Bulletin of the Green Section of the U.S. Golf Association

Vol. II

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No. 3

A MONTHLY PERIODICAL TO PROMOTE THE BETTERMENT OF GOLF COURSES

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Foresight

The title of this editorial does not indicate a tendency toward clairvoyancy, but rather a warning that unless common horse-sense is applied to the problems of golf course maintenance the green committees of clubs and the Green Section of the United States Golf Association will get nowhere.

Though the results of the first year of the Green Section were apparently flattering, we are constantly in receipt of letters that show courses maintained by successful, intelligent men in the same old haphazard way without a thought of the past or the future.

Our title might well have been *Foresight and Hindsight*, for the two go together. Foresight without the retrospection of hindsight is plain guess-work.

To illustrate our sermon, we have before us a letter from a club that has a beautiful bluegrass turf. It is so located that a plentiful supply of manure should be easy. Nevertheless, the 1922 budget of the club forecasts an expenditure of about three thousand dollars for seed and commercial humus.

That seeding on established turf is, to say the least, of doubtful value, has been determined time and time again. That good old-fashioned compost made of manure and loam is better than so-called humus, cannot be denied.

Why, then, in the name of common sense, should not this particular club look ahead a little? Why not cut some of the seed and humus out of this year's program and provide for the future by starting a compost pile, which will pay dividends year after year in the way of reduced expenses?

Did you ever see a successful gardener or greenhouse man without his compost pile? Did he ever let a year go by without replacing new material in his pile to take the place of what was used up?

If the ordinary gardener or greenhouse man cannot afford luxuries such as humus or excessive seed, it is a certainty that a green committee cannot.

Any club in the Green Section of the United States Golf Association that does not start a compost pile in 1922, if it has none now, and every club that does not keep up its compost pile year by year, should be fined, excommunicated, ostracized, or something worse. The bigger the pile, the better, because it is like money in the bank; but if funds will not permit the starting of a big pile, then start a little one; but make a start. The minimum should be around fifty cubic yards—we never saw too much on any course.

Look back to see the mistakes of the past and look ahead to their correction.

Back Numbers of The Bulletin

The Green Committee still has available a limited supply of the 1921 Bulletins. Not all numbers can be furnished, but most of them. These may be obtained at 20 cents per copy.

The Green Committee of the U. S. Golf Association is always glad to publish items showing how work around courses can best be done.

The New Officials and Committees of the United States Golf Association

OFFICERS

President—J. Frederic Byers, Allegheny Country Club. Vice-Presidents— Robert A. Gardner, Onwentsia Club; Wynant D. Vanderpool, Morris County Golf Club. Secretary—Cornelius S. Lee, Tuxedo Golf Club. Treasurer—Edward S. Moore, National Golf Links. Executive Committee—Roger D. Lapham, San Francisco Golf and Country Club; John R. Lemist, Denver Country Club; James D. Standish, Jr., Lochmoor Club; Alan D. Wilson, Merion Cricket Club; Thomas B. Paine, Atlanta Athletic Club; Azariah T. Euffington, Fall River Country Club; Albert D. Locke, Brae Burn Country Club; Bonner Miller, St. Louis Amateur Athletic Association. Six Sectional, State or recognized Golf Associations are on the ticket as follows: Robert A. Gardner, Chicago District Golf Association; Roger D. Lapham, California Golf Association; John R. Lemist, Trans-Mississippi Golf Association; James D. Standish, Michigan State Golf League; Azariah T. Buffinton, Inter-Collegiate Golf Association; Bonner Miller, Missouri Golf Association. Nominating Committee, 1923—James F. Burke, Oakmont Club; David H. McAlpin, 2d, National Golf Links; Walter L. Ross, Inverness Club; H. Chandler Egan, Waverly Country Club; William E. Stauffer, Audubon Golf Club.

NEW SUB-COMMITTEES APPOINTED AT EXECUTIVE COMMITTEE MEETING, FEBRUARY 1, 1922

Rules of Golf Committee-Howard P. Whitney, Chairman, No. 15 Broad Street, New York City; James Francis Burke, Robert A. Gardner, Cornelius S. Lee, Wynant D. Vanderpool, Frederick S. Wheeler, Frank L. Woodward, George H. Walker.

Championship Committee—Robert A. Gardner, Chairman, The Rookery, Chicago, Ill.; Joshua Crane, A. D. Locke, Edward S. Moore, Thomas B. Paine, Alan D. Wilson.

