The National Greenkeeper

Isn't this the sensible way to fight... BROWN PATCH?

Year by year, one greenkeeper after another is making this decision: It's easier to prevent brown patch than to repair turf damage caused by the disease. And it costs a lot less!

At hundreds of the nation's finest courses, greens now are treated at weekly intervals throughout the season to prevent brown patch. With the two most dependable fungicides, Semesan and Nu-Green — both now available at new low prices — preventive treatments for the entire season cost but a fraction of the initial investment in your greens. Contrast this small cost of brown patch prevention with the usual high cost of course maintenance or even with the expense of returfing greens destroyed by brown patch—and you'll see how sensible this plan of protection is!

Used regularly, either Semesan or Nu-Green will effectively protect turf against both large and small brown patch. When the disease has already appeared, either fungicide will kill it promptly, without even the slightest injury to turf.

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prevents and controls the disease under all conditions, but is especially recommended where the soil is highly fertile. Nu-Green contains the same effective ingredient as Semesan, plus other ingredients which invigorate grass growth. For that reason, it is advised where soil fertility is lower.

Both Semesan and Nu-Green (the only brown patch disinfectant licensed under U.S. Patent No. 1,787,581) may be obtained from your regular seedsman or golf supply house. Order now and start turf treatments at once to protect your greens.

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Write today for new pamphlet, "Fungicides for Controlling BrownPatch."Gives treatment methods; advice on disinfecting grass seeds; opinions from turf experts and well knowngreenkeepers.



SEMESAN 25 lbs., \$51.25 100 lbs., \$200.00 300 lbs., \$585.00



NU-GREEN 25 lbs., \$33.75 100 lbs., \$130.00 300 lbs., \$375.00

Economy on the Golf Course

By JOHN QUAILL, Superintendent, Highland Country Club, Pittsburgh, Pa.

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

I N THESE dark ages of business depression when everyone is yelling economy and cutting budgets here and there with the one thought in view of saving money, it is the greenkeeper's hard luck to be the goat in a lot of the budget cutting. The Board of Directors and Finance committee of the average country club are holding night sessions trying to figure a way out of the financial difficulties which practically all of the clubs of the country are faced with today. The usual outcome of these meetings is the order to cut down expenses and cut them deep.



JOHN QUAILL

One of the younger greenkeepers who has made a remarkable reputation at one of the most prominent courses in the Pittsburgh district. As the saying goes, "be knows bis stuff." fertilizers and others lean toward the architectural side and construction. The greenkeeper who can sit down and figure out his own problems and the best methods of working his men and the best fertilizers to use is the man who has nothing to fear in this time of budget cutting. He will find a way out and will not have to suffer in the next few years from the economy he was forced to practice this year.

True economy can be traced back to the construction days of the course. Did the contractor look ahead to the problems that the greenkeeper would have to face? Did the architect lay out the

The one thought is to save money this

year. Did the Board of Directors and the Finance committee look ahead a few years to see what the outcome of this economy program was going to be? Did they consult the greenkeeper and ask, if there were no fertilizers put on the fairways for a couple of years what would become of the beautiful turf that the greenkeepers worked long and hard to get? Did they figure that the cost of repairs and the loss of time keeping the old equipment going would be more costly than some new equipment; something more efficient and more economical to operate? In ninety-nine out of a hundred cases they didn't.

NO TWO COURSES ARE ALIKE

S OME courses can be more economically maintained than others. No two courses in the same district can use the same methods. No two courses get exactly the same results from the same brand of fertilizer. In each case, there is a particular problem which must be met at each course. The demands of the membership, the wealth of the club, the attitude of the officers and directors and last but not least, the knowledge and experience of the greenkeepers are vital factors.

Some greenkeepers are born executives, some are experts in the mechanical line, some are experts in course with the view of economical upkeep? The chances are that they didn't. Their idea was to build a golf course and make their money out of it and the club could worry about the other stuff.

