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# The NATIONAL GREENKEEPER

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*Official Organ of the National Association of Greenkeepers of America*

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## Contents

BACTERIA IN GROWING TURF <i>By Dr. J. G. Lipman</i>	5	ERADICATION OF BROWN PATCH <i>By Arthur Boggs</i>	18
SINS OF COMMISSION AND OMISSION <i>By Alfred E. Lundstrom</i>	9	MINNESOTA GOSSIP <i>By H. E. Stodola</i>	19
BUILDING GOLF COURSES IN JAPAN <i>By George Penglase</i>	12	OKLAHOMA NEWS <i>By Merle Zucifel</i>	19
GOLF COURSES CANNOT BE STANDARDIZED <i>By Fred A. Burkhardt</i>	14	PACIFIC COAST GOSSIP <i>By Arthur Langton</i>	20
GREENKEEPERS OF RHODE ISLAND AND ADJOINING TERRITORY MEET AT KINGSTON, RHODE ISLAND	15	CANADIAN NEWS <i>By J. H. Evans</i>	20
TURF FIELD DAY AT THE NEW JERSEY AGRICULTURAL EXPERIMENT STATION <i>By Dr. Howard B. Sprague</i>	16	GOLF NEWS	20
GOLF TOURNAMENTS	17	WHAT'S DOING IN GOLF CIRCLES	22
		AROUND THE OFFICE DESK	24
		MARKET PLACE AND BUYER'S GUIDE	25

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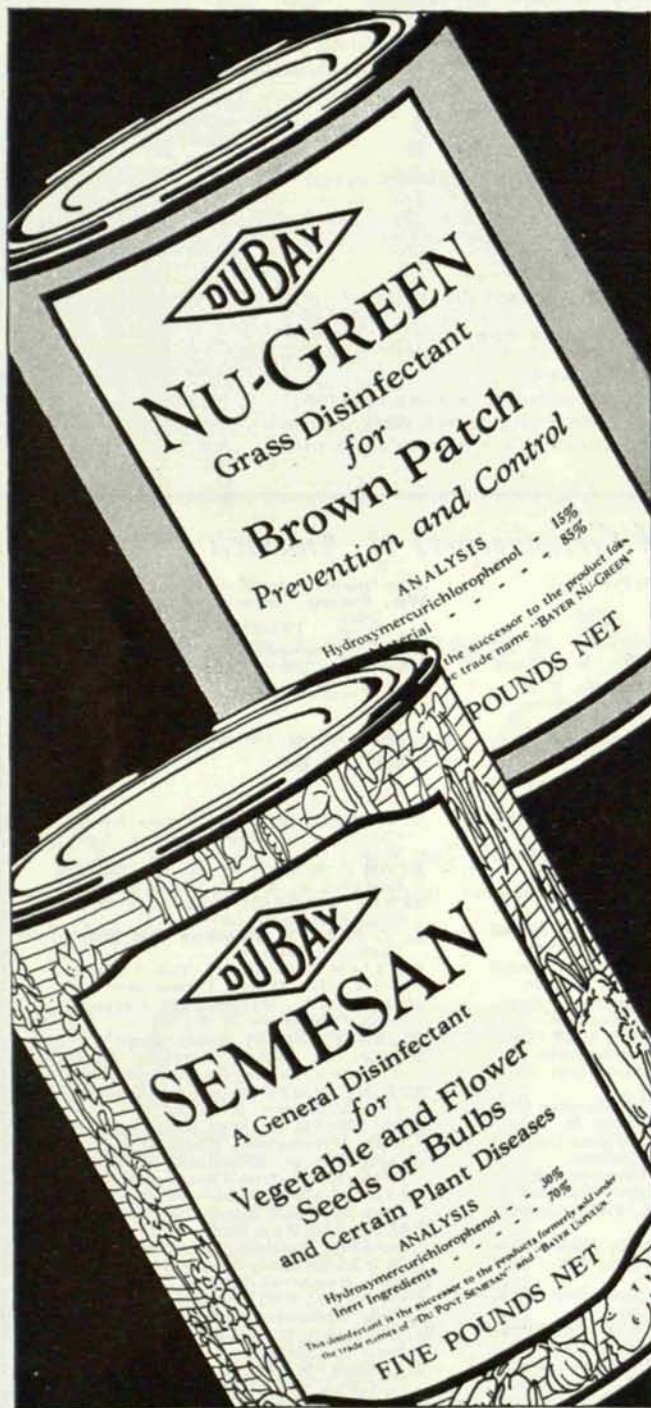
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# NOW...Watch out for

## BROWN PATCH



Midsummer weather gives brown patch "the edge" in the fight for healthy greens. So here is sound advice! Use a standard fungicide—and treat turf every week!

