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What They Said at Greens' Meet

SPACE limitations prevent publication in full of the many valuable addresses at the 1932 N. A. G. A. convention. In the following digests, practical and concise resumes of each address are presented in convenient and workable form for the greenkeeper and chairman.

Other details of the meet will be found in the news story of the convention which appears in February, 1932, GOLFDOM, to which this convention address summary is a supplement.

Fertilization Pointers

By ROBERT J. HAYES

Greenkeeper, Pelham (N. Y.) Country Club

IN THE EAST the problems of many greenkeepers the past year have been most trying. It is my desire to suggest some of the things we may do to help ourselves in these exacting times.

The importance of knowing the condition of the soil where turf must be maintained cannot be too strongly considered; under such circumstances periodical soil tests should be made to determine the soil's degree of acidity.

In my opinion, many turf troubles are directly due to excessive accumulation of acids causing toxic conditions of the soil, retarding growth of turf, locking up necessary minerals for root growth, etc., thus depriving the grass of the necessary food elements. It can be reasonably determined that such conditions will affect the turf during the summer. Soils in New York's vicinity are types that need considerable watching and testing to overcome this trouble.

Acid soil not only deprives the turf of its food but retards growth of bacteria necessary to change ammoniates to nitrates so the grass can take it up for blade and leaf growth.

Many of us must put up with poa annua, whether we like it or not, and where very acid conditions are evident, through tests, we run into difficulty trying to keep it in healthy, growing condition. This we have been told is due to its need of a soil near the neutral point and favoring alkalinity. Being a native grass, where we must tolerate it we must maintain it and my advice is to give it attention prior to hot spells of summer.

Poa annua responds to limestone treatment and it is my opinion where lime is applied in May or early June that it will respond to this treatment with healthier growth and greener color.

Balanced Feeding

The next problem we have is feeding. Excessive food will do more damage than no food at all. Complete balanced foods applied in early spring in combination with compost will amply repay their application and if again applied in the fall will benefit the turf more.

Various formulas are recommended but a selection should be made to fit one's needs and requirements. I am convinced in maintaining my own course that limestone has its value and after making an application have noted its direct benefits and needs. Nitrogen promotes leaf growth. Phosphorus increases the root system. Potash furnishes the starches and brings the plant to maturity. I believe lime is more important under acid or toxic conditions than the previously mentioned three, for fertilizers cannot beneficially function if applied to toxic soil and in some cases do more damage than good.

Turf that does not procure proper nourishment, or is in poor condition due to toxic or acid soil, will be affected by the various diseases we have to combat.

The misuse of many of the fertilizing elements, particularly the acid fertilizers, has given us no end of worry. Of course, we all know that moisture, top-dressing and drainage are necessary, but proper feeding in balance will produce good turf through common sense application.

Grasses are like human beings and have their likes and dislikes as far as plant foods are concerned. Therefore we cannot take too readily the word of others as to

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.

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.

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 Cocoos 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, 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

no variables the science of fertilizing soils would soon become exact. As it is, nobody can put his finger definitely on some of the problems confronting us.

The amount of nitrate accumulating in the soil from organic fertilizers and materials depends pretty largely on the ratio between nitrogen and carbon. If too much carbon is present in proportion to the nitrogen, nitrates do not appear in the soil for some time after adding the organic material. Organic materials with less than 4% nitrogen usually produce this absence of nitrates. Peat moss comes in this class. Many times it has tended to give poor results, which could have been avoided if a little nitrogen had been added with the peat. After the bacteria have worked on the organic material and have largely decayed it, some nitrate has a chance to accumulate. These so-called toxic effects of peat are therefore only a shortage of nitrogen because the bacteria that decay the peat take nitrogen away from the plants.

Test Nitrogen Availability

The question of how quickly organic nitrogen fertilizers become available can be partly answered as follows: nitrate accumulation from organic nitrogen sources is closely related to the amount of water soluble nitrogen in the organic material. In the case of cottonseed meal compared with dried blood on soil 3 (Massachusetts) you will notice (see table) that cottonseed accumulated nitrates faster than did dried blood. The water soluble nitrogen in each fertilizer is practically the same, but the proportion of water soluble nitrogen in cottonseed meal to total nitrogen is much higher than in dried blood. Again exceptions occur in this respect, but it is

Nitrate Accumulation, Massachusetts Soils

Soil No. 1—Fertile, sandy loam. pH value 6.12. 8 milligrams nitrogen added from various substances.

Source of nitrogen.	Per cent nitrogen changed to nitrate in 4 days	6 days	10 days	14 days	22 days
Cottonseed meal	0	.7	0	21.2	16.5
Castor pomace	0	8.5	13.7	22.9	15.0
Urea	4.8	16.1	48.1	88.2	114.2
Dried blood	2.03	0	33.6	68.2	114.2
Milorganite	9.1	18.1	45.0	27.9	55.0
Grass clippings	13.0	31.6	45.5	33.7	44.2
Ammonium sulphate	0	.7	38.5	79.8	111.3
Ammonium sulphate plus 23 lbs. limestone per 1,000 ft.	0	2.0	53.5	88.2	79.5
Liquid ammonia	0	4.8	54.9	107.4	111.3

Soil No. 2—Infertile sandy loam. pH value of soil was 5.3, and with lime added, 6.05. Other conditions same as above.

Source of nitrogen.	Percent nitrogen changed to nitrate in 4 days	6 days	10 days	14 days	17 days	22 days
Cottonseed meal	0	0	0	0	2.0	3.3
Castor pomace	1.0	1.6	2.0	.8	3.1	5.1
Urea	0	0	0	1.0	4.0	18.5
Dried blood	0	0	.8	0	1.0	2.7
Milorganite	0	1.4	.7	0	1.3	3.5
Grass clippings	1.0	.8	.9	0	2.8	13.7
Ammonium sulphate	0	0	0	0	0	0
Ammonium sulphate plus 92 lbs. limestone per 1,000 ft.	1.9	1.3	4.1	6.4	18.7	62.4
Liquid ammonia	0	0	0	1.1	7.0	22.3

Soil No. 3—Fairly fertile sandy loam. pH value 6.0.

Source of nitrogen.	Percent nitrogen changed to nitrate after 12 days	14 days	16 days	18 days	21 days	24 days	30 days
Cottonseed meal	0	0	2.05	6.4	4.5	8.9	5.9
Castor pomace	.4	2.6	10.8	19.6	28.6	26.7	31.1
Urea	1.2	1.2	15.3	12.6	34.5	43.4	46.7
Dried blood	0	.6	9.19	13.5	27.4	26.7	32.3
Milorganite	2.56	2.49	7.66	14.1	23.4	25.4	34.0
Grass clppings	6.37	8.77	17.1	23.8	38.2	36.9	46.7
Ammonium sulphate	0	0	0	0	0	0	6.3

In this experiment 30 mgms. nitrogen added per 100 gms. soil. Such a large amount of nitrogen probably accounts for poor showing of sulphate of ammonia. Behavior of grass clippings indicates they have considerable value as source of nitrogen.

Nitrate Accumulation, Iowa Soils (Harper)

Description of soil.	Mgms. of nitrogen added per 100 gms. soil.	Per cent nitrogen changed to nitrate after 10 days	15 days	20 days	28 days
Basic silt loam	10	72	82	88	94
	30	33	53	70	92
Neutral fine sandy loam	10	55	86	90	109
	30	14	32	53	71
Medium acid loam	10	31	53	63	97
	30	10	18	22	39

Nitrate Accumulation, Alabama Soils (Naftel)

	pH values.	% nitrogen changed to nitrate after 10 days	20 days	30 days
Soil No. 1	5.2	15	32	66
	5.6	66	93	100
Soil No. 2	5.9	42	..	..
	6.2	91	..	..
Soil No. 3	5.6	33	..	..
	6.8	96	..	..

