

percent of your members gives a "continental" what the experts shoot? What the members are interested in is their own scores.

If we will retrace the ground we may save a percentage of our present golfers between 35 and 65 to the game, but this is not the permanent answer. We must turn to the youngsters and by getting them interested in the game while they are still children, which is the only age at which one can start and attain a reasonable proficiency in the game that will stick through life, we may build up a generation of golf-conscious and golf-playing people who will be able to enjoy the game and as finances permit become the loyal supporters of golf.

I think that every daily fee club should sell golf for about 25c a day to all those

under 18 years of age from Monday to Friday and 50c on Saturday and Sunday. High school kids can afford to pay 25c but it is doubtful if they can or will invest 50c to play three or four hours after school or even all day during vacation. The result is that they do not play and possible future supporters for the game are lost. A 50c rate for Saturday and Sunday would permit the young boy who has to work most of the week to get in a day of golf at a fee he can stand out of his weekly wages where a \$1.00 or \$1.50 charge would probably bar him. He would never acquire skill in his youth so would be lost to the game later in life when he might take it up for a few brief years and then quit in disgust, like thousands of others do annually on account of their inability to "give the old ball a ride" in a fair percentage of the attempts made.

HOLLOW FORK TECHNIQUE

By A. LOWELL
EASTMAN

*This club has brought about great improvement
in its greens through sustained forking program*

THE successful maintenance of golf greens demands that the turf plant retain undisputed possession of a soil which is constantly in a fine state of tilth. Very little difficulty is experienced in cultivating the average garden crop, but to cultivate sod land without completely destroying the crop itself is quite another problem.

Bearing this fact in mind, it would seem essential that golf greens be established on soils possessing unquestionable qualities for remaining in friable condition. Yet many greens are constructed with apparent neglect of this fact. To save on hauling costs, materials which may be had in the immediate vicinity are used regardless of their ability to remain in good tilth. This practice has resulted in the complete rebuilding of greens so constructed, or in less severe cases, the necessity of cultivating benefits.

Most loam soils are capable of satisfactory crop production providing cultivation has a place in their management. This fact has been clearly demonstrated in many instances where golf courses have been constructed on farm land whose soils produced abundantly only to fail miserably when planted to grass simply because cultivation ceased on the establishment of turfed areas—convincing evidence that

cultivation is a major factor in the successful management of any soil.

Most greenkeepers realize this need for cultivation when normal maintenance practices fail to give desired results and resort to the use of spiked rollers, or, in extreme cases, strip off the turf and spade up the underlying soil, incorporating soil-building materials, a most effective but always expensive method.

The need for a turf cultivator which could be applied without destroying the surface has been met in the development of the hollow-tined perforating fork, a hand tool which will actually fork or cultivate to depths up to 4½ in. without disturbing the surface and with little interference to play. These tines permit the removal of cores of soil, leaving deep, well-defined holes for the reception of topdressing materials.

In September, 1933, the Suffield (Conn.) CC undertook a cultivating program using the hollow-tined forks, which pro-

TABLE NO. 1. General Improvement in Cultural Condition of Greens After a Five Year Forking-Topdressing Program.

Item	Improvement Since 1933
Desirable Grasses, Amount....	9 %
Desirable Grasses, Health.....	30
Desirable Grasses, Texture....	31
Weed Varieties	21 Fewer
Weed Quantity	21 Fewer
Surfaces	68
Physical Condition of Soil....	31
Scars	8 Fewer
Total Average Improvement	24%

gram has been continued through 1937. During the five year period, it has been our privilege to note many cultural improvements in our greens, the text of which is given in Tables 1 and 2.

The improvements noted are not entirely due to the forking in some cases, but, this cultivating program has been the backbone of our entire maintenance schedule, contributing more than a little to all phases of the substantial gains.

Establish Root Feeding Zone

Of primary importance in bringing about these numerous changes is the improved physical condition of the soil. Use of a suitable topdressing medium after forking has largely influenced improvement of soil conditions. In order to realize any appreciable gain in this respect, it is essential that the topdressing materials used be of such nature as to correct the faulty structure of the existing soil. The cores formed by the hollow tines encourage a general deepening of the root system (especially noticeable in heavy soils), but development of the all important feeding roots requires that the cores be well supplied with a suitable rooting medium. Unless a satisfactory feeding zone is established, the new roots are apt to become "cordy" and of little value as plant sustainers.