Membership and Reinstatement Committee-Cornelius S. Lee, Chairman, Tuxedo Park, N. Y.; Edward S. Moore, Wynant D. Vanderpool.

Amateur Status and Conduct Committee—A. D. Locke, Chairman, No. 179 Lincoln Street, Boston, Mass.; Robert A. Gardner, Cornelius S. Lee, Thomas B. Paine, Wynant D. Vanderpool.

Committee on Sectional Affairs—Thomas B. Paine, Chairman, Trust Company of Georgia Building, Atlanta, Ga.; Findlay S. Douglas, Albert R. Gates, Roger D. Lapham, John R. Lemist, Bonner Miller, H. H. Wilder.

Selection of Courses Committee—Robert A. Gardner, Chairman, The Rookery, Chicago, Ill.; W. C. Fownes, Jr., W. E. Stauffer.

Implements and the Ball Committee-Wynant D. Vanderpool, Chairman, No. 766 Broad Street, Newark, N. J.; Robert A. Gardner, A. D. Locke, James D. Standish, Jr., Alan D. Wilson.

Eligibility List Committee-James D. Standish, Jr., Chairman, Ford Building, Detroit, Mich., Cornelius S. Lee, Wynant D. Vanderpool.

Green Section Committee—Alan D. Wilson, Chairman, No. 321 Walnut Street Philadelphia, Pa.; Dr. Walter S. Harban, E. J. Marshall, Dr. R. A. Oakley, C. V. Piper.

International Matches and Relations Committee, Walker Cup-Howard F. Whitney, Chairman, No. 15 Broad Street, New York City; Robert A. Gardner, Cornelius S. Lee, Edward S. Moore, Wynant D. Vanderpool, George H. Walker, Azariah T. Buffington.

Intercollegiate Committee-Azariah T. Buffington, Chairman, Yale University, New Haven, Conn.

Publicity Committee-Cornelius S. Lee, Chairman, Tuxedo Park, N. Y.; Wynant D. Vanderpool.

Finance Committee-Edward S. Moore, Chairman, No. 14 Wall Street, New York City; Mortimer N. Buckner, Cornelius S. Lee.

Public and Municipal Golf Courses Committee-James D. Standish, Jr., Chairman, Ford Building, Detroit, Mich.; Albert D. Locke, Robert McKinley, Grantland Rice, Malcolm McGregor.

"Winter-Kill"

A Discussion

This discussion has been introduced by Mr. W. J. Rockefeller, of the Inverness Club, Toledo, Ohio, who at a recent date has written us as follows:

In nearly every issue of THE BULLETIN some mention is made of the winter-killing of grass; "winter-kill," as it is commonly called. Inasmuch as in my nineteen years of experience I have never met "no such animal," I am venturing some statements of what I do not know about the subject.

turing some statements of what I do not know about the subject. I have never seen any turf that had been killed by the winter, though I have seen the Inverness turf pass through all kinds of winters; the frigid kind that makes one think he is in Medicine Hat or in the Polar regions; and the open kind; and, worst of all, the kind where the range of temperature is the widest—warm and thawing one day and bitterly cold the next.

The only thing I've seen that answers at all to "winter-kill" appears after ice has been on a spot of grass during the winter, and then it is not a kill but a setback. Such grass is slow in recovering in the spring, but I have never observed a kill. Where the surface drainage is good enough to permit rainfall and water from melted snow to run off, I have never noticed a bad result due to winter. There is one little spot on our No. 11 green that appears to be set back every winter by an accumulation of ice but that is the only one, and it is so trivial that it has never been fixed, though it is one of the things we intend to do "some day."

to do "some day." To my mind, winter-kill, as described, appears to be the result of poor drainage, both subdrainage and surface drainage, and I would like to see or hear of a case which occurred where the drainage was good. Mulching greens during the winter with straw or similar material has often been proposed by inexperienced persons, but though it may be all right on a lawn or something like that, it would never do on a green. The mulch might protect against the temperature changes of the winter, but it would do more damage in the spring than it did good all winter. The mulch would stimulate a weak, spindly, unhealthy growth that would be likely to perish shortly after the removal of the mulch. It would be a practical impossibility to remove the mulch without damage.