In this experiment 4 mgms. nitrogen were added per 100 grams of soil. In both experiments nitrogen was supplied as sulphate of ammonia.

Nitrate Accumulation, Wooster (Ohio) Silt Loam Soil (Bear)

Source of nitrogen.	% nitrogen changed to nitrate after 21 days with varying moisture in soil. 23 % water in soil	28 % water in soil	33 % water in soil	38 % water in soil
Sulphate of ammonia	112	118	93	27
Nitrate of soda	110	115	91	54
Dried blood	82	81	61	7
Cottonseed meal	69	69	43	5
Activated sludge	66	66	60	4
Alfalfa hay	60	62	56	6
Muck	39	39	39	5
Garbage tankage	26	28	20	5
Calcium cyanamid	7	6	6	5
Horse manure	4	4	3	4

This soil made neutral by adding lime. 20 mgms. nitrogen added per 100 gms. soil.

fairly safe to say that nitrate nitrogen accumulated from organic materials practically in proportion to the amount of water soluble nitrogen contained.

The rapidity with which nitrate nitrogen accumulates in soil is the best single measurement for the productivity of that soil. In making controlled experiments it is the common practice to add to soil some nitrogenous fertilizer such as sulphate of ammonia, keep the soil at favorable moisture and temperature for a time, and then determine the amount of nitrate in the soil. In the tables, summaries of experiments in which nitrate accumulation was studied are given. This accumulation is stated as a percent of the original nitrogen added to the soil. The important thing in all tables except the last is the time factor. Several things in these tables may be mentioned as outstanding.

First, the acidity of soil 2 (Massachusetts) had definitely prevented the accumulation of nitrate nitrogen without lime added. Even when liquid ammonia was added the neutralizing effect was not enough to induce the accumulation of nitrates. The lime added with sulphate of ammonia was thoroughly mixed with the soil, yet in spite of this mixing nitrates did not accumulate for some time. How much longer would it require for lime, applied as a top-dressing and inadequately mixed with the soil, to give a response in terms of nitrates produced?

Second, manure should be considered as typical of the materials with a low nitrogen and high carbon content. The behavior as regards nitrate accumulation is also typical. Very little nitrates are produced, or at least accumulated, and if plants were growing on the soil they would undoubtedly suffer from lack of nitrogen. Garbage tankage behaves similarly. Other tests have shown that the nitrogen availability in garbage tankage is very low.

Third, the effect of too much water in soil in the experiment by Baer is plainly evident. The 38% water content is probably higher than most soils can carry under playing conditions. No doubt the available nitrogen in many greens is lost because of poor drainage, and occasionally because of over-watering. Even when nitrates are added to the soil as nitrate of soda or similar material, the nitrates disappear under the influence of too much water.

Illustrated Lecture on Turf Diseases

By JOHN MONTIETH, JR.
USGA Green Section

DR. JOHN MONTEITH, JR., USGA Green Section, presented an illustrated lecture on turf diseases that was especially helpful because of the clear, colored slides with which this noted expert brought out vivid details of his remarks.

He identified turf diseases as being of two types: (1) caused by invasion of disease organism, and (2) caused by other conditions affecting growth of the plant. The principal cause of disease in humans is bacteria; in plants, fungi. Dr. Monteith showed a vastly enlarged cross-section of a blade of grass and pointed out how diseases hit the cells of grass. Other enlarged cross-sections showed progress of fungus penetrating grass through pores in the blades. He went into this in detail to explain how extensive microscopic investigations had confirmed the fungus theory of brown-patch.

Monteith counseled his hearers to be extremely careful when diagnosing grass diseases, saying that especially during the troubles of last year greenkeepers were apt to make the mistake of treating for diseases that didn't exist. He showed pictures of disease organisms growing in cultures and went to pains to show his practical audience how the scientists let nature confirm or damn the theories.

Pictures of plots on which mercury treatments were tested were shown and many interesting developments of the patient, extensive work done by the turf scientists in attempting to aid the men in the field were put on the screen.

Comment was made on slides showing effect of lime and air current in preventing brown-patch.

In discussing pythium, Monteith emphasized that the disease develops most at high temperature, hence the prevalence of that trouble during 1931.

Showing slides of snow-mold, the USGA scientist warned that the mild winter might be responsible for severe attacks of this disease. Late growth of grass and lack of freezing, followed by sudden cold weather and snow, makes a perfect setting for development of snow-mold, he stated. Bichloride of mercury and calomel treatments have demonstrated effectiveness against this disease. He presented slides of leaf spot and expressed regret that no satisfactory treatment for leaf spot had been discovered.

Slides of fairy ring, ring spot, mildew, smut, chemical burns and scald also were shown. Fairy ring cure was requested by several at the conference and Monteith said that although definite cases of fairy ring had been under observation for many years no certain cure had been discovered.

This report courtesy of O. M. SCOTT & SONS CO., Seedsmen, Marysville, O.

Economy on the Golf Course

By JOHN QUAILL

Supt., Highland C. C., Pittsburgh, Pa.

THE GREENKEEPER'S role as the goat in budget cutting requires him to make two suggestions to finance committees, began Mr. Quaill, who named these points as: (1) what will be eventual economy of the program? (2) will repair cost and loss of time of worn-out equipment be more costly than replacement?

Design of golf course, soil conditions, wealth of club, demands of membership and ability of greenkeeper govern cost of course maintenance, Quaill continued, and cited greenkeepers' need of balance in executive ability, turf culture and mechanics as vital in contending with reduction in budgets.

True economy in maintenance dates back to construction and many present problems are faults of architect and contractor, he alleged, but further cited topography of course as an unavoidable controlling factor. He questioned the wisdom of unduly big greens on score of playing requirement, mowing, fertilizing, watering, top-dressing, fungicide cost and construction cost. Much of this is, in his opinion, in unnecessary undulations. He put 8,000 sq. ft. as a maximum green size for thrifty maintenance. Tees should be larger as they afford one of the best spots for course economy. He stated:

With economy in view a golf course can be constructed that will be a greenkeeper's paradise: medium sized greens, large tees, fewer but larger traps, and if there is any need for terraces they should be pulled out into long, gradual slopes for cutting by power mowers.

Even the tough problems of economical maintenance of hilly courses could be eased by architects and builders, although drainage of such topography continues to be a puzzle. He said, on this irrigation, and on trap building:

The water you put on the fairways runs down into the roughs and you have a nice, luscious growth which, getting a couple of inches long, offers the best of hiding places for a ball. Likewise with fertilizer. Put it on the fairways and the roughs get the benefits. Drainage is also a trouble. The seepage from the hillsides must be taken care of, and that is no little problem. When you put in drains, install them with the idea of some day extending them so you can pick them up and run new ones to the main if necessary.

Some people say that a large trap is an expense. All traps are an expense as far as that goes, but a large trap is more economic to keep up. There are less banks and terraces and less work trimming. If they are properly constructed, the amount of labor required will be negligible compared to keeping three little ones. It may seem like it takes a lot of sand to fill them up, but there is less wastage.

Equipment Insures Thrift

Relative to equipment, the Highland man commented:

Good equipment is best insurance against high upkeep costs. Equpiment that is in the shop about one day out of 5 for repairs is a drain on the treasury. You not only lose the services of the machine but you lose the time of men repairing it and cost of parts.