Du Bay Semesan—the original brown patch fungicide—is recommended for prevention and control of the disease where soil is normally fertile. Nu-Green (the only brown patch disinfectant licensed under U. S. Patent No. 1,787,581) is equally effective, but because it stimulates grass growth it is advised where soil fertility is lower.

Either fungicide, used as directed, is entirely harmless to turf. Order from your seedsman or golf supply house.

### LOWER PRICES to cut maintenance costs!

SEMESAN	NU-GREEN
25 lbs. .... \$51.25	25 lbs. .... \$33.75
100 lbs. .... 200.00	100 lbs. .... 130.00
300 lbs. .... 585.00	300 lbs. .... 375.00



#### Turf Disease Pamphlet Free

"Brown Patch Diseases; Their Prevention and Control" tells how to recognize principal grass diseases, when they occur, how to prevent them with DuBay Fungicides. Ask your seedsman or golf supply house, or write Bayer-Semesan Co., Inc., Dept. 96-A, DuPont Building, Wilmington, Del.

# SEMESAN NU-GREEN

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JULY  
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VOLUME VI  
NUMBER VII

# The NATIONAL GREENKEEPER

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America

## Bacteria In the Growing of Turf

By DR. J. G. LIPMAN,

*Director of the New Jersey Agricultural Experiment Station, New Brunswick, N. J.*

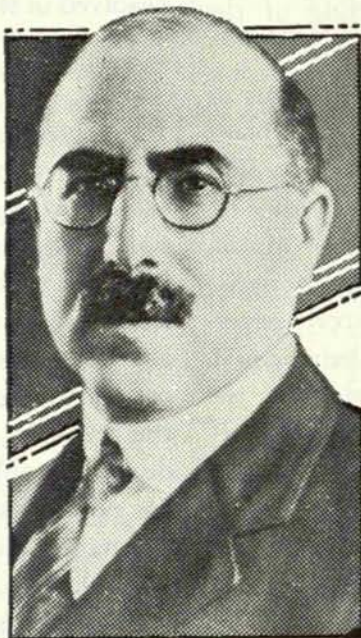
*Read at the 6th Annual Educational Conference of the National Association of Greenkeepers of America, held at New York City, January 19-22.*

SINCE the beginning of the present century, methods have been perfected for the growing of plants in water and sand culture. It is possible by these methods to grow normal plants in solutions, or in sand supplied with solutions, of known composition.

In such cultures, bacteria are not necessary. We may, therefore, say that *theoretically* bacteria are not essential for the production of grasses or of other plants. Practically, bacteria are essential. Even in water and sand cultures bacteria are not kept out; and the plant physiologist considers his pets in such cultures as sterile babies when they are not sterile.

The greenkeeper may find some interest in the fact that, theoretically, turf grasses may be produced in a sterile medium, but what concerns him most is the question whether bacteria play any part in the growing of turf under his particular conditions. He wishes to know whether bacteria may be a help or an obstacle to him. If they may be made helpful, he wishes to know how he may so modify his practices as to get the greatest use out of bacteria toward attaining his goal. In so far as bacteria may be a detriment, he wishes to know how the damage done by them may be lessened or entirely eliminated.

The discussion which follows will deal, therefore, with bacteria and other micro-organisms as a positive and negative factor in the growing of turf.



*Dr. Lipman, the author of this splendid article, has made an intensive study of the growing of fine turf and we offer here, to the readers of the NATIONAL GREENKEEPER, the results of his experience.*

The plants commonly used in greens are the specialized and selected representatives of their class. They are expected to thrive and to survive under conditions that would be fatal to most plants. Frequent and close cutting, the stimulation and overstimulation of root development, the compacting of the soil, and the frequently abnormal moisture, temperature and aeration conditions represent an environment that is not a normal one. 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 that turf grasses are made to undergo. Such devices and treatments must reckon with the pres-

ence and activities of bacteria.