TOPOGRAPHY AFFECTS UPKEEP COSTS

T_{HE} topography of a course has a lot to do with the upkeep costs. A flat or level course can be maintained far more cheaply than the hilly course. The rolling or undulating type of course offers few problems. But, if they were poorly constructed, they can run up the costs very fast.

When the greens were built, were they great big greens of fifteen or twenty thousand square feet? Where is there any economy in having a green that big? The cost of mowing is greater, the cost of fertilizer is greater, the cost of topdressing is greater and think of it when Brown Patch hits the big green! The cost of fungicides will amaze you to say nothing of the amount of worry you have.

The only advantage of a big green is that you have more playing surface. And very often these big greens are used up in useless rolls and undulations for, without these, the green would look like a baseball diamond. It would have been better to have a green of six or eight thousand feet or smaller April, 1932

The National Greenkeeper

NEGLEC

THIS year, more than ever before, golf clubs will be known by the players they keep! And the players they keep will be determined by the fairways they keep. Next to building a new course the most impressive thing you can do is to build fine turf.

Don't neglect your fairways. Thicken up your turf and produce luxuriant growth by the use of Nitrophoska — the concentrated, complete fairway fertilizer. Nitrophoska is economical four times as rich in nitrogen, phosphoric acid and potash as the ordinary complete fertilizer. One ton is equal in plant-food to four tons of ordinary fertilizer. Moreover, all of its plant food is soluble and quick-acting. And, because it is granular, it is as easy as wheat to broadcast. Early spring application of 200 pounds per acre produces marvelous results on fairways — gives you better turf at low cost. Order now from your supply dealer or direct. Synthetic Nitrogen Products Corporation, 285 Madison Avenue, New York.

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your

fairways

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Urea is recommended by the U. S. Golf Association. It contains 46% nitrogen (55.9% ammonia), in the same soluble organic form as nitrogen in liquid manure. It is *both* quick-acting and long-lasting, and does not leave any undesirable residues in the soil. It gives the grass a healthy, dark green color, and produces unequalled results in spring, summer or fall.

15–30–15 Use Nitrophoska — the Fairway Fertilizer and be able to keep it right and keep it more economically.

If they had to make something large it should have been the tees. Too often the tees are cut down to a thousand square feet when they should have five thousand square feet in them. This is one of the best places to economize that there is on a golf course. In the first place, you can move the markers often and always have a good teeing place. It will give the used part a good chance to heal. On a level course where there is not a steep terrace, the tees can be cut with the fairway mower. At any rate, the power mower can be used to good advantage.

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

HILLY COURSE COSTS MORE TO MAINTAIN

O_N A hilly course, problems of economic upkeep are so many that you could keep talking all day on the subject. Usually, the tees and greens have to be built way up and this means terraces. If you haven't the money and material this means steep, sharp slopes. This in turn means they have to be cut by hand with a scythe and that form of labor is costly. Keep the terraces long and gentle and the old power mower can do the work. Irrigation, drainage, and fertilization all present big problems on the course with many hills.

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 economical to keep up. There are less banks and terraces and less work in trimming. If they are properly constructed, the amount of labor required will be negligent 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.

Good equipment is the best insurance against high upkeep costs. A piece of equipment that is in the shop about one day out of five for repairs is a drain on the treasury. You not only lose the services of the machine but you lose the time of the men repairing it and the cost of repair parts. Buy good, reliable equipment and have a good mechanic take care of it and you will have satisfaction. With the new type mowers on the market today cutting a swath up to twenty-six feet wide, you can almost forget your fairway mowing.

GREENKEEPER SHOULD CHOOSE HIS EQUIPMENT CAREFULLY

 $T_{\rm HE}$ greenkeeper should pick out the type tractor and mowers best fitted for his particular needs and standardize on that type. If you have three or four different makes of mowers and one of them goes bad, you have a job for a couple of mechanics and a machinist to make them hook up with the ones you are using.