He said that with the mowing equipment on the market today the gamekeeper could almost forget his fairway mowing. He discussed power greens mowing and said that again the course topography entered because of the time element in transferring power mowers from one green to another. He mentioned that at his course one man cut all tees and approaches in a day with a 30 in. power mower and had time left for cutting clubhouse lawns. With hand mowers, three men were needed for the work.

Referring to mechanical distribution of fertilizer he remarked:

Modern equipment for top-dressing and spreading fertilizer are great money savers. It is nothing to top-dress 18 greens a day with the top-dressing distributor. Fertilizer can be applied in a short time and be applied more evenly. For fairway fertilizing, the lime spreader can be adapted to most any type fertilizer used. Last spring when I applied fertilizer, we used the lime spreader, altered a bit. We covered 15 fairways in one day with two men hauling and two spreading. The ground thawed that night and it was too soft to use the spreader the next day, so as we only had one more fairway to fertilize we decided to do it by hand. Ten men lined up with buckets to do the job and it took the ten men one hour and a half to fertilize that one fairway. If the lime spreader didn't save money and time then I don't know what I'm talking about.

Careful in Buying

Careful study of buying was urged as a self-preservation move for the greenkeeper. In citing the advantages of basic knowledge of materials, he set forth a misleading analysis of fertilizer as a typical case

of competent investigation determining true value. On buying seed, Quaill remarked:

Grass seed is another item which can run up costs very fast. Cheap grass seed is cheap grass seed and nothing else. Good seed is good seed and a lot more. It is insurance that it will grow and produce a good turf. Why buy a seed with a germination percentage of 60% for $30 per hundred when you can buy an 80% seed for $35 per hundred and get better results? Buy your seed on the basis of a guaranteed analysis and from a reputable seed house and you will have the satisfaction of knowing you are getting seed true to name and of the best quality.

One of the handicaps to economical maintenance is the pressure brought to bear on buying from members. He told of a case where 10 members of a club said they must have business from the watering system being installed or they would resign. The directors weakened and difference in delivery dates, character of pipe, checking up on orders and deliveries continually tied up the job and ran up expense. Extension of the installation next season was handled on a competitive bid basis. No member resigned and the club was saved considerable money.

Effects of staff reductions which do away with the niceties in course maintenance that identify a first-class course were pointed out. Results of pay cuts reducing efficiency and spirit of the staff also were mentioned as something greenkeepers must carefully guard against. He advocated changing tasks of men so they would retain interest and strongly advocated having all greensmen play golf. He said his own chairman gave him a valuable policy tip in labor management by remarking that when the greenkeeper was doing manual work it meant some one of the staff had been improperly trained or was loafing.

Quaill strongly emphasized the peril of procrastination in golf course work. In laying down his conclusion of making certain that enforced economies were not penny-wise and pound-foolish cases, he expressed himself thusly:

At this time practically every club in the country is retrenching and thinking out the financial problems which are confronting them. Now is the time for the greenkeeper to get his words in and tell where he thinks it best to start the economy program. Tell your chairman what you think and show him that you are not sitting back and letting them work out your problems. Tell him your ideas and I'll bet he will approve a bunch of them and give you credit for being wide awake and on the job.

Present Day Qualifications of the Greenkeeper

By O. B. FITTS

Greenkeeper, Columbia Country Club, Chevy Chase, Md.

VARIOUS educational campaigns of the past few years, said Mr. Fitts, have resulted in greenkeepers assuming responsibilities which formerly were on the shoulders of the green-chairman, golf architect, construction engineer and other experts and specialists. In other years, the greenkeeper was a sort of foreman, carrying out all but the merest of routine work on orders of the green-chairman.

These educational campaigns, however, have awakened the greenkeepers to the necessity of keeping abreast of the times, of gaining all possible knowledge of the many intricate phases of golf construction and maintenance, of becoming in fact earnest students of their profession. Changing standards, improved types of equipment, new turf diseases and pests have added to the greenkeeper's responsibilities and have given him an incentive to anticipate the future through study.

Take On Alteration Work

The speaker referred to the greenkeeper's part in course alteration programs, saying:

During the five years that I was with the U. S. G. A. Green Section I visited many golf courses. At many of these I found some change or alteration either in progress or under contemplation for the golf course. In most of these cases, especially if the alteration was to be of any consequence, the services of an architect had been or was to be secured for planning the work, and in some instances a construction engineer was also called into service. All of which was, in most cases in those days, the wisest thing for the club to do, for the average greenkeeper had not gone in for that type of work and was not qualified to handle it.

The story is different today, however, for the successful greenkeeper has made a study of the architectural and constructional phases of golf course work during the more recent years and has demonstrated his ability to execute any alteration of the course in a manner that satisfies the whims of the golfer and at the same time simplifies maintenance problems more than the work of some one who is not as familiar with local conditions. This knowledge and ability has made it possible for the greenkeeper to demand a better salary and at the same time effect a saving for his club.

Fitts outlined the intricate knowledge a greenkeeper must have to undertake alteration work. He must be a golfer so that the holes he designs are fair and sporting for expert, average and dub golfers alike. He must know landscaping, so the final result will be pleasant. He must remember the factors which make for economical maintenance. He must understand soils and drainage and irrigation, and must be familiar with various types of grasses, so that playable turf grows on his fairways and greens.

Becomes Purchasing Agent

The rise of the greenkeeper as a purchasing agent was next discussed, Fitts saying:

One of the greatest responsibilities which the rise in the standard of greenkeeping has placed in the care of the greenkeeper is that of purchasing equipment and supplies for the golf course. Not so many years ago practically everything for the golf course was purchased through the secretary of the club at the request of the green-chairman. All advertising matter was sent to these officials, and when a salesman visited a club he called on these officials. The result was that the greenkeeper knew what he was getting to use on the golf course or to work with only when the delivery man arrived with it. The greenkeeper has probably always had the privilege of asking for what he wanted or needed, but that was about the extent of his privilege and in many cases he never exercised this privilege, because the acknowledged subordinate standard of his position placed him in a constant state of intimidation. There were exceptions to this rule, of course, but there were fewer exceptions to than adherents to the rule.

It would be difficult to picture the successful greenkeeper of today having to stand back and wait for his chairman to decide what he needed or what he should use on the golf course. Whom does the supply and equipment salesman call on today? Whom does he have to convince of the value and practicability of his product before he may hope to make a sale? Who decides on the kind of seed, fertilizer, etc., to use, and who makes the investigations as to price and quality? Who chooses the equipment needed for the work on the golf course? The answer to these questions is, in most cases at least, the greenkeeper. "Why the greenkeeper?" you may ask. Because it is he who has made the most thorough study of the needs on the golf course and it is he who has familiarized himself with the practical particulars of these products to such an extent as to enable him to make a more intelligent selection than the average green-committee chairman is able to do.

The greenkeeper must be a good salesman, too. He must sell himself to his chairman, convincing that superior that he is capable of handling every phase of greenkeeping to the best advantage of the club. He must sell the importance of the greens job to the membership as a whole, not only because such effort will prevent his being fired and a new man given his job, but also because the members' attention should be called to the excellent playing conditions they enjoy through his efforts.

The greensman must also sell himself to his laborers by setting up a fair but strict set of working rules. He must insist on his authority being respected and tolerate no insubordination. He should recognize the varying amount of efficiency in a group of workers and so apportion the work and pay that each man is most advantageously employed. Selling the grounds crew on the fairness of their working conditions makes them satisfied and interested.

Must Rebound from Set-Backs

A greenkeeper sometimes has to take a licking, said Fitts, and accept it only as a matter of past consequence from which to begin all over.