I have heard green-keepers advise covering greens with a thin layer of sharp sand, but I can not see how that treatment would protect against the winter. The sand might work into the ground in the spring and have a beneficial effect then, but I can see no good in it as a protection against winter-kill. It seems to me that grass was intended to live out of doors unprotected, and

It seems to me that grass was intended to live out of doors unprotected, and that it is more or less hazardous to try to improve on nature. But drainage is another thing, and that involves merely reproducing the best conditions of nature. If grass growing in a well-drained position will do better than that which is covered at times by water or ice, it seems reasonable to provide good drainage. Of course it must be expected that a thin growth from a fresh fall seeding will suffer more from the winter than an old-established turf, but these statements refer only to old turf. The recording of experiences in THE BULLETIN affords the best means of making progress in the art of green-keeping, and I am submitting these statements in order that others may contribute their experience.

WM. J. ROCKEFELLER, Inverness Club, Toledo, Ohio.

Mr. Rockefeller discusses a subject on which accurate knowledge is rather scarce. We hope that green-keepers who have had actual experience with winter-killing of turf will give us all the benefit of their observations. In the meantime the following information and expressions of opinion may be helpful:

Winter-killing of plants is not all due to the same condition of factors. If one left his pet rubber tree out of doors on a freezing night he would not be at all surprised if it died. Many tropical plants are killed by a temperature at or near the freezing point. Fall-sown oats will survive a mild winter but will be killed in a severe winter. Even fall-sown wheat is not rarely killed by very low temperatures at times when there is no snow cover for protection. Fall-sown wheat is but rarely killed by very low temperatures at times when there is no snow cover for protection. Fall-sown grass is sometimes killed in the same way. In all these cases the factor is the same—the chilling or freezing of the plant to so low a temperature that it fails to recover. Some botanists think that death is due to a coagulation of the protoplasm. Be that as it may, it is an absolute mystery why some kinds of plants are killed at freezing point while others remain uninjured. It is well known, however, that any perennial plant in a dormant condition will withstand much more cold than when it is actively growing.

A second kind of winter-killing is due to uprooting of the plants by the alternate freezing and thawing of the soil. This process is called "heaving" and often results in pulling the roots out of the soil and leaving them on the surface. In the case of alfalfa the roots may be pulled up as much as one foot.

So far as known, winter-killing of either of the above-described types does not apply in the United States to well-established grass turf of any of the really northern grasses. But such southern grasses as Bermuda, carpet-grass, and others have their northern limits fixed by winter cold—or in other words, they are killed by cold that northern grasses easily survive. Nevertheless the killing of large patches of old turf on northern golf courses and in lawns is by no means rare, at least in New England.

It is not at all surprising that Mr. Rockefeller has never seen winter-killing of turf; neither has it ever been observed here at Washington. During January and February, 1919, the golf courses about Washington were covered for at least six weeks with a solid sheet of ice, the result of alternate thawing and freezing of snow. Some of the green-keepers were very much worried over the situation, yet no harm resulted to the grass.

yet no harm resulted to the grass. In New England, however, it is not a rare thing to see large patches of grass killed between fall and spring. These dead patches very often are in places from which the water does not drain, but not infrequently in well-drained spots which for a time at least during cold weather were full of water or water-logged. These killed patches may be found on a hillside below the place where there was a snowdrift. Sometimes they occur in well-drained lawns, possibly because the freezing of the deeper soil allows the upper layers to become water-logged for a time. At any rate winter-killing is associated very often and perhaps always with a water-logged soil, even though the water-logging may be for a short period.

No experimental investigations to determine the factors involved in winterkilling of grass turf seem to have been made. Not many half-baked theories have been advanced. One of these is to the effect that the grass is killed by the ice covering acting as a burning-glass to concentrate the rays of the sun! If this were true, all the grass should have been killed around Washington by the conditions in January and February, of 1919.

> C. V. PIPER and R. A. OAKLEY, Green Committee, U. S. Golf Association.

In response to letters of inquiry, several New England gentlemen have sent us accounts of their observations and experiences, from which the following quotations are extracted :

I have had considerable experience in building skating-rinks on city parks here in Burlington. We plow a strip in the fall, making a bank perhaps a foot high. When cold weather comes and freezes the ground a few inches we put on water with a hose and spray-nozzle, being careful to put on just enough to freeze without thawing the ground. This is followed by a similar treatment or treatments until we get a good base, when we put on about ten inches of water and let it freeze to form a skating area. The result usually is good skating. However, the next spring and summer we always find that the grass is, for the most part, dead. One can easily get the exact area which was flooded, by the weed flora of the area. The lines are so sharp and distinct that no one could mistake them. This holds on both sandy soil and clay. In fact, it is so detrimental to our parks that we refused this winter to build rinks on our grass areas. It would seem that this exactly fits into the water-logging idea.