The process of removing old soil and adding new not only provides beneficial soil organisms, but tends to equalize their distribution and increase their activity. I have observed a timely forking correct a sluggish, unsatisfactory response from a normal fertilizer application, unquestionably due to stimulation of the soil flora. The essential requirements for

normal bacterial activity are, namely, a warm sweet soil, ample moisture, free air circulation and a balanced ration, all factors which are beneficially influenced by soil cultivation.

Before putting a forking program into actual operation, careful consideration should be given to several factors, among the more important being: when to fork, frequency of forking, preparation of greens to be treated. Due consideration of these details will permit a more efficient and economical operation of the program.

How to use forks: Briefly, the forks consist of six hollow tines, $\frac{3}{8}$ in. in diameter, and available in lengths ranging from 2 in. to 4 $\frac{1}{2}$ in., tapered on the inside to eliminate plugging. They are spaced approximately 2 in. apart. To insure a clean job, the forks may be equipped with a plug catcher which is quickly and easily emptied into a pail as workmen progress.

In using the forks, the operators work backwards inserting the forks every 2", 3", 4" or at whatever frequency is desired. Our practice at Suffield has been to space the insertions approximately 3" apart.

At least two men should work a green in order that an appreciable showing will be made, and the green topdressed before drying out occurs. This is important as the many vents encourage rapid loss of soil moisture by evaporation. Holes should not be left open more than a day unless careful attention is given to watering and this tends to close the holes, making it difficult to work topdressing into them. It is best to fork half a green and topdress immediately.

Use Water to Soften Soil

To facilitate the forking, we have found it advisable to thoroughly *hand* water the turf from 12 to 24 hours before beginning operations. Careful watering by experienced men helps to put the soil in good working order, greatly speeding up the operation and increasing the ease with which the forks may be inserted.

The tines will plug up occasionally and a 6 in. spike with the point filed off is very useful for cleaning them out.

Worn tines have a tendency to plug frequently, greatly increasing the cost of operating and they should be replaced with new ones. Generally, tines will work

TABLE No. 2. Forking Time In Labor Hours, and General Gain Each Green Has Shown Since 1933.

Green No.	Area Sq. Ft.	Soil Type	Average Forking Time	Evaluation		Per Cent Improvement
				1933	4-Year Av.	
1	4300	Clay Loam	35 Hours	68.5	80.9	12.4
2	3870	" "	31 "	62.5	79.5	17.0
3	3700	" "	38 "	72.0	80.9	8.9
4	4120	Silt Loam	30 "	81.5	85.3	3.8
5	3600	Clay Loam	22 "	67.5	77.8	10.3
6	3480	" "	22 "	68.0	77.9	9.9
7	3700	Silt Loam	27 "	74.0	83.5	8.5
8	5500	" "	46 "	75.5	82.0	6.5
9	4500	" "	30 "	74.5	81.3	6.8
		Average	31 "	71.5	81.0	9.5

NOTE: Evaluations based on 100 per cent for a perfect green. Inspections made annually by a noted turf authority.

efficiently for from 100 to 125 labor hours.

From Table 2, it may be calculated that our forking time has averaged 7 labor hours per 1,000 sq. ft. Two men will fork the average 5,000 sq. ft. green in two nine-hour days. This may appear to make the labor cost excessive, but reference to the results we have obtained as given in Tables 1 and 2 show that the investment is decidedly worth while compared to other less effective methods of perforating only the soil surface. For an annual investment of 40 labor hours per green, this cultivating program has aided materially in acquiring for us, without interference to play, the following essential requirements for establishing fine turf:

1. Improved physical condition of soil.
2. Encouraged deep root system.
3. Corrected sod-bound turf.
4. Increased water efficiency.
5. Increased soil aeration.
6. Increased available plant nutrients.
7. Improved drainage.
8. Increased activity of soil bacteria.
9. Reduced weed, disease and insect invasion.

After Tining, Work Dressing In

Topdressing: As previously stated, the topdressing material used should be of such a nature as to correct the undesirable structure of the existing soil.

Greens may be topdressed in the usual manner, being especially careful to work as much material into the holes as possible. Wooden lawn rakes reversed made excellent tools for this purpose.