When a set of beautiful greens, the result of diligent and tireless effort, succumb to the ravages of disease and insect pests and to the uncontrollable conditions of nature, one must possess more than mere courage in order to pitch in again and go through all the tedious and patience-wrecking course of treatment necessary to bring them back to their former state of excellence. One must have that necessary desire to conquer, and an unfailing love for the beauty and fineness of quality which he expects to restore to his disease-ridden and insect-infested turf. The successful greenkeeper has trained himself in these qualifications and, though he may be somewhat down-hearted at times, he never quits.

The speaker closed his remarks by cautioning his listeners against the theory that the greenkeeper has progressed beyond where expert assistance is not frequently needed.

It is my sincere belief that the present high standard of greenkeeping would never have been achieved except through the cooperation of men who are specialists in their respective fields. I also believe, just as sincerely, that we must have the cooperation of green-committee men, golf course architects, construction engineers, scientists, and trained investigators if we expect to progress. We have learned the very important lesson of how to cooperate with these men to get the greatest benefit of their knowledge. And having learned this lesson we must never under-estimate their indispensability to our future success.

This report courtesy of O. M. SCOTT & SONS CO., Seedsmen, Marysville, O.

Soil Conditions and Root Development

By HOWARD B. SPRAGUE

Agronomist, N. J. Agricultural Experiment Station

ROOTS ARE vital to plants—they provide anchorage, store food and absorb water, nitrogen and minerals. For this reason, Dr. Sprague explained, it is extremely important that cultural practices be governed just as closely by root demands as by the requirements of top-growth.

While anchorage and food-storage functions of roots are important, it is in the absorption of water and nutrients that plant roots are most vital to the plant. In this connection, the speaker pointed out:

Absorption of Water and Nutrients

Without the essential elements for growth, the permanent fixation of the plant would be of little value, and there would be no food to store. Quantities of water absorbed by plant roots are far greater than ordinarily thought. It has been estimated that on bent greens of average quality, the grass roots must take up during the growing season at least 3,750 gals. of water for each 1,000 sq. ft. of green. On Kentucky blue—redtop fairways, the amount absorbed by roots during the season is approximately 186,000 gals. per acre. In other words, the plant must take up 300 to 500 lbs. of water for every pound of dry substance formed in leaves, stems and roots.

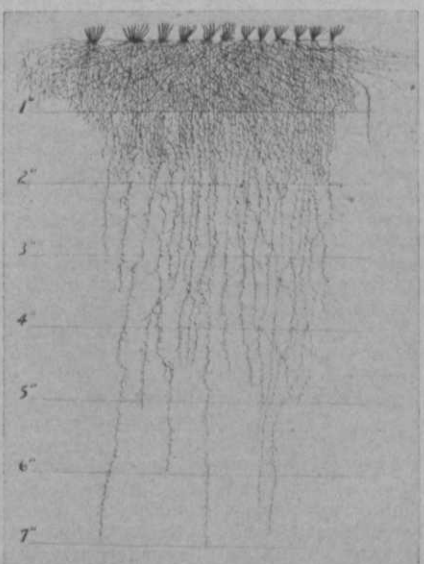

Fig. 1. Typical distribution of roots at various depths, for grass on putting greens

With regard to nutrients, the roots of fertilized bent putting greens must absorb, for each 1,000 sq. ft. of surface, nitrogen equivalent to that found in 15 lbs. of sulfate of ammonia, phosphorous equivalent to 12 lbs. of superphosphate, and potash equivalent to 6 lbs. of muriate of potash. On healthy Kentucky blue—redtop fairways the nitrogen absorbed per acre equals that found in 400 lbs. of sulfate of ammonia, phosphorus equal to 200 lbs. of superphosphate, and potassium equal to 200 lbs. of muriate of potash.

Both water and mineral substances are held by the soil with some tenacity; consequently the roots must make intimate contact with every group of soil particles before the water and minerals in contact with these particles may be utilized.

Root Structure

Grass roots are admirably adapted for making contact with the soil particles (Figure 1). Fine roots develop in whorls at each joint of stems that are located at or below the surface of the soil. As a result here is built up a fine network of roots and their branches to form what is called a fibrous root system. This is very different from the tap root system of such plants as dandelions, dock, trees, etc. These fibrous roots of grasses do not live indefinitely, but usually die within a year or two and are replaced by other roots. New roots are formed most abundantly during the spring months after growth of tops begins, and death normally comes in fall or early winter.

If the individual roots or branches are carefully examined (Figure 2), it will be found that at the tip there is a root cap composed of loosely arranged cells which slough-off as the root grows and pushes between the soil particles; these cells acting as a lubricant much as would oil on a bearing. Immediately back of the tip, is the growing point where new cells are constantly being formed as the root elongates. After formation, the new cells soon begin to enlarge, and the effect is to increase the length of the root and push the growing point further into the soil mass. As the cells enlarge, some of them are modified to perform different functions. Near the center of the root, certain groups of cells become elongated and the walls are thickened for conducting water; others become adapted for the movement of foods, and both types together form the vascular strands or veins as they are called. Between these strands and the outer layers are the storage cells which comprise the

cortex, and the outermost layer of cells form the epidermis or protective coating. Certain of the epidermal cells are greatly elongated and become root hairs.

Root hairs are of great importance since practically all water and nutrients absorbed by the plant enter through them, very little passing through the epidermis. Moreover, root hairs are found on roots in a very limited zone just back of the growing tip, and the individual hairs have a relatively short life. New root hairs must be formed continually to maintain normal absorption. When the root hairs have died, the epidermis of the root at that region becomes impermeable and unable to function for absorption. Since root hairs are very easily affected by soil conditions, attention must be given to this relation. It has been estimated that the root hairs increase the area of contact with a soil by 10 to 15 times as compared with the same root without hairs.

The extent of the root system and the thoroughness with which it occupies the soil mass is determined to a great extent by the system of management followed and by the nature of the soil itself.

Soil Moisture and Aeration

Experiments have shown that within certain limits, a relatively low water content of the soil stimulates roots to greater development, and likewise increases the abundance of root hairs. For example, plants grown in a soil with a moisture content of 19% available water have a total root area 1.2 times as great as the leaves and stems, whereas similar plants grown in a soil with only 9% available water possess a root area more than twice as great as the tops.

Soils which are compact and poorly aerated will permit only scanty growth and this will be confined to the upper layers. On the other hand, when the soil is very dry, root development is retarded or may even cease, the above-ground parts being dwarfed accordingly.

With the artificial watering generally practiced, one may do much to modify root development. Keeping the surface soil too moist during the early part of the season when new roots are being formed will favor development of a relatively shallow root system. Under such conditions the turf will be easily injured by drought later in the season because of the small volume of soil from which moisture is obtained. On the other hand, reducing the quantity of water used, or withholding water as long as possible will promote a deeper root system if other soil conditions are favorable for growth. Waterlogging the soil even temporarily may cause the death of roots in the flooded soil layers. Certain grasses are more tolerant of over-watering than others, but all of the better species are injured by such conditions.

The critical factor in cases of waterlogging and over-watering is usually not the excess of water, but the absence of sufficient oxygen for plant growth in the pore spaces of the soil.