> GEORGE P. BURNS, Botanist, University of Vermont, Burlington, Vt.

Let me preface what I shall say concerning the causes of winter-killing of grass in mowings and pastures with the statement that I have not planned and carried out experiments with a view to throwing light upon the problem. I have, however, been a student of the conditions affecting the herbage in mowings and pastures for a good many years, and I have opinions, supported, I think, by sufficiently well-established facts, to justify me in expressing them.

Let me say further that I think the conclusion that excess of water is one of the commonest causes, is correct. I do not think, however, that it is necessary, in order that killing may follow, that the soil be actually water-logged. I have seen the grass, for instance, killed in my lawn, where I know the soil is never water-logged, because of water. I should express it in this way: If there is in a mowing or pasture, or lawn, for that matter, a hollow, large or small, in which water will accumulate during the season of the year when its conversion into ice is probable and under conditions under which it can not sink into the soil, perhaps because of frost below, the grass is killed. This same condition, of course, is fatal to alfalfa, which is yet more sensitive than ordinary grasses and clovers.

Of course, in water-logged soil grasses are rather frequently killed by heaving, especially that type of heaving under which the whole surface becomes, as it were, honey-combed, and without doubt this result is much more likely to follow in the case of newly-seeded land.

Another condition which, without doubt, sometimes great injures, perhaps even kills, grass roots is the presence of too heavy a growth of succulent leafage, which, under heavy snows particularly, is packed down and, especially if there is little or no frost in the ground, begins to decay or ferment, to the serious injury or even killing of the grass roots.

On the other hand, I think that sometimes too close grazing and trampling by animals pastured until late in the fall strips the roots of protection, and to such an extent that, as in the case of a grass like timothy (dependent for per-sistence upon the bulblets), the destruction of these results in what may be called by some "winter-killing"; and indeed, from a certain point of view, the term is sufficiently descriptive, unless it be perhaps in the case of timothy, where the disappearance of the grass is due to the fact that the animals have eaten or trampled the bulblets.

I think it not unlikely that in some cases the disappearance of certain grasses from mowings, especially those newly seeded, may be due to the fact that those particular species do not find conditions essential to their healthful and vigorous growth, but that coincidentally there may be other species, which find the conditions much more congenial, which suppress and finally drive out the first. Thus persons not thoroughly informed in relation to grasses may perhaps sometimes conclude this to be due to winter-killing, which of course it should be understood may have nothing whatever to do with it.

Please observe that nowhere do I explicitly state an opinion as to the cause of the death of grass. It, however, seems to me that cutting off the supply of oxygen needed by the roots and bulbs is probably the most important among the factors which result in killing.

WM. P. BROOKS, Consulting Agriculturist, Agricultural Experiment Station, Amherst, Mass.

I have paid little attention to the winter-killing of grass in pastures and lawns except in a very general way, and this has been limited more to the latesown grasses for purposes other than pasture. The experience here is that such crops late planted have not developed sufficient root surface to hold them in the soil and in severe winters are often more or less heaved out of it through freezing, with death resulting. So far as water-logging of the soil is concerned, I know that serious injury often occurs to the roots of our fruit trees in such soils, and presume the same effect might occur to a less degree with the grasses. G. P. CLINTON, Botanist,

Agricultural Experiment Station, New Haven, Conn.

I have no definite knowledge on winter-killing and can find no one who can help me out, so I can only give my theory, for what it may be worth. There has been a rather commonly held theory here that this damage results from patches of ice which act as lenses or burning-glasses and focus the rays of the sun to such an extent that they burn the roots of the grass. Personally I do not believe in this theory. So far as I know, winter-killing has resulted about here only from patches of ice which stayed on the ground unusually late in the spring

after a severe winter. I do not see how this ice could injure the roots of the grass while the ground is frozen solidly, and believe that the damage is done in the spring when the grass roots are coming to life and the ice would not normally remain. Perhaps a better term would be *spring-killing*. Whether the damage results from a smothering effect at a time when the ground is opening up and the roots require air, or whether it is a rotting effect from the continual wetting from the melting ice with frequent refreezing at night, or perhaps a combination of this action with a lack of air, I do not know, but I believe that this is the time when the harm is done. It would be interesting to try the experiment of breaking up and removing these patches of ice as soon as the ground began to thaw out in the spring. So far as I know, this experiment has not been tried around here, and this does not look like a very promising year to test it.

