongly championed good compost pile as greens maintenance necessity. Lack of care in soil selection and preparation and excessive fertilization he held responsible for much greens trouble. For proper greens soil, he advised thoroughly mixing approximately one-third loamy, fibrous topsoil, one-third sharp sand that will not pack, and one-third humus such as old, rotted stable manure and peat moss or leaf mold with a little wood ashes. If sub-soil is heavy clay, he advised plowing it up and

mixing in a few loads of clean fine cinders or common sand, then rough grading to approximate contour.

Emphasizing correct drainage, he advised following procedure:

Most greens as a rule are built sloping slightly to the approach, and in this case the drains should be laid crosswise of the green, the trenches dug about 18 or 20 inches deep at the start with a gradual fall to the main which would be on one side of the green, falling to the lowest corner and the most convenient outlet. The trenches should be on an average of 12 to 15 ft. apart and either 3- or 4-in. drain tile used and placed close together in a straight line making connections to the main with tees which are made for this purpose, and should be back-filled with 1/2 in. crushed rock to within 10 or 12 ins. of the finished surface of the topsoil.

After the drains have been filled with the rock, the subsoil should be rough graded between the drain trenches and sloped a little from the center to the line of tile, taking care that there are no low pockets lying between the drains in the subsoil. However, I would suggest not to cover the rock with the subsoil, but to leave it open and let it be covered with the topsoil when you are filling the surface. This will give perfect drainage of the subsoil to the trenches, and the topsoil on the rock will assure a complete porosity from the finished surface to the drains below.

Next is the filling in of the topsoil. This is done by wheelbarrows on plank boards, taking care that the grade of the subsoil

or the rock in the trenches is not disturbed by the dumping of the soil.

After the fill with the topsoil has been finished and a fairly good grade given to the surface it should be given a thorough treading down both ways with the feet close together, to make it settle and firm the top ready to be raked and graded smoothly for the sodding.

Cut sod slightly beveled about 3 ft. long by 1 ft. wide for convenient handling, advised Williamson, who described precision methods for this operation. Cut to an even thickness of about $\frac{3}{4}$ in. and roll for easy laying. Cutting and laying should be coordinated operations for exact fitting. Provide long boards for wheeling sod and men to work on. This preserves grade of green. Start laying in straight line closest to sod pile; even edge of green later. Place boards for workmen on sod, facilitating packing of sod and eliminating necessity of extra rolling and tamping. Finish with necessary small patches and rub in top-dressing with flexible steel mat.

Tee Rebuilding

Tee on natural ground is preferred if drainage is good. Few lines of drain tile 15 ft. or 18 ft. apart usually assure good drainage. Make drainage to back of tee. Fall of 1 ft. in 25 ft. provides good drainage, stance and appearance.

In building elevated tees avoid slopes so steep players have to climb and jump. Provide plenty of tee area in avoiding costly repair work.

Build tees with sides parallel to fairway and fronts square across proper line of shot.

When fill is being made, spread while dumping, in layers 6 in. or 8 in. deep to assure quick, even settling. Spread on layer of topsoil and trod down. In sodding lay sod lengthwise to within 1 ft. of outer edges. By leaving this 1 ft. all around the sod will have a better hold than if joined exactly at the edge of the flat top surface.

Course Maintenance and Budgeting

By JOHN MacGREGOR

Chicago Golf Club

LABELING course maintenance budgeting "a tool which will enable you to reduce outlay materially in the majority of cases without sacrificing playing conditions," Mr. MacGregor commented on timeliness of his subject by impressing greenkeepers with necessity of demonstrating they are "business men capable of conserving employers' money, yet giving results in time of need."

Budgeting, he said, means not only forecasting expenditures but carefully keeping track of costs to see forecasts have not been exceeded. Greenkeepers are fully capable of cost-keeping if given a "simple, efficient set of records whereby, in from 5 to 15 minutes at end of each day, labor and material charges can be properly distributed." He believed many greenkeepers shied from the work because of the wrong idea that it involved complicated accounting.

He drew parallel with clubhouse operations, saying:

Club officials generally recognize that if their club is to continue to operate, maintenance costs both on the golf course and in the clubhouse will have to be materially reduced. This cannot be done by cutting quality of food or the condition of the course, because that would cut down patronage—and we must have two things today—maximum patronage available and minimum operating expenses on all sides.

MacGregor predicted that greenkeepers who have not installed precise, simple sys-

tem of daily costkeeping within 2 years will have difficulty in controlling costs and holding jobs. Budgeting, formerly a loose and approximate operation, the Chicago golf expert remarked, now calls for exact knowledge of daily, weekly, monthly and season costs of each maintenance detail.

To establish a simple cost-keeping system, MacGregor advised first organizing "yourself and your daily work. Have a system in your daily work—just like a factory. Allot to each man a certain task or combination of tasks. Estimate approximately the cost of each job each day."

Said the Wheaton Scot: "I hope never again to have to operate a golf course without my own figures to tell me constantly what I am doing and enable me to control costs." He further described his labor organization and cost-keeping as follows:

When you have done this, you have a foundation upon which to estimate labor costs for each month, and a total for the year. It is relatively simple to estimate how many men are necessary to maintain your course successfully and to allot each man a reasonable amount of work to do and see that the work is done efficiently. In other words, don't watch your men to see that they are working, but watch the men's work to see that it is done properly and in sufficient volume. This solves the problem of the superintendence of men over a widely scattered area to a greater degree than anything I have ever encountered.