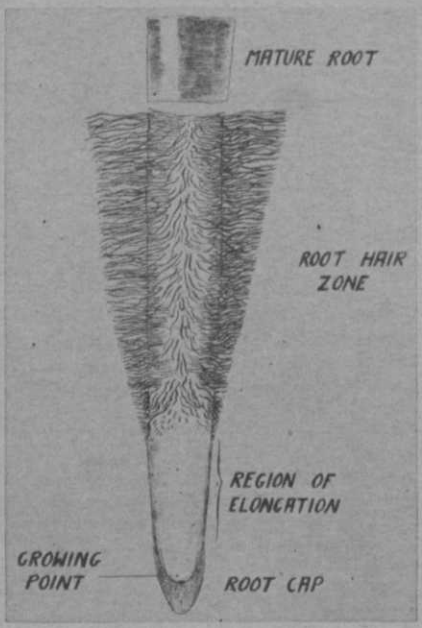

Fig. 2. Enlarged view of young grass root tip. Root cap protects growing point and acts as lubricant as root pushes through soil. Root hairs absorb practically all water and nutrients required by plant

Little if any growth of roots occurs when soils are frozen. Growth of our northern grasses begins soon after the soil temperatures reach 40° F. However, the soil does not warm-up in spring as soon as the air, and the deeper layers are slower in warming than the upper layers. Therefore, little root growth is made until the mean daily air temperatures are at least as high as 45° F. Soils that contain a large amount of water are much colder in spring than well aerated soils which contain smaller amounts of water.

Nutrient Supply

Supply of nutrients in an available form in the various horizons or layers of soil is an important factor in modifying the character of root systems. Roots branch more profusely in the soil layers that are liberally supplied with nutrients. Upon coming in contact with a soil layer rich in nitrogen, roots not only develop much more

abundantly and branch more profusely, but they also fail to penetrate as far into the deeper soil.

On the other hand, the presence of an abundance of phosphates has been shown to increase root development strikingly. If phosphorous is deficient in soil, its application in an available form may be expected to greatly stimulate root length and branching.

Soil Acidity

Soil acidity and a lack of lime may also limit root penetration. The tolerance of turf grasses to soil acidity varies with the species, but all are injured to some extent by strong acidity. In some cases it may be found that the roots will penetrate only as deeply as the soil is freed of active acids. Soil acidity may affect absorption of nutrients and water even before it modifies root extent. This is due to the fact that root hairs are injured or destroyed by excessive acidity, just as they are killed by the presence of poisons in the soil water.

The extent of the root system can be considerably influenced during the period of its development by the height and frequency of cutting. Plants cut very short are able to manufacture only a limited quantity of food in the leaves. If the supply of nitrogen is abundant or excessive at this period, the tendency will be to produce luxuriant top growth without a corresponding root development. On the other hand, plants that are cut less closely may utilize considerably greater amounts of nitrogen without hampering the development of the root system. The critical point seems to be the ratio of carbohydrate food present in the plant to the supply of available nitrogen. An overabundance of nitrogen favors top growth and retards root growth. This relation is probably most important in early spring when roots are actively growing.

Dr. Sprague concluded by giving details and results of the studies made at New Brunswick, N. J., on which the preceding remarks were based. The study data will be found in March GOLFDOM.

Bacteria in the Growing of Turf

By DR. J. G. LIPMAN
N. J. State Agricultural College

PLANTS commonly used in greens are the specialized and selected representatives of their class, expected to thrive and to survive under conditions that would be fatal to most plants. Frequent, close cutting, stimulation and over-stimulation of root development, compacting the soil, and frequently abnormal moisture, temperature and aeration conditions represent an environment that is not normal. It is evident that this abnormal environment would weaken and ultimately destroy the most hardy of the turf grasses except as special devices and treatments be used toward offsetting the weakening effects of the treatment. Such devices and treatments must reckon with the presence and activities of bacteria.

Factors which affect the growth and vigor of turf grasses may be grouped under the heads of environment and in connection with the food supply of plants. Amount, character and distribution of organic matter is of major importance. Amount of organic matter directly affects the circulation of air and water in the soil, and, to some extent, its temperature. Everything being equal, the more organic matter in the soil, the greater the amount of water absorbed and held. It is possible, therefore, to create a supply of organic matter so large as to interfere with optimum root development. The quality of the organic matter is also of direct significance in that its composition and physical nature may favorably or unfavorably influence root growth and the activities of soil bacteria. Distribution of the organic matter is also a factor of importance, since the amount of it at different depths of the soil and subsoil control the circulation of water and air and, through these, the feeding of the plants.

Everything being equal, the deeper the root zone the more vigorous the plants and the greater their resistance to unfavorable changes in their soil and climatic environment.

Carbon's Part Important

Approximately 50% of the dry weight of grasses, and of other plants, is carbon, the element which makes up all but a small proportion of the entire weight of coal or charcoal. There is only about .03% of carbon dioxide in moisture-free air. Areas on which vegetation is flourishing draw heavily and repeatedly on this relatively small supply. Had it not been for the constant movement of air above the land surface the gases overlying any area on which forests, cultivated crops or grasses grow vigorously would become depleted of their carbon dioxide supply to a point where plant growth would be checked. It is fortunate that there is not only the circulation of air, but also the replenishment of carbon dioxide from the soil itself.

Actively developing plant tissues con-

tain only 5 to 10% dry matter. The rest is water. Without adequate water supply growth of both roots and tops is retarded. It is not merely a question of the amount of water supplied by rain or artificially, but also of the circulation of water in the soil, its ability to lift water from lower depths, and its ability to allow water to move downward and laterally. Together with water supply, we must consider air supply, for, in so far as the space not occupied by soil particles or roots is filled with water, it is not occupied by air or vice versa. When the soil is saturated and water stands at the surface, there is no air in it except for the small amounts of air gases dissolved in the water itself.

Preventing Plant Poisoning

For the best growth of plants there must be an optimum relation between water and air in the pore space. Growing roots take something out of the soil water and something out of the soil air. The latter must move about freely enough to prevent such changes in the composition of the soil air as would be inimical to the activities of soil bacteria. When such inimical or unfavorable conditions arise, substances more or less poisonous to the plants may be formed. Types of bacteria, fungi, protozoa and algae objectionable to the greenkeeper might, under such conditions, become unduly prominent. They might interfere with the functioning of the roots of turf grasses and of the kinds of bacteria that are important in providing for a satisfactory supply of certain plant ingredients.

In the soil available plant food is both manufactured and dispensed, so that there is a more or less constant transformation of raw materials into finished products that plants can use, and there is also a transformation into material made unavailable. The manufacturing processes in the soil are carried on largely by bacteria and other micro-organisms. One of the plant nutrients prominent in promoting growth of tops and roots is nitrogen. Nearly all nitrogen in soils is present in combination with carbon, hydrogen, sulphur and other elements in the so-called organic matter. This, as is well known, consists of residues of plants, the cells of micro-organisms and of the remains of insects, worms and other soil-inhabiting organisms. They must be broken down and the nitrogen released in the form of ammonia and nitrates.

Make Plant Food Available

Bacteria and other soil micro-organisms are the living agency on which we depend for breaking down soil organic matter and for manufacturing ammonia, nitrates, sulphates, phosphates and other essential plant nutrients. Everything else being equal, the warmer the soil and the more favorable the conditions as to water and air supply, the greater the number of soil bacteria, the more intense their multiplication and activities and the greater the rate of plant growth. Soil organic matter which contains too large a proportion of carbon does not favor a large supply of ammonia and nitrates to growing plants. In soils of this character bacteria actively compete with the higher plants and interfere with their growth in so far as the supply of available nitrogen is concerned. The ammonia and nitrates of the soil solution are so rapidly taken up by bacteria and changed back into unavailable organic matter as to deprive plant roots of a sufficient supply of this important plant nutrient. To a lesser extent this will apply also to sulphate, phosphates, lime and magnesia. The greenkeeper, if he succeeds, so tunes up the biological machinery in the soil as to create optimum growing conditions for the plants in which he is interested.