N. STUART CAMPBELL,

Agawam Hunt Club, Providence, R. I.

The winter-killing of grasses is not considered a serious matter here in New England, as far as my observation and experience goes. Of course, we have some winter-killing of grass in meadows, pastures, and lawns where the water tends to stand for some days during the early spring. The cause of the winter-killing in such cases I have always attributed to the water-logged condition of the soil, which results in actually drowning the plants through the lack of sufficient air. Alfalfa very frequently winter-kills, but mainly as a result of the heaving up of the plants and the tearing off of the roots on soils with any considerable amount of clay in them. Timothy is also subject to winterkilling, particularly when the field has been mowed or pastured late in the season and not sufficient substance has been stored in the bulbs to withstand the rigors of continued low temperatures with the absence of a snow covering. Our clovers also frequently winter-kill, and this I have usually attributed to the alternate freezing and thawing which we have in the early spring after the snow has left.

F. W. TAYLOR, Agronomist, Agricultural Experiment Station, Durham, N. H.

Early Spring Work on a Golf Course

DR. WALTER S. HARBAN, COLUMBIA COUNTRY CLUB

This has been an unusually bad winter for anything more than the winter work at the barns such as detailed in the article in the February 23, 1921, number of THE BULLETIN (pages 16 and 17). It is therefore assumed that the green-keeper is prepared, ready, and waiting for the opportunity to go to work on the course.

FAIRWAYS

As soon as the snow has disappeared and the frost is out of the ground, when yet too wet to do anything to the fairways and putting-greens, it would be well to inspect the wet places about the course to see whether the drains are sufficient, and put in others where necessary. All such places show up more clearly in the spring than at any other time, and the evidence of needed lateral branches is more apparent. It may also be found that banks of the streams, bunkers, and water hazards are broken down by the frost. These should be protected to prevent further disintegration, and made more sightly.

Perhaps, after all these things have been done, the fairways may be dry enough to roll. Of this, however, one should be certain, as there is nothing that can be done that will be more injurious to the development of turf than heavy rolling when the ground is very wet. The only complete remedy for such an error is another winter's upheaval. I realize that there are many advocates of only light rolling at all times. I am strongly convinced, on the other hand, that heavy rolling after the winter's upheaval is not only beneficial but necessary to make dense, vigorous turf. I am sure that since the introduction of the triplex form of mowers, fairways generally are not rolled enough. The clay fairways of the Columbia Country Club are rolled twice every spring with an old-style gasoline mowing machine that weighs 2,800 pounds. Under this treatment they have developed until today for beauty, quality, and perfection we invite the closest inspection or criticism.

PUTTING-GREENS

What has been said about rolling the fairways holds equally well for the greens, only the roller should weigh not less than 1,200 nor more than 1,600 pounds, and drawn by man-power. Under no circumstances should a power mower be used on the greens, as the dragging and turning necessary in operation disturbs the even surface, often leaving ridges and depressions hard to remedy. In designating the points of the compass of greens look sickly, as sooner or later they will respond to the warmth of higher) north, and east and west accordingly. Commencing at the north, rolling east and west successively, the line left by the roller is pressed out, due to the slant of the green, leaving a perfectly even surface. The green should then be raked or brushed vigorously in one direction only, and cut, using the grass catcher. After that it should be raked or brushed in the opposite direction, and cut again. This should be repeated, always in another direction, until all the long blades that have formed during the winter have been cut off. At each successive cutting use a machine set a trifle lower until you get down as close as the greens are ever cut at any time of the year, so as to make the crowning, so to speak, early, when the grass shoots will have a better opportunity to respond in the warm, moist days of each spring, and form a closer, denser mat before summer or very hot weather. Do not be discouraged if for a week or two the greens look sickly, as sooner or later they will respond to the warmth of the sun. The greens should be seeded now, if necessary, as the ground, from the raking or brushing, is open to receive the seed. Top-dress heavily with a suitable compost of two parts of finely-screened mushroom soil, two parts of wood earth, and one of sand, all of which was prepared in the early winter and kept dry in the barn. Apply from one to two yards, according to the size of the green. Afterwards brush and drag thoroughly until the dