

the merits of any product unless we are convinced of its value.

Changes are continually taking place, new improvements are being made, and each and every one of us must keenly watch these things for our own good. Our profession can and will be better recognized when we endeavor to solve our own problems through contact with those desiring to assist us, and through our own experimenting to control diseases and poor growth.

Greenkeeping Yesterday and Today

By J. O. CAMPBELL

Weathersfield (Conn.) Country Club

AS THE MAJOR advance in today's greenkeeping practices, Mr. Campbell named the wise practice of selecting course sites with construction and maintenance costs in view, and of engaging the greenkeeper in time to be on the ground during course construction. He later referred to greenkeeper activity during construction as avoiding poor drainage and improper contouring, which are responsible for many greens troubles.

Because courses are judged by their greens, Campbell placed greens turf choice and condition as prime factors, confusing because of variations in bents. Proper conditioning of bent greens he named as one serious problem of today that did not bother "yesterday's" greenkeeper. He commented:

The greens are either seeded or stolons. The seeded ones are of a mixed bent, usually South German, which produces an excellent turf but does not develop a uniform color as do stolons. Another objection we find to using mixed bent seed is that some is non-creeping and does not form as matted a sod as does true creeping bent. The velvet bent which is included produces a very fine leaf and stem growth but is susceptible to brown-patch and other turf diseases. One of the best-known seeded turfs is Cocos or seaside bent, distinctly a creeping bent which spreads rapidly and makes a very fine turf. Personally, I prefer bent stolons, either Washington or Metropolitan strain. In recent years a larger percentage of the greens in this country have been planted by the vegetative method. This makes a green which is uniform in color, more resistant to brown-patch and has a truer putting surface.

Campbell endorsed mercury compounds as preventives and cures for the fungous diseases with which today's greenkeeping must contend.

With reference to insects and worms he recommended arsenate of lead treatment,

It is my earnest opinion that no difficulty should be experienced in maintaining turf if good judgment is used and we remember that plants are subject to their environment; that is, they must stay where put and cannot move when conditions for their growth and development are unfavorable. We, as greenkeepers, must study our problems today more than ever and with common sense and sound judgment provide proper growing conditions in order to fulfill our part in the game.

especially advising arsenating greens during construction, and cited confirmation from his own experience.

Soil Tests as Guide

Concerning developments in fertilizer practice Campbell advised frequent soil testing as today's safeguard. He rated sulphate of ammonia highly as a fertilizer which will hold its present popularity. He stated old methods of compost pile preparation still hold good, and pronounced compost vital in truing greens.

The speaker credited improvements in equipment design with having much to do in raising course maintenance standards and related details of progress in power-operated equipment. Power sprayers and fertilizer distributors he named as correcting the old fault of uneven distribution.

Recognition of the importance of a fixed watering schedule was noted by Campbell who told of his own method of sprinkling mechanically and taking advantage of prevailing winds. He told his hearers:

I do not believe it is economy to use, even in these days, obsolete, worn-out machinery. There are new labor-saving devices being perfected every year. It would pay the clubs to take advantage of this equipment.

As one of today's important greenkeeping duties he named beautification of club grounds and advised earnest study of this subject. Tree preservation he strongly advised.

Man Is Greatest Difference

The greatest difference in greenkeeping today is in the men. Present-time greenkeeper's responsibilities involve "turf specialist, knowledge of golf architecture and construction, drainage, landscaping, plumbing, carpentry, entomology, electricity, mechanics, botany, accounting and, for good measure, financial advice to the club."

Campbell, a successful practical student

himself, urged close, thoughtful reading of golf business literature.

In advising on greens building today he said:

After the location is selected, plow the surface and remove topsoil. Then remove all stones to a depth of at least 12 ins. Lay sufficient drainage to a depth of approximately 24 ins., using 4 to 6-in. land tile, about 15 ft. apart, laid with the fall of the land. It is best to cover the tile with burlap bags or a 2-in. layer of straw, refill trench, proceed to build up the green to about an 8-in. depth in the lowest level. This soil should be first-class topsoil. In grading the slope of the green to hold a shot, the back of the green should be not less than 16 ins. nor more than 24 ins. higher than the front. This will take care of the surface water. Countouring is very important; this should not be abrupt, but

gently sloping and irregular in shape. Cover with about 4 ins. of good topsoil and 2 ins. of compost, mixed with arsenate of lead at the rate of about 6 lbs. to 1,000 sq. ft., to grubproof the green. Rake and roll until a fine seed-bed is completed. Then plant seeds or stolons. Greens built this way are cheaper to maintain and are less liable to develop brown-patch or scald. Good drainage is the foundation of a good putting green.

Campbell's concluding comment was:

Usually when the finance committee starts looking for a place to reduce club expenses, it starts with greens maintenance budget. This does more damage in one year than the greenkeeper can repair in four. Any greenkeeper is anxious to cut costs as far as practical and wants cooperation of the finance committee and green-chairman to this end.

Factors Affecting Accumulation of Nitrates in Soil

By M. H. CUBBON

Prof., Massachusetts State College

NATURE PUT many varieties of bacteria into soil, each to do a rather particular job. Certain organisms work on one type of organic matter, others on different types. Products which one group discards as waste materials another group requires as food.

When organic matter is decayed by soil organisms it produces simple substances, mostly gases. Of these gases the one that concerns us most is ammonia. Regardless of how complex the organic matter may be, the nitrogen in it ultimately reaches the ammonia condition. As many as a dozen different groups of organisms in soil produce ammonia from organic nitrogen. Thus if one group happens to be indisposed another is there to do the work.

Plants normally cannot use nitrogen as ammonia, hence it must be changed to a usable form—nitrate nitrogen. Nitrates are produced from ammonia by a process of oxidation by two groups of bacteria. If conditions are unfavorable to them the production of nitrates must stop, because there are no other organisms to do this particular job. And like many skilled workmen, they are quite particular about the conditions under which they labor.

In the case of nitrate bacteria the soil must not be too wet nor too acid nor too cold. Nature usually has soils that are quite acid, and very often wet and cold, yet plants are expected to find the nitrates they need. In the case of greens, man often makes conditions worse instead of better, unintentionally of course.

Let us look more into the details of the

requirements for nitrate production in soil. Since the process is one of oxidation plenty of oxygen must be present. Packed or wet soil has little and sometimes no air (oxygen) space. Heavy soils (silts, clays, loams) are the ones that pack worst. The remedy is to incorporate sand, organic matter, or any material which will loosen the soil. Packing is much worse when soil is wet. Packing due to persons walking over greens is much more severe than the rolling the greens normally get.

Ordinary temperatures are satisfactory for the production of nitrates. By ordinary is meant above 60° F. Acid soils require somewhat higher temperatures than 60°, while neutral soils are able to produce considerable nitrates as low as 50°. This may account for a difference in starting time in spring.

What Does "pH" Mean?

The most important single factor in the production of nitrates is soil acidity, expressed in terms of pH value. pH7 is neutral, and any pH value less than 7 is acid. The smaller the number expressing pH value, the more acid the soil. pH4 is more acid than pH5. Soils rarely get below pH4. pH5 is too much acid for most plants. pH6 is perhaps a little too high for the best greens conditions, everything considered. In most soils, bacteria do not produce nitrates when the acidity is stronger than pH5. Considerable variation among soils occurs and in some cases exceptions do happen. This is typical of the complex conditions found in soils. If there were