Probably every greenkeeper has his own ideas when it comes to tractors and mowers, but a fellow can hardly go wrong these days with the fine equipment on the market. Some prefer a push type tractor and some prefer the pull type. Each has its own advantages and drawbacks. The push type offers a clear view of the mowers and where you are going and does not lay the grass down before it is cut. It is easy on the operator as he does not have to turn around continually to watch his mowers and a lot of other conveniences which are not found on the pull type.

On the other hand, the pull type is more flexible and can be used for a number of other purposes by simply unhooking the mowers which takes some time with the push type. The general trend today is towards the pull type. The average course can be cut in from eight to fourteen hours with the modern tractors and when using the extra wide mowers this time can be cut by a couple of hours. Saved time means saved money so here is one place to start economizing.

POWER MOWERS FOR GREENS HAVE DRAWBACKS

 $P_{\rm OWER}$ mowers for the greens have their good and bad points. Anyone who likes the power putting-green mower can save time by using them. When I say this, I means the triple mower. The single mower does not save all the time claimed for it and there is not much difference between that and the hand mower. On the hilly course, transportation of a power mower means a lot. Taking my course as an example, which is sure hilly enough as any one who has been over it will verify, the triple mower would not save so much time as we would lose all the time gained by faster cutting in getting from green to green. We would have to double back quite a distance to get around. As time April, 1932

is what we are trying to save, it is not the last word for us.

Power mowers can well earn their upkeep other places though. Tees and approaches can be cut very quickly and in good shape with the thirtyinch power mower. One man on my course last season cut all the tees and approaches in a day and sometimes had enough time left to cut the lawns around the clubhouse. Before we got the power mower, three men were doing the same job. Where the terraces are long and gradual around the tees, greens and traps, the power mower holds its own. A man with a power mower can take care of all these in very little time and make a better job than by hand with a scythe.

Modern equipment for topdressing and spreading fertilizer is a great money saver. It is nothing to topdress eighteen greens a day with the topdressing 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 which we altered a bit. We covered fifteen 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.

PRICES DOWN AND BUNK IS OUT

Now that we have discussed the equipment and construction end we will get into the purchasing end of the question. It is gratifying to know that prices are on the downward trend and that will help out a lot. A few years ago, the golf course was the easy mark for the seed and fertilizer salesman but through the Green sections, the service bureaus and the Greenkeepers' associations, that has all been changed. A few years ago, if a salesman came around we had to take his word for a lot of bunk about organics and inorganics, soluble and insolubles and a lot of other things that the average greenkeeper did not fully understand. All he knew was that he wanted an organic base in his fertilizer



Lower Prices

With prices the lowest in 15 years, it's even more important to be sure of quality. Sow Scott's pure, weedfree seeds. About 1300 other courses find it pays.

Turf Builder

Use this ideal grass food on greens and fairways this spring. Paul Dye, Urbana (Ohio) Country Club, tested various fertilizers last year. Turf Builder outshone the field in results and small quantity needed.

Bent Stolons

Our Washington and Metropolitan strains will be ready for shipment the latter part of April.

Free Booklet

Copies of our popular treatise, "The Putting Green," are still available. Contains 40 illustrated pages on construction and care of greens.



and the salesman could sell him most anything with that base.

But since the greenkeeper has become better educated through the annual conferences and short courses conducted by the colleges he knows more than the average salesman about his fertilizers. Fancy names, and fancy claims go hand in hand with fancy prices. Do not be misled by great, big important looking analyses on the bags. Most times they don't mean a thing. I once saw a bag of fertilizer with a fancy name like Greely Great Grass Grower for Golf Greens with an analysis like this.

| Nitrogen | 4.2 per cent |
|----------------------------------|--------------|
| Equivalent to Ammonia | 5.0 per cent |
| Phosphoric Acid (Soluble) | 6.0 per cent |
| Phosphoric Acid (Reverted) | 2.0 per cent |
| Available Phosphoric Acid | 8.0 per cent |
| Insoluble Phosphoric Acid | 1.0 per cent |
| Total Phosphoric Acid | 9.0 per cent |
| Potash (Water Soluble) | 5.0 per cent |
| Equivalent to Sulphate of Potash | 9.4 per cent |

What was really meant by this analysis was that it was just another 5-8-5 fertilizer and priced at eighty dollars a ton it was far from cheap. Most fertilizers have been overpriced considering that a large percentage of them are made up from waste or by-products. Why pay \$75.00 a ton for an 8-5-2fertilizer which means you are paying \$5.00 per unit for plant food when you can buy forty units of plant food for \$80.00 a ton or \$2.00 per unit, a net saving of \$3.00 per unit.

A ton of sulphate of ammonia and a ton of 20% super phosphate costs about \$60.00. You are getting forty units of plant food at the cost of \$1.50 per unit. If you prefer an organic base fertilizer, you can buy a complete fertilizer today that sells for about \$30.00 per ton with an analysis in itself of about \$-4-2 or at about \$2.00 per unit. By using this as a base and building it up with sulphate of ammonia and super phosphate you can have a fertilizer that will give results for a cost of about \$2.00 to \$2.25 per unit. Think this over before buying your fertilizer and see how much you can save.

GOOD GRASS SEED IS INSURANCE

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 seed with a germination percentage of 60% for \$30.00 per hundred pounds when you can buy at 80% seed for \$35.00 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.

In every country club there are members who sell things you need on the golf course. These men are always after the business and too often want to make their profits from the club pay their club expenses. Some even go so far as to quit the club because they do not get the club's business. Buy where you get the best quality and price regardless of who the members are. You will be sure to have the majority behind you and they will uphold you if you are right.

I know of a certain case where the club was putting in a watering system and they were in the market for quite a lot of pipe and fittings. About ten members of that club sold pipe and all ten wanted the order and threatened to resign if they didn't get it. The club finally split up the order into about ten parts and about ten different kinds of pipe were used on the job. When it came time for delivery, every one delivered at a different time and some only part delivery. The job was continually tied up for lack of some needed item which had not been delivered. It almost took an expert accountant to figure out who had the order for the needed items and then it was a case of calling and begging for delivery.

The following year, the lines were extended and this time, the club advertised for bids on materials The lowest bidder meeting the specifications got the order and the funny part about it was that no one quit the club. Everything went along red and rosy and the job was finished up in good time because material was there when needed and if it wasn't, you knew who to blame.

The wide-awake greenkeeper will hunt out his best sources of supply and stick to them as long as they treat him right and give good quality and service at the right price. Oftentimes, when two or more clubs are located close together, considerable money can be saved by co-operative buying or the pooling of orders for supplies. The price on fertilizer is cheaper per ton by carload lots than by less than carload lots. By getting their heads together, they can figure out some good substantial savings. WHEN CLUBS ADOPT ECONOMY PROGRAM WHEN a club adopts an economy program it usually starts with labor reductions and wage reductions. This is all right if they are willing to concede a few points relative to upkeep and appearances. When you are forced to work with a short crew something has to suffer. Your course loses that well-groomed appearance. Little things that make a good course have to be dropped. The first thing you know, some one is kicking because the ball washers aren't filled or the towels are not clean or the patch of weeds way off to one side look like thunder and a hundred other kicks.

It's the little things like ball marks on a green or divot holes in fairways that get the players' goats. After driving straight down the fairway for two hundred and fifty yards to have your ball end up in a divot hole or the ball on the green comes to rest in a ball mark is enough to make any golfer kick and damn the course. Cutting down your force cuts out all these little items that help to make the game what it is today. If we leave the the big items like regular fairway or green mowing go, the kicks are just as bad and a kicking membership means a dissatisfied membership and it won't be long till they will be yelling for your scalp.

If wages are reduced, the help kicks and they do not put their hearts into the work and again the course suffers. If a man is dissatisfied, he will not make a good man to have around. He will poison the other men in contact with him and the poor greenkeeper then has his hands full.

With dissatisfied help, the greenkeeper becomes dissatisfied and will probably end up by throwing up his job. He has to work hard to get the most out of his crew and has no time to relax and plan out a program for the best upkeep of his course. If you have to cut down your crew, see that you get enough good equipment to be able to do the usual work with less labor. If a machine will replace two men, alright, but don't buy a machine to replace one man for you are not gaining a thing because it takes a man to operate the machine.

PAY A FAIR WAGE FOR A FAIR DAY'S WORK \mathcal{P}_{AY} a man a fair wage and insist on a fair day's work in return. If a laborer will not give you a fair day's work he has no place in your crew and will spoil the other men. Vary your men's work so they will get a chance to do a little of everything.



—by comparison, investigation, or actual test—and you will find F. & N. Mowing Equipment truly superior in every respect: Smooth mowing. Ease of handling. Long, trouble-free service.

Smooth operation is permanently assured with F. & N. Unbreakable TITAN Fairway Mowers and with F. & N. Putting Green Mowers — every one is equipped with the senuine, patented F. & N. Self-Adjusting Device in the revolving reel. No difficult hand adjusting or poor mowing with these

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BEST OF ALL, patented self-adjusting ball bearings.

The new, *all-steel* gang frame is also stronger, lighter, more flexible, more efficient. Fits any tractor. Handles three to five mowers. Fully guaranteed throughout

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The F. & N. Putting Green Mower

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erywhere say this mower is easily the finest they ever used. Self-adjusting reel bearings. Alemite oiling, etc. Rubber-tired carriage for transporting is furnished. Write for particulars.



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The National Greenkeeper

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A fellow gets tired of sitting on a tractor all day cutting fairways. Give him a chance once in awhile and he will appreciate it. The same applies to the men who cut the greens. After pushing a mower for a few hours he will be glad to do something else. This is one of the best ways to keep the men satisfied.

Another good idea is to get your men interested in the game. If a fellow plays a little he will appreciate a good green and all other departments of the course. He will see how necessary it is to have a true surface on a green or a good lie on the fairway. After he gets into a few deep footprints in a sand trap he will see that they are raked properly and regularly. A man interested in his work is usually a success and this applies to the ordinary laborer as well as to the scientist.

The greenkeeper has enough to do without undertaking a lot of work that his men should be doing. Some greenkeepers pitch right in and mow greens and drive tractors and do about as much work as two or three of his men. While he is working so hard, his men are probably sitting under some tree or at the barns waiting for orders. The greenkeeper has enough to do when he properly oversees the work. He should have time to plan his work weeks ahead and think out new ideas. He should have time to experiment along scientific lines with the thought in view of more economical and efficient maintenance.

My chairman once told me that when I pulled a weed from a green I was doing some other man's work and that I was getting paid to see that he did it. When the greenkeeper is working hard it is very likely that a couple of his men are standing around watching him work and wondering how long he is going to last.

Practically every club in the country is retrenching at this time and thinking out the financial problems which are confronting them. So now is the time for the greenkeeper to get his words in and explain 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 a good hat that they will approve a bunch of them and give you credit for being wide awake and on the job.

(Continued on page 34)

Soil Structure of Putting Greens

By KENNETH WELTON

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

IT SEEMS most appropriate that the subject, "Soil Texture of Putting Greens," be brought to your attention at the commencement of a conference during which the putting green will probably receive major consideration. In the study of any subject it is always well to start at the bottom and recognize the fundamental facts concerning it before progressing to the many phases which will develop later. Following this line of reasoning we will commence far below the putting surface, with the fill or subsoil.

The sub-soil is important to the turf on the green insofar as it influences drainage and the rise of water from below by capillary attraction. We require large quan-

tities of sub-soil or fill in building putting greens and fortunately it does not matter a great deal what type of material we use since we can modify the construction to suit the soil. When using fine soils, such as clays or silts, we should pay particular attention to procuring uniform drainage from the top of the fill. In other words the fill should have good surface drainage before the topsoil is put on it. No depressions or pockets should be left to collect water and toxic materials, and no sharp or high mounds should be left to shed water and dry out quickly.

For safety's sake tile underdrainage should be put in clay and silt sub-soils. Layers of various materials, such as cinders, sand, gravel and peat, should not be laid between the topsoil and the sub-soil. In the past this was common practice but most greens with such construction have had to be rebuilt. Such layers interfere with the natural rise and fall of soil



KENNETH WELTON Member of the staff of the U.S. G. A. Green Section, who bas made an extensive study of soils in relation to fine turf.

moisture. Porous layers drain the topsoil too thoroughly and cut it off from the reservoir of moisture and fertilizing elements which rise from the soil below much as ink rises on blotting paper.

Lines of tile quickly carry away excess water and do not interfer with the rise of capillary moisture in the soil. Layers of clay or peat are sometimes put on sand fills to preserve moisture but these layers are as bad as layers of cinders or sand on clay fills. They prevent natural drainage and elimination of toxic materials from the topsoil. It is better to use the clay or humus to prepare a deeper topsoil on a sand fill.

We now come to that important part of the putting green which

surrounds the roots of the turf and supplies the plants with food and water—*the topsoil*. Let us first consider the topsoil from the golfer's viewpoint. We all know how important modern golf architecture is in making the pitch shot. And we know that by far the large majority of golfers use that shot either from necessity or preference in the approach to the putting green.

If the soil is as hard as concrete it is impossible for the average player to hold the green. Hence, when greens become in such a condition 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 and the soil become more packed or puddled and if allowed to dry it 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.

Now, let us consider the topsoil from the greenkeeper's viewpoint. 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 the 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 the soil 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 players' and the greenkeeper's point of view, and we must select or mix a soil which is suitable.

STUDY OF SOIL IS MOST INTERESTING

BEFORE speaking of topsoil preparation I would like to remark that soil is not the commonplace ordinary material which some think it to be. The study of soil is a most interesting one, and anyone who follows the study to its ultimate conclusions will find it as highly technical as desired. The more familiar greenkeepers become with soil phenomena the more intelligently they will be able to attack the many problems in plant growth.

The soil layer is a comparatively thin one covering the solid part of the earth below. This layer originated from broken and weathered fragments of rock. At first simpler forms of vegetation grew on the pulverized rock, then more highly developed forms. Each tribe of plants has taken mineral matter from the disintegrated rocks and carbon and oxygen from the air until the soil has accumulated a great store of organic matter and a teeming population of microscopic life.

The soil has three general phases: the physical,

which has to do with the size and shape of the particles, the movement of air and water in the soil and other physical aspects; the chemical, which deals with the composition of the particles; and the biological, which deals with the minute forms of life which are of great importance in manufacturing food for plants. The greenkeeper is concerned with all these phases but chiefly with the physical since he can influence the other phases sufficiently with his cultural practices providing he has the proper soil texture and structure to start with.

Soil texture refers to the six of the soil particle. Soil is classified into various types such as sand, silt and clay according to its texture—the sand being the large, coarse particles, silt finer particles and clay still finer. There are numerous classifications or soil types depending upon the proportion of particles of various sizes. Loam soils are mixtures of coarse and finer particles along with more or less organic matter. Soil structure is the arrangement of the particles in the soil, and the arrangement may be such that the soil is crumbly, open, and porous; or tight and compact.

Soil plasticity and cohesion have a great influence on soil structure. Plasticity of soils enables it to be molded into various forms without fracturing much as can be done with putty. Cohesion is closely related to plasticity and is the tendency of the particles to stick together and preserve the mass intact. Plasticity will allow soils to lose their crumbly nature and become puddles when wet and cohesion will hold the soil mass intact like rock or brick when it is dry.

Soil structure is largely dependent upon plasticity and this in turn is largely dependent upon soil texture since plasticity is most marked in the finer particled soils such as silts and clays. In coarse sandy soils plasticity is nil.

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, the moisture is held within the organic matter and a certain amount of organic matter in finer soils increases the drainage and loss of free water by keeping the finer particles from settling together into a more or less compact mass. Soils with sufficient organic matter do not dry so quickly