Balance in Soil

Examination of the plant roots may show that they do not penetrate deeply enough, nor are they more or less symmetrically distributed. The fault may lie in the texture of the soil and subsoil. In that case, artificial drainage must be provided for. Otherwise, the use of chemical fertilizers may hinder rather than favor normal and vigorous root development. The greenkeeper must bear in mind that, in applying chemical fertilizers, he inriches the soil solution which bathes the plant roots. He may make this solution so rich as to corrode the root hairs and the fine rootlets. He may also swing the biological balance in the soil toward types of bacteria and fungi that would be detrimental rather than helpful. In his anxiety to maintain a sufficient supply of organic matter he may resort to the use of peat, which has valuable as well as objectionable characteristics. It is true that any organic matter, including peat, will open up heavy soil and make more compact loose, sandy soil. It will increase the water-holding power of the soil and improve the circulation of air in fine textured material. At the same time, the organic matter of peat is not readily usable as a source of food for bacteria. Hence, peat is less desirable than good compost for stimulating soil bacterial activities. There is another factor in the use of composts that should not be overlooked. In one sense, good compost is like yeast in that it inoculates the soil, supplies it with billions of bacteria and sets up fermentation of organic matter that results in liberating a more adequate supply of available plant nutrients. The question of soil inoculation for greens is one that has not received much study. It is not necessary to use composts for the purpose. It is conceivable that, in the

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 1½ 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 ¾ 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 topdressing 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 system 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.

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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More Addresses from NAGA

Vitality of Trees in Relation to Root Environment

By HOMER L. JACOBS, Arboriculturist
The Davey Tree Expert Co., Kent, Ohio

THERE are six "factors" required for the growth and health of the higher plants: light, heat, air, moisture, soil nutrients and mechanical support. Since soil supplies the tree with five of these, either wholly or in part, we can readily see the importance of root environment in the health of a tree.

We can, within certain limitations, control soil temperatures. By irrigation and drainage we can regulate the moisture supply. In a like manner we may influence aeration of the root area and by the use of fertilizers the needed elements may be supplied. We transplant large trees and in doing this we cut away the roots severely. How can we restore and enlarge this root system rapidly in order to avoid pruning the top too severely? When our trees are suffering from poor soil conditions what fertilizers are usually needed and how may they be applied most efficiently to lawn or to other sod-grown trees?

The presence or absence of air rather definitely limits the downward growth of roots. Aside from the texture or fineness of the soil particles, aeration is quite largely influenced by the moisture supply. We cannot expect to induce deep and vigorous root growth on our common trees in a soil with a high water table or a soil so nearly saturated that but little air movement can take place. Even such shallow rooted and swamp loving trees as larch and black spruce have been known to more than double their growth rate following drainage of their native swamp.

Good drainage is especially essential for transplanted trees where copious and frequent watering is necessary. In fact where the soil drains freely, heavy watering may even assure good aeration. This can be readily understood when we remember that, in entering the soil, water displaces the air present and in draining out draws in a fresh supply of air. In addition, water from a hose or overhead sprinkler is charged with oxygen which is available to the roots.

Cultivation has long been considered a means of introducing air to the soil. Research of recent years indicates quite strongly that stirring of the soil, aside from reducing weed competition for moisture and nutrients, has been over-emphasized. It seems doubtful if surface cultivation would very greatly influence root conditions in the undisturbed soil layers 18 inches or more in depth. Furthermore, when our landscape picture is made on a carpet of green we do not take kindly to having patches of it laid bare in order that our trees may enjoy the benefits of cultivation.

Two white ash trees, August, 1927, being given first of annual fertilizer treatments

Same trees, August, 1930, showing effect of three years of fertilizer applications

Barren soil beneath a tree prepared by power driven earth augers to receive fertilizers and organic material to a depth of 2 feet throughout its entire root-area

During a period of hot summer weather and light rainfall, trees soon exhaust the soil of its available moisture. Here again the deeper rooted trees have an advantage over those which because of their shallowness are denied the moisture of the deeper soil. We should remember, too, that during a prolonged drought such as we had in 1930 the soil moisture is exhausted to a considerable depth and that even normal rainfall during late summer and fall may not restore the normal subsoil water content. For this reason, it may be necessary to water our trees even after our lawns and gardens have recovered from the dry spell.

I had occasion during the past season to examine a number of dying white oak trees on the grounds of The Greenbrier at White Sulphur Springs, W. Va. This was in the heart of the 1930 drought area where for six months during the spring, summer and fall there was not a single rainfall which could be measured in a standard raingage. Rainfall in 1931 up to the first of September had been about normal, and yet the resident engineer assured me that, with the exception of a few inches of surface, the soil to a depth of 12 ft. was almost as dry as dust. This points out once again the value of prolonged irrigation over frequent light applications. Transplanted trees, which draw their moisture from a limited volume of soil, exhaust the supply rapidly and require more frequent but no less thorough watering.

Tree Fertilizing

Of the three elements supplied in complete mixtures, nitrogen is by far the most important in a tree fertilizer. There is much research work yet to be done on shade tree fertilizer problems, but in the light of our present knowledge there is no reason for spending much of our fertilizer dollar for phosphorus or potash.

While nitrogen may be supplied in any one of a number of forms, a mixture of two or three forms should be used. Materials such as sodium nitrate are rapidly available, but leach out so readily under certain soil and moisture conditions that they should not be depended on for the entire supply. On the other hand, straight organic carriers such as bone meal or cottonseed meal are rather slowly available and, even over a period of years, have not proved as efficient on deciduous trees as mixtures of both organic and mineral carriers. Trees make root growth and absorb food materials over a long season of the year and it seems advisable to supply them with a fertilizer containing both immediately and slowly available nitrogen.

Manure or any other organic material, of course, plays much the same role in improving soil conditions for trees as it does for other agricultural or horticultural crops. If manure is used in transplanting or elsewhere, where it may be placed at any considerable depth and where the soil is likely to be quite moist, great care should be taken that it is well rotted and past the period of most rapid decay. For surface mulches or where there is a more direct connection with the atmosphere the shredded manures may be used.

On transplanted trees where rapid root growth is desired, peat moss seems to be especially suitable, perhaps because it combines great water and air holding capacities. This material even when mixed with poor subsoil, under some conditions, induces better and more rapid root growth than when topsoil is used. Peat moss contains but little organic nitrogen and seems to decompose without the formation of harmful gases even when mixed to considerable depths in heavy soils. This, however, may be directly due to its effect on aeration. Where this is done, nitrogen fertilizers should be used from time to time throughout the summer. This is necessary to supply both the tree and the bacteria which decomposes the peat moss and to take care of leaching under the frequent watering necessary for transplanted trees.

The so-called crowbar or perforation system of applying fertilizers to trees has been used for many years. Originally a comparatively small number of holes was made under each tree. In more recent years, we have a newer conception of this method and a higher regard for the place it occupies in our attempt to make shade trees more nearly independent of irregular rainfall and rapidly changing soil temperatures. This is particularly true with the development of power-driven earth augers, with which holes can be made more easily and rapidly than by hand.

By the perforation method it is possible over a period of years to bring about an improvement in the soil around large trees to a considerable depth and with a minimum of disturbance either to the roots or to the lawn.

