This is a far more practical and economical method of operation than working men in gangs or crews. A man who has a certain amount of work to do either does that work on time and properly, or is replaced. It results, too, in the elimination of the unfit and the creating of a picked crew after a season's work.

Now when you have figured and estimated about how much money is necessary for labor, your attention must then be turned to upkeep—to fertilizers, fungicides, vermin eradicators, sand, gasoline, oils, grease, power machinery parts and repairs and other small items classed under miscellaneous. Estimate this approximately and then add to it the cost of labor and upkeep, and that will be your budget for the ensuing year.

Figure Emergencies

However, in view of the uncertainty of weather conditions and the always-present possibility of drought and insect pests, to play safe it is well to ask for $1,000 reserve fund which, while you don't intend to use it under normal conditions, will be there to prevent you exceeding your budget in case of emergency.

Now when it comes to the distribution of labor and upkeep, this is either a daily job or it is valueless. To accomplish this you keep a diary of your day's operations, and the cost of the different work done. It is surprising how simple it is to keep the cost of operation if you will carry a diary in your pocket and make your entries from it promptly.

With this diary it is simple to determine the cost of the different items. The next step is to have available a monthly cost sheet, and take the items daily out of your diary and distribute on these cost sheets as concisely as possible and in the proper divisions.

One way of handling the monthly cost sheet is to divide it into eight headings; for instance, green mowing and green sprinkling would be one heading. Enter separately all of your other major operations, including rough cutting, fairway mowing, etc., so each will be allotted a column.

Now if your entries are made daily, it is an easy matter to total from time to time and see how you are running against your budget. You will have this information if your green-chairman should want to know. And if he doesn't want to know, you should know anyway.

At the end of each month a greenkeeper operating under this plan knows from his own notes how much he is over or under his budget to that date. It is hardly necessary to call your attention to the fact that upkeep items are totalled once each month.

At the end of the year the different items in each group are pulled off and compiled on one sheet, and the total yearly operations submitted to the green-chairman.

Soil Structure of Greens

By KENNETH WELTON

USGA Green Section

COMMON practice in greens construction of the past was to put down various layers, such as cinders, sand, gravel and peat, between the topsoil and subsoil. Mr. Welton pointed out that this interferes with the natural rise and fall of soil moisture, prevents natural drainage and elimination of toxic materials from the topsoil. It is better to prepare a deeper topsoil on a sand fill. Where better drainage is desired, "lines of tile quickly carry away excess water and do not interfere with the rise of capillary moisture in the soil."

On the subject of topsoil from the golfer's point of view, the speaker said:

If the soil is as hard as concrete it is almost impossible for the average player to hold the green with a pitch shot. A great cry arises from the indignant players and the greenkeeper is forced to soften the offending greens by pouring water upon them until the soil is saturated and muddy. The players trample the greens while in this condition, the soil becomes more packed, and if allowed to dry is harder than ever. It is expensive to water greens frequently, but if that were the only disadvantage to keeping greens wet, very few clubs would object.

The truth is, however, that such greens are always going from one extreme to another. The players cannot tell from day to day how different putting greens will act. And more important still is the fact that good turf cannot be kept for long on greens which require such treatment.

The greenkeeper knows that the soil is porous and that these pore spaces should be filled with air since roots require an almost constant supply of oxygen. The greenkeeper also knows that the soil must be loose enough for the roots to grow and forage in search of moisture and plant food. If pore space in the soil is filled with free water for too prolonged a period the roots are affected and the plant sickens and dies. If the soil puddles and packs while wet it becomes a solid mass and the pore space, and hence the oxygen in the soil, is greatly restricted. If the soil becomes as hard as brick when dry the roots

are sealed and cannot grow. Obviously a topsoil which exhibits the above characteristics is unsuitable both from the player's and greenkeeper's point of view, and we must select or mix a soil which is suitable.

The Green Section authority went into some detail to describe the three major phases of any soil's make-up—the physical, the chemical and the biological. The greenkeeper is concerned with all three, but mainly with the physical, since his cultural practices influence the other phases, provided always he has the proper soil texture and structure to begin with.

Welton had this to say on organic matter:

Organic matter plays an important part in the fertility of the soil. It is necessary for the microscopic life in the soil, and has a marked effect on the structure and water holding capacity of the soil. On account of the affinity of organic matter for moisture which is held within it, a certain amount of organic matter in finer soils increases drainage and loss of free water by keeping the finer particles from settling together into a more or less compact mass.

Advises Topsoil Test

It is surprising, the speaker declared, how few golf course constructors will bother putting their soils to a plasticity test before using them on a putting green, although the method of testing soils for this characteristic is very simple. He explained:

This does seem negligible when one considers that the putting green is not dug up or cultivated from year to year and hence there is little opportunity to improve the soil once the green is in turf. Also, many greenkeepers kick about the tendency of their putting greens to form a hard crust on the surface, but although they mix soil for top-dressing purposes many times a year they never go to the trouble of testing the soil except by its feel when it is in that fine floury condition just after it has been put through the screen.

Some soils examined while under the field conditions may appear open and friable and in excellent physical condition, but that is no guarantee that this soil will not become as hard as brick under putting green conditions. Other soils are highly fertile and desirable for agricultural or gardening purposes. But fertility is what a soil is capable of producing under best possible conditions and in the putting green these soils may loose the structure they were maintained under in the field and in the garden and become unfertile in the green. It is, therefore, advisable for the golf course constructor or the greenkeeper to subject his putting green topsoil to test.

Equal quantities of the various soils or mixtures should be procured while dry enough to handle. They should then be wet and puddled in a uniform manner. It is important that the samples be handled alike as difference in wetting and mixing may confuse the results. A practical manner of handling the samples alike is to pour a similar amount of each sample into a similar container. A quart of soil in a 12-qt. bucket is easily handled. Then add water slowly while mixing and churning with a stick until the soil will absorb no more water. If too much water has been used, a little more of the same soil can be added to take up the superfluous water. With a little practice it will be possible to bring each sample to such a condition with equal handling that it will just flow from the pail when agitated. No record need be kept of the amount of water added to the different samples; the point is to add enough water to put each of them in the same plastic condition.

Samples should then be poured into uniform molds. Little troughs of equal size may be made for this purpose or small flower pots or boxes of the same capacity, shape and material may be used. The tops of these samples should then be troweled to smooth them and the samples set under cover to dry. After a few days the samples may be removed from the containers and allowed to dry further. The time of drying of various samples should be noted. Samples containing too much organic matter will show up as they will take overlong to dry. After the samples are thoroughly dry they may be handled and it will at once become apparent if some samples are unfit for putting green purposes.

Soils too high in sand or organic matter, or both, will not stand handling and may break while being removed from the mold. Samples which exhibit too much cohesion will be difficult to break. Samples which took a reasonable time to dry, which could be removed from the mold without crumbling and which could be broken down readily between the fingers and thumb, are at, or approaching, the correct texture. It will be found by this method that about one-third of clay or silt loam soils mixed with a third coarse sand and a third organic matter such as cultivated peat, humus or ground peat moss, will approach the condition described.

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for additional condensed reports on NAGA speeches