As we analyze the factors which, in one way or another, affect the growth and vigor of turf grasses, we find that some of the factors may be grouped under the head of environment, while other factors may be considered in connection with the food supply of plants. Among the factors which influence growing conditions in greens, that pertaining to the amount, character and distribution of organic matter is of major importance. As to the amount of organic matter, it directly affects the circulation of air and water in the soil, and, to some extent, its temperature. Everything being equal,



the more organic matter there is in the soil, the greater will be the amount of water absorbed and held.

#### AMOUNT AND QUALITY OF ORGANIC MATTER

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 its physical nature may favorably or unfavorably influence root growth and the activities of soil bacteria. The distribution of the organic matter is also to be considered as 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.

Past and present studies of the root systems of grasses indicate that the soil zone from which plant roots draw their nourishment and water supply may be shallow or deep. Under some conditions, the plant roots are confined in a thin layer of soil. Under other conditions, the root zone may be measured by feet rather than inches. It is scarcely necessary to point out here that, 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.

Actively growing plants require a liberal supply of the element carbon. This is obtained from one of the air gases known as carbon dioxide. It is well to remember that approximately 50 per cent of the dry weight of grasses, and of other plants, is represented by the element carbon, the element which makes up all but a small portion of the entire weight of coal or charcoal. There is only about .03 per cent 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. As will be noted later, bacteria play a significant role in the maintenance of a reasonably constant supply of carbon dioxide in the atmosphere.

Actively developing plant tissues contain only 5 to 10 per cent of dry matter. The rest of it is water. Without an adequate water supply, the 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, insofar 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.

#### WATER AND AIR IN PORE SPACES

WHEN the soil is dry, the empty space, or so-called *pore* space, is occupied by air. 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. Furthermore, the upsetting of normal conditions in the relation between soil moisture and soil air would also disturb the desirable balance among the various groups of soil micro-organisms.

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.

The plant food capital of the soil represents a certain turnover, in a sense analogous to the turnover of the commodities on the merchant's shelves. There is, however, an essential difference in that the merchant must replenish his supplies from the stock of the wholesaler or manufacturer. 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 trans-



formation into material made unavailable. Such material may be worked over again, in a sense like scrap iron that is reworked into steel. The manufacturing process in the soil is carried on largely by bacteria and other micro-organisms.

It happens that one of the plant nutrients prominent in promoting growth of the tops and roots of plants is nitrogen. This plant nutrient is of particular importance in the growing of turf. Nearly all of the 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.

#### SOIL NITROGEN IS LOCKED UP

**M**ORE of the soil nitrogen is locked up in these organic materials. They must be broken down and the nitrogen released in the form of ammonia and nitrates. Bacteria and other soil micro-organisms are the living agency on which we depend for the breaking down of the soil organic matter and for the manufacturing of ammonia, nitrates, sulphates, phosphates and of other essential plant nutrients. We should also remember that the extent and intensity of the biological activities in the soil is determined by the amount and composition of the organic matter, the environmental conditions relating to water, air supply and temperature, and soil treatment which involves applications of chemical fertilizers, lime, composts and other materials.

*Everything else being equal, the warmer the soil 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 a soil of this character, bacteria actively compete with the higher plants and interfere with the growth of the latter insofar 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 is successful, so tunes up the biological machinery in the

soil as to create optimum growing conditions for the plants in which he is interested.

#### SUPPLY OF WATER IS IMPORTANT

**I**N THE light of the above, it may properly be asked how our practice may be so established as to give us the best greens under any given set of conditions. We realize that, from the standpoint of environment, turf grasses must be well supplied, but not over supplied, with water. We know that in many greens drainage conditions are far from satisfactory. An examination of the plant roots will 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 enriches 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 loose sandy soil more compact. 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.

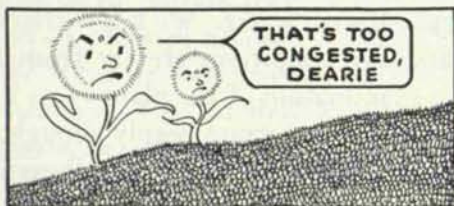
There is another factor in the use of composts that should not be overlooked. In one sense, good compost is like yeast, in that it inoculates the soil, supplies it with billions of bacteria and sets up fermentation of soil organic matter that results in liberating a more adequate supply of available plant nutrients.