Food and Air Introduced

Present practice is to form numerous holes from within a safe distance of the trunk throughout the entire spread of the roots. These holes are 10 to 18 ins. deep or even deeper. Chemical fertilizers alone may be used and the holes refilled with the loosened soil. Usually the hole is filled with a mixture of chemical fertilizer and some humus forming material to within a few inches of the top. The hole is then filled to the top with soil to re-establish an immediate growing medium for the grass roots. In either case we have introduced fertilizers at a depth of several inches and at the same time formed a partial air pocket and channel which for some time will offer less resistance to the entrance of air than was the case before the soil was loosened up.

One other point may be made in connection with this method. Soil chemists are fairly well agreed that phosphorus and, to a lesser extent, potash, are fixed in the soil within a short distance of the point where they are applied. If you feel that trees need high phosphorus fertilizers, then it is certainly more advisable to place them deep in the soil where the roots can actually come in contact with the phosphorus than to scatter them over the surface where the phosphorus may never go below the shallowest grass roots.

Extremes of temperature, both winter and summer, can be controlled to a certain extent. Fortunately, a heavy sod is a fairly good protection to the tree roots. Nevertheless, these organs do not possess great resistance to low temperatures and as a result trees do often die of winter injury to the roots. Soil or litter should never be removed from the base of the trunk or large roots just before cold weather. In exposed locations or where winter injury is feared, a mulch of leaves or other material may be used over winter. It should be removed in spring to allow the tissues to regain their resistance by exposure to the air during summer and fall. For trees which as a species have persistently shallow roots, ground cover planting will give the necessary protection. Such covers, made of Vinca minor or Pachysandra terminalis, being evergreen, are less objectionable than ordinary mulches and are quite permanent.

The Greenkeeper's Schedule

By C. A. TREGILLUS
Supt., Mill Road Farm Golf Course

WE ARE deluged with figures indicating the total investment in golf real estate, construction in buildings and layouts, and a little quiet pondering on the relationship of the greenkeeper to all this might well occupy some of his more serious moments. Not with the idea of the glorification of his own importance, but to a fuller realization of his responsibilities and liabilities.

While this office is commonly known as "Greenkeeper" in reality the scope of the work has widened considerably and we find many other duties attached to this position. What we actually find is that in addition to the maintenance of the course, he is "clerk of works," having within his care much of the belongings of the club.

The development in recent years in the golf club organization shows a tendency towards managerial administration. It is not within the purpose of this talk to discuss the pros and cons of this, but I will remark in passing that where the club is run by a general manager, who is responsible to the directorate for all the maintenance, service, and development, the greenkeeper generally becomes the general superintendent in charge of the outside maintenance of buildings, grounds, etc. At times when the administrative offices may be moved to the city or elsewhere, the greenkeeper automatically assumes charge at the club property. At such times, he assumes authority over the physical plant, though not over the service staff where the clubhouse is kept open for winter parties. That, of course, usually comes within the steward's office.

Director and Buyer

The agencies by which the greenkeeper discharges his trust falls into two general classes, labor and materials. In managing the former, he must exercise his best talent as director of operations and in the acquiring of the second, he must possess all the shrewdness and keenness of a first-class purchasing agent. To faithfully combine these is not an easy task, but in these days of keen competition, reduced budgets, etc., the success of the club relies very much upon these shining virtues.

The hiring of labor and its management is the oldest duty in this field of calling, in fact the whole business of greenkeeping in the beginning was a matter of labor supplemented with the simplest of tools.

The first observation is that no two men will assume authority over others in the same way. While two men may achieve the same results, it is certain they will go about it by entirely different routes. Temperament and personality are things we cannot closely standardize and for that reason every foreman and officer has to work out for himself his own course of action, his own method of approach. The same thing applies to the workers, but one must look at it in a more collective manner as we have to deal with racial temperament as well as individual temperament.

The closer one's contact to the individual workers, of course, the more helpful it is to give attention to this relationship. While it is idle to say many words on discipline, since any man who has had to direct the labor of others learns the necessity of maintaining a distinct authority over the workers, still it is well to remember that we may increase individual efficiency, which means general efficiency, by allowing a worker some latitude in how he goes about his job. If he can achieve the result we want, in a way all his own, with no more cost of time and materials than if he went about it our way, we are quite satisfied. It is the result that counts and the cost of achievement. This fact is particularly noticeable in this country where national habits of workers are so divergent. A simple illustration is the manner in which many German mechanics use a hacksaw, drawing it towards them on the working stroke as against the usual American practice of pushing it away.

Buying and Selling Labor

I sometimes look at the labor relationship as that of buyer and seller. I like to feel a regard towards the other fellow, whether he is selling me a carlot of sand or the labor of his hands to put it into the bunkers.

It is a good idea, I believe, to hire the "all year" men by the month; they are closer to the organization and one feels more reliance towards them. The seasonal labor is a different proposition and must be handled accordingly. It is turned away in the fall with the hope that the same phases will show up in the spring. In some instances, the men have winter work to go to. Those who stay at home we try to help out by dividing up any work that may come along during the winter months. Last winter we made changes in the water system and alternated the men week about. It gave them a little help. This year, owing to the very mild fall, we kept the gang together on alterations until December. We do work on our trees during the winter and that gives some employment. My experience is that it pays to

keep a skeleton labor gang together where any appreciable number are employed during the golfing season.

I have seen superintendents who seem to be on the run from morning to night, and others who generally have time to sit down and chat the afternoon away; and strange as it may seem, the latter are invariably the efficient superintendents. It is a mistake, I think, to become immersed in a set of "chores" that become an all-day routine. One should be free to turn in any direction for any emergency without the worry of something being left undone.

Two things I would reserve, however; one is time-keeping and the other is cup-changing. I like to see the greenkeeper keeping the time as that brings him in closer touch with the individual workers. To change the cups or to accompany the man doing this work should be his ritual of office. In this instance, I liken him to the doctor making his daily round to take his patients' pulse and temperature. He is sure then to be familiar with the condition of his greens, both above and below ground.

Greenkeeper's Buying

The authority to purchase supplies and equipment is a privilege every greenkeeper would like to have but few possess. The usual procedure of lining up the green-committee and the lobbying for new implements with considerable apprehension as to whether they are forthcoming causes no little worry in the minds of many superintendents. It rests with the greenkeeper to bring to the committee's realization that his requirements are conservative, and that he is just as interested in and sensitive to the budget limitations as any of the membership. I think the day of excessive sales pressure on credulous greenkeepers is over. These are enlightened times.

Purchases in quantity can sometimes be made to the advantage of the club and where storage facilities are available is good economy. Buying is business that calls for constant vigilance whatever line of goods are involved, and quantities to carry on hand and when to be in the market are matters that alter with the individual circumstances. I endeavor to keep in touch with prices at all times and continually explore the channels of trade to uncover new sources of supply. The golf industry is well supplied with business houses catering to its requirements and they perform a very valuable service, but the wide-awake greenkeeper should nevertheless endeavor to keep himself informed that prices are properly in line, and see to it that he is getting a dollars worth of

actual value for every dollar of club's money he spends.

I am not in favor of carrying a large inventory of spare parts for the mechanical equipment. I have seen stores carried by some clubs that would do credit to a supply house, but I cannot see where this is an economical practice. I would much rather see some of the investment in an extra truck, tractor, and cutting units.