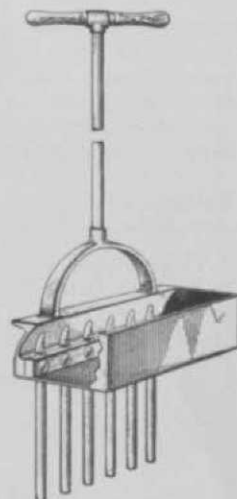
It is well to apply the material somewhat heavier than is customary for the

average topdressing to compensate for the extra material required to fill the holes. Spread $\frac{3}{8}$ " to $\frac{1}{2}$ " thick should be sufficient.

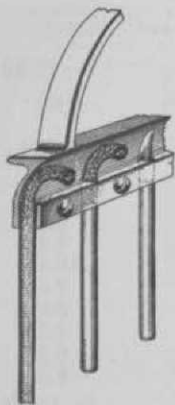
In order to spread well, the material must be comparatively dry. This, of course, necessitates a thorough watering immediately after completing the topdressing operation as the dry material absorbs the soil moisture. Frequent watering is essential until the roots become established in the new medium. If forking is done previous to the root regenerating period and general maintenance requirements are strictly adhered to, by mid-summer new roots will be abundant in the many perforations of the hollow-tines.

When To Fork

Above all else, the deciding factor should be the necessity for this type of



The hollow tines, tapered on the inside to prevent plugging, are available in lengths from 2 in. to 4 $\frac{1}{2}$ in. and are spaced 2 in. apart.



This cut-away view of a hollow-tined fork shows how plugs of soil are worked up through each tine. Plugs are caught in a hopper (see previous cut).

the supply of plant foods which have been stored in the roots for the winter, no particular ill effects will be noticed. I personally prefer this period to any other because of convenience in laying out the working schedule, much of the routine work being discontinued and also because the alternate freezing and thawing which takes place over winter tends to settle the topdressing material around the root system, preparing the turf for an early start in the spring.

Summer Forking Best Avoided

Emergency forking may be carried out during the summer months, but it is not advisable as a general practice, as it interferes with normal summer dormancy. Not only the forking but also the heavy topdressing and watering which must necessarily follow have a forcing effect on the turf—generally considered undesirable at this time.

The number of times a green will require forking is largely a local problem. Where the soil structure is definitely the limiting factor to normal plant growth, several treatments may be necessary to bring about the desired structural condition. When we first undertook this program at Suffield, frequent treatments were given to the more backward greens (three forkings a season) as the soil had become so thoroughly puddled that one treatment proved inadequate.

Since 1934, however, one, or at the most, two forkings a year have proved ample and in some instances the treatment has been omitted altogether for 12 to 18 months. This, of course, is as it should be, indicating that the program is proving effective. Each season should bring about a reduction in the number of treatments required unless unusual conditions cause temporary setbacks.

Where a program of this nature is introduced for the express purpose of correcting faulty soil structure, I am of the opinion that it should become a more or less permanent part of the maintenance program, bearing in mind that the longer the program is in force, the more economical its operation becomes because of increased ease in working the forks and a more lasting effect from each successive treatment.

treatment. If a green needs attention, it should be treated immediately regardless of the time of year (providing the soil can be worked).

There are certain advantages to be gained, however, by forking either in the early spring or late fall. Bearing in mind that the major benefits of forking greens are associated with the root system, it seems advisable to carry out a program of this nature at a time when normal root growth will be stimulated. The root system of grasses being for the most part annual in nature, maximum growth must occur at a definite period in the growing season. Data on this phase of turf maintenance is comparatively meager but it is generally believed that new roots are developed early in the growing season, very little if any regeneration taking place after May or early June.

It should be understood that use of the hollow tines results in a temporary destruction of the root system, a certain amount of roots being removed with the cores of soil. The extent of root destruction is not great, but it might prove detrimental if over-forking occurs after the period of normal root regeneration.

Advises Spring or Fall Spiking

Theoretically, then, early spring or late fall seems to be the ideal time to undertake a program of this nature. Early spring forking tends to stimulate normal regeneration and in cases where soils become thoroughly puddled during the playing season, it is advisable to take advantage of the loosening effect of the winter heaving.

While forking in the fall may reduce