#### SOIL INOCULATION NEEDS STUDY

**T**HE 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 be able to



# Weeds Never Heard of the Depression



An Editorial  
on Golf Course  
Maintenance

The Dandelions and Plaintains aren't practicing birth control. They're still in full-time production—looking for bare spots in your fairways to give their offspring a start in life.

The only way to check weeds is to beat them at their own game. Sow good grass seed, develop strong, thick turf or the weeds will take over the huge investment you have in your golf course and run it to suit themselves.

Keep up your layout. If necessary, give dime banks as trophies this year instead of diamond-studded gimcracks, or serve ginger ale in unbreakable tin cups. But don't cut down on grass maintenance. Good golf is BUILT from the ground up and turf can't be applied like a coat of paint.

Now is the time to plan on Fall seeding. Insist on Scott's weed-free seeds of proven quality. More than 1300 other golf courses have found it pays even in years when prices were much higher than now.

Wire, Phone or Write for Prices.



develop artificial inoculants that could be applied to greens as a means of accomplishing the various improvements that an active soil bacterial flora may make possible.

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. The stimulus which soluble nitrogen salts furnish to turf grasses is nothing short of striking. It may be over done, as we all know. 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.

In following the best fertilizer practice that he knows of, the greenkeeper may use too large quantities of chemicals. He may use too little. He may apply too much at a time, and he may fail in making a uniform distribution of these materials. He 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. He knows, or should know, that over-emphasis 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. Out of his own experience and observations, the greenkeeper has much to draw upon. If he will supplement his own fund of knowledge with technical information readily to be had from technicians and soil specialists, he will be on the way toward defining a practice for himself that will give him both results and satisfaction.



# Sins of Commission and Omission

By ALFRED E. LUNDSTROM, *Greenkeeper,*  
*Berkshire Country Club, Reading, Pa.*

THE gross cost of blunders made in the construction and maintenance of golf courses is impossible to estimate. The best we can do is to guess. We can readily understand why mistakes were made years ago, when there was no precedent to follow, but when they are made in this era of "scientific efficiency" it is not so. It simply proves that human nature does not change, and that like the poor, the simple-minded and gullible are still with us. However, there is a reason even for this. The average golf club member belongs to the office-and-desk executive type whose knowledge of the actual workings of the natural elements is at best only indirect.

Of course, he knows that grass is, or ought to be, green; that soil is something that grass grows in; and that a little water now and then is good for it. But when it is a question of constructing a new course, or even the maintenance of one, he finds himself in a *terra incognita* where his more or less profound knowledge of the stock-market, or legal technicalities, or political intricacies is of no avail. He contacts a set of activities entirely new and foreign to his training and mental habits.

## THE SAD AWAKENING

AT FIRST, when the construction program begins he is usually tremendously enthused, and gullible enough to believe everything that the experts tell him, and hence very acquiescent and pliable. But it is at a later stage, when faults of construction and a senseless waste of money become only too glaring and obvious, that the pale cast of thought sicklies over his countenance. And when the inevitable special assessment and higher dues are found necessary



*Alfred Lundstrom really should have the title of Professor because of his world-wide experience in the building and care of golf courses. While he speaks very frankly it is all for the good of golf.*

in order to make both ends meet, the erstwhile meek lambs are metamorphosized into roaring lions.

There is a reason for this also. In every group of men there is always the Leader—the Master Mind—some dominant or even domineering character to whom the others look up to with awe and admiration as one whose judgments are infallible, who can do no wrong. He is as it were the keystone in the arch. He cheerfully and as a matter of course assumes all responsibility, and the others are only too glad to have him do so. But alas! as often happens, under the stress and strain of practical application the "Master Mind" proves to be the weakest link in the chain, and we all know that no

chain is stronger than its weakest link. There is a flaw in the keystone, and the arch comes tumbling to the ground with a great scattering of bricks, dust and confusion.