Record Keeping Vital

There is one more point I wish to mention, and that is the keeping of records. These are days of reduced budgets so we have to be more careful than ever before. I firmly believe the greenkeeper should keep all the books that his time will allow him to without becoming a burden. Our own records are very simple. We do not break down our golf course labor, except to separate the mechanic's time. We keep the cost of labor and materials and a diary showing weather conditions, appearance of disease, pests, etc., and any other work done out of the ordinary routine. Each month end we prepare a statement showing the money spent during that month and the preceding months of the calendar year, and compared with the same period the preceding year. It is done this way: In the left-hand column is the list of the accounts we keep, such as labor, seed, fertilizer, chemicals, etc. In the next column is set down the January expenditure, in the next February, etc. As each month's statement is prepared, we add up the total spent to date in the calendar year and beside it to the right the amount spent for the same period last year. There is a comparison of the gross expenditures in each account. Each column is added up and the amount for the month shown. Below that is entered the amount for the same month the previous year. Any unusual expenditures are explained in marginal notes. This statement is a good deal of work to prepare, but it gives a wonderfully clear picture that anyone can understand without close study.

Our Job

By L. J. FESER

Woodhill C. C., Wayzata, Minn.

MR. FESER advised confident, clear thinking in economics as part of the greenkeeper's job, saying the work today not only called for solving problem of budget allotment but thinking about how money for club could be obtained.

He refused to be submerged in too-popular gloom of business thinking today and pointed out that losses of the war in men, money and physique were much more serious than today's troubles. He aptly reminded fellows who were in the war about

all the old crying about the war never ending that followed when the hooie about "out of the trenches by Christmas" exploded.

At his club, Feser said about 50 people in families of greens staff were supported by income from the course. He estimated more than 70,000 people were directly dependent on course maintenance expenditures. Additional were people engaged in all phases of manufacture and distribution of golf equipment and supplies.

He strongly advocated junking of obsolete equipment and "haywire" systems under present conditions. Feser dislikes the term "labor saving." He calls "labor-saving" machinery labor-making because it is a producer of wealth. Use hand labor properly and machines wisely and golf courses are going to look a lot better in proportion to money spent, said Feser, who added, "I know there is no course in this country or any other country that could not be improved upon."

But, how are clubs going to bear cost of "wealth-producing" system in the light of present economic conditions? Feser answered this question by saying it gets back to the damnable cycle that everybody talks about but few are willing to try to break.

He illustrated the situation by taking tobacco and golf as two items that could be dispensed with. The elimination of golf clubs that increase property values and utilities, discharging of many direct employees and reduced income of others and scores of far-reaching adverse developments would constitute a throw-back in the standard of living and make competition more serious for people engaged in producing necessities. The pleasures of life have just a vital place in an advanced civilization and in progress, he reminded the greenkeepers.

In general, Feser's talk was on the part the golf business plays in the distribution of wealth and pleasure and constituted a unique and thought-provoking contribution to the business literature of the game.

He laid down the greenkeeper's platform under present conditions as follows:

The best economy in the world is to make every dollar granted to you in the form of a budget produce 100 cents worth of value, 100 cents worth of beauty and wealth, 100 cents worth of satisfaction on the part of your club members. It is your privilege to try to get as large a budget as you possibly can, but base your request on practical foresight and knowledge of your job. Use your ability to get an adequate budget, and when you do get it, remember that your personal and professional responsibility is a heavy one.

When the year is over be prepared to meet with your chairman, lay your figures and the picture of your accomplishment on

his desk; have the feeling in your heart that you have used your innermost ability to satisfy him and the members of your club, and that you have used your position in life to help your fellowmen. That, in the most high and honorable sense of the word, is our job.

Landscaping Points

By PROF. M. R. BRACKEN
Pennsylvania State College

PROF. BRACKEN lectured from colored slides in presenting major details of course and clubhouse grounds landscaping. He showed a number of views emphasizing natural effects in landscaping from standpoints of beauty and golf playing influence.

He set forth some principles of landscape architecture that apply to design of golf courses and particularly referred to the problems of landscaping around service yards of golf clubs.

The Penn State landscaping authority counseled against distribution of clumps of planting at many spots around clubhouse grounds, ruling these out because of improved scenic effect of planting grouped closer to house and because of high maintenance. He dwelt on the combination of golf architecture and landscape architecture in making such tree plantings as may be advisable for separation of closely parallel fairways. Usual method of planting straight rows of trees he condemned, advocating natural looking groupings so located that they would call for shots directed away from the adjacent fairway.

Although deciduous trees are decidedly troublesome to golf courses during the fall, Prof. Bracken admitted, there is a danger in too strong concentration on evergreen planting both on the course and around the house.

Natural appearing landscape masks for equipment barns and clubhouse service yards Prof. Bracken considered an advisable yet most neglected detail of golf landscaping. He showed a number of slides that suggested how unsightly areas near course boundaries be made beautiful without heavy expense in planting or maintenance.

Some Thoughts on Greenkeeping

By M. E. FARNUM

ACTIVITIES of the greenkeepers' association, the Green Section and various other national and sectional bodies, said Mr. Farnum, have eliminated "trade secrets" from the profession of greenkeeping. This is a constructive development, because the "best" method of course maintenance will never be discovered and greenkeepers need all possible assistance and hints in their quest at their home courses for ways and means of improving playing conditions.

But all the work of scientists and golf associations to date has not eliminated certain problems with which the greenkeeper must cope. One of these is the question of relations with the green-committee. How far should the committee dip into the activities rightfully under the control of the greenkeeper? On this point, Farnum said:

Many unsatisfactory conditions persist under committee management which would not exist long under a more business-like form of management. However, I can not look for a correction of conditions from this angle. The greenkeeper must add another to his multitude of activities. He must sell his abilities as well as be constantly enlarging them.

The percentage of green-chairmen who, from choice, wish to dictate greenkeeping practices is relatively small. The percentage of chairmen who do, to a greater or less degree, dictate greenkeeping policies is larger than it should be. Undoubtedly this condition is due to lack of knowledge of conditions and a lack of confidence in the greenkeeper. It is this condition which I view as one of the major problems of the greenkeeper.

Very probably, the speaker said, greenkeepers are seen too often in work clothes. This costume implies a job where physical ability is paramount; as a matter of fact, the greenkeeper's job is far more mental than physical—but club members do not realize this. If greenkeepers would dress

up to their jobs, the importance of the profession would receive more general acceptance from golfers.

The greenkeeper's position should be such that his recommendations be sought. A recommendation should not be made unless it is essential and worth fighting for. Once made it should be actively supported. If, for due and sufficient reasons, it must fail it should be made a matter of record in writing for future reference. The man whose recommendations are shown by time to have been correct and essential has redress if he has presented those recommendations in writing.

Can Enough G. M.'s Be Found?

Farnum spoke at some length on the possibilities of the general managership idea at clubs. In the main, he favored the plan, believing the running of a golf organization to be very little different from operating any other business. If the plan works elsewhere, why not with clubs? Weaknesses in the idea from the club standpoint are two-fold: many clubs cannot afford a properly qualified man for such a position; and, secondly, there is probably a dearth of qualified men to meet the needs of the clubs. An inefficient general manager would be worse than the present committee form of club organization.

Ethics Can Be Improved

The next problem taken up was that of greenkeeping ethics, Farnum pointing out that much improvement can be made along this line. A greenkeeper who has been particularly successful should not sell his advisory services to another club without the consent of the local greenkeeper. Nor should a greenkeeper solicit employment indiscriminately in the absence of known vacancies. The speaker recommended "some collective action in setting up professional standards."

Bettering Working Conditions

While considerable progress has been made in knowledge of turf culture and maintenance methods, the problem of bettering working conditions has been too generally overlooked, Farnum declared. But this is a problem that must be solved not by collective action, but rather by individual initiative. Each time a greenkeeper improves his own position, he boosts the standards of his profession. So it behooves every greenkeeper to sell himself and his profession to his club and to see that the reputation of the profession does not suffer in his hands.