but in connection with bridge, teas and entertainments of various characters are absolutely essential to the stimulation and promotion of business whereby the club may add to its gross revenue.

Although a great deal of effort will be exerted by the average golf club this year in connection with the points I have touched upon above, these in themselves will not solve the problems completely. The question of cost of operation, the introductions of methods of efficiency and economy, play a big part in the final result obtained at the end of the year.

It is appropriate therefore that our manager should give considerable attention to the club's financial structure and operation, the methods they are employing in its management. They should take inventory of the club's business methods to the end that the best ideas available today may be introduced.

Modernize Food Department

Inasmuch as it is in the restaurant that most clubs find their heaviest losses at the end of the year, the question arises as to whether or not many of our country clubs are on the wrong track so far as restaurant operation is concerned.

There was a time when the country club member considered his club a luxury to the extent that he was willing to pay almost any price for the meal which he bought for himself and his guest. He expected the de luxe type of service and a choice of menu items which rivaled those of Delmonicos and Sherry's.

We doubt if that is true today, for the average golfer has become more sensible in food matters and realizes that his habits of eating play a great part in his quest for health and wellbeing. No longer will a golfer sit down to a heavy lunch and then go out and play 18 holes, nor will the enthusiast who plays 36 holes in a day load his stomach with heavy viands between rounds.

Inasmuch as the trend is toward lighter food and those dishes which are more appetizing through their attractiveness, it follows also that employment of expensive kitchen staffs are no longer essential.

Not only has a change taken place in regard to the habits of golfers themselves but we find a renaissance as well in regard to the dining custom of the entire family.

Why is it that the tea rooms, cafeterias, coffee shops, and restaurants which specialize in home cooking have sprung up like mushrooms and thrived these past few years, whereas the more elaborate dining places which continue to feature continental food have, in most cases, a handful of people patronizing them? Because there has been a change and this change is towards simpler eating.

This is not meant to be a treatise upon the eating habits of the general public in this day and age for many better qualified than myself have been setting forth their arguments in trade journals and proving their point.

More Profit in Simple Items

What I am leading up to is this. It is pretty well recognized that the golfing public and the families of this same group are satisfied with simpler and more healthful types of menu items and it will be a wise golf and country club manager who will staff his kitchen with less expensive employees who are thoroughly capable of producing delightful and attractive yet simple and appetizing items of food which can be produced to meet the average pocketbook today and show a greater profit or a smaller loss, as the case may be, than the heavier types of food served in the past.

Consider also the smaller possibility of loss on these items than one finds in buying loins and ribs, racks, chicken and game and keeping them in the ice box subject to the call which often does not come.

We believe it is time for the country club manager to think it over and consider the idea of the simplified cuisine mentioned above for greater satisfaction, not only to club members as individuals but in new results on the club's financial statement. This is a new age, new habits on the part of the eating public concerning cuisine and, sad though it may be, it is also true that new ideas in regard to spending have taken possession of them also.

Managers must meet these conditions with progressive ideas.

Many may take a leaf from Colonel Holden's book of experience at Olympia Fields and install the cafeteria idea. Sounds ridiculous to see "cafeteria" and "country club" used in the same sentence but most of us have learned not to be surprised at anything.

These are your planning days, Mr. Country Club Manager—How will you make use of them?

TRAIN waiters and bus-boys to be economical with linen. It will reduce laundry bills appreciably.

Report of the Educational Conferences

of the

National Greenkeepers Association

1932 Convention

New York City

January 19 to 22, 1932

PUBLISHED AS A SUPPLEMENT TO GOLFDOM
THROUGH THE COURTESY OF

O. M. SCOTT & SONS CO.

. . . . . SEEDSMEN . . . . .

MARYSVILLE, OHIO

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

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