In a recent development that I have in mind they underestimated the golf course construction cost 74% (and without doubt all other improvements in the same proportion) simply because they allowed one man to dictate the choice of architect, design, contractors, and methods of construction—all without opposition. During this period those whose duty it was to protect the club merely stood at attention like well-trained and respectful boy scouts when the scout master lays down the law. Later, however, when it was discovered that the actual cost of construction (of the golf course alone) was 74% more than they had been led to believe, there was consternation and dismay in the erstwhile harmonious camp, and there was heard ominous rumblings of revolt.



This huge sum would not be so bad if they really had a modern and meritorious golf course—but they have not, for it is built on solid clay with not a foot of sub-drainage either in greens or fairways. The physical conditions of the soil, even in the greens, were never taken into consideration, badly as it was needed. It is a solid aluminum clay which should have been treated accordingly. And as for the design of the greens, I can best picture them all in the shape of a coal shovel, thus causing water to stand in the middle of the green and the approach—a most favorable condition for breeding disease and to cause scald.

From the standpoint of distribution the irrigation system is a joke. The supply is ample enough for the most lavish use, still its volume was not taken advantage of as it only has one (1) three-quarter-inch opening for each green, and for each fairway one (1) one and one-half (1½) inch opening. And with this they actually expected soft tees and greenswards in September!

#### FLAGRANT FAULTS COST MONEY

FROM the very beginning the Master Mind's attention was called to the flagrant faults, time and

## When Discriminating Greenskeepers Themselves Conduct the TEST

—then is when actual performance in mowing has its inning—then mere TALK does not count, but actual PERFORMANCE. Jacobsen revels in such tests—tests involving hand mowers and ALL other makes of power putting green mowers—ALL of them—tests of speed and EXCELLENCE of work. When greenskeepers do THIS

### —they Buy the JACOBSEN

Hundreds of instances substantiating this statement are recorded. The greens brush attachment improved greens with every cutting—time reduced one-half, reports Hillcrest Country Club, of Los Angeles.

Complete satisfaction, greater speed, very small maintenance

costs, reported by U. S. Golf Association, Green Section.

Used on bent grass, made greens smoother than hand mowers, in one-fourth time, says Jefferson City, (Mo.) Country Club. Saved \$350 in one season (one Jacobsen mower) for Surprise Park Golf Club, Cedar Lake, Ind.

#### FREE Demonstration Anywhere Any Time

Name the place and the date. We challenge comparison. Remember, the Jacobsen Power Putting Green Mower is more than a mower. It is a greens conditioner. Greens brush and power transport optional equipment. Sales and service everywhere. Write for catalog and terms.



**JACOBSEN MFG. CO., Racine, Wis.**

**JACOBSEN**  
BUILT TO SAVE RUNNING EXPENSE

time again, not only to the unscientific way of building a course without a topo-map or soil-checks or drainage or water, but also to the obsolete type of machinery used as well as methods of construction and labor.

The only accounting system, to my knowledge, was the time-book and the gross amount of money spent, and no one knows what any individual branch of the development cost. In all, it is a hit-and-miss proposition, and the net result is a course that must be rebuilt before it can compare with a modern, well-constructed course.

It is hardly necessary to say that all of these stupid blunders have created a spirit of rebellion which even the lowliest workman on the course is aware of. The blame, however, should not be laid so much on the self-appointed dictator as on those who could at least have greatly modified his activities for the better—if they had possessed what is commonly known as “backbone.” Of course, committees were appointed, but they made themselves conspicuous by their absence while construction was going on. But these are the very ones who now complain the loudest. But it is no use; the damage is done, and they might as well grit their teeth and assume the burden.

#### GREENKEEPER MUST CARRY THE BURDEN

NOT only feel sorry for those who must pay for these blunders, but particularly for the greenkeeper who must carry on under all these handicaps and until the course is reconstructed. Ninety-nine per cent of the membership do not understand the true conditions and will invariably blame him. He is not in position to explain his side, for he comes in intimate contact with but a few of the members, and consequently is helpless. His bread and butter depends on his silence. If he protests, then he can make up his mind to look for another job, and if those who really are to blame were to confess it, then a miracle would happen, for the average man of affairs is loath to have his mistakes and ignorance become publicly known.

There are courses built years ago that stand today as creditable monuments to their designers and builders, and some of these may well stand as patterns for some of our present builders. Gross blunders are inexcusable today. There is no reason why a golf course cannot be constructed within a certain limit of cost, and at the same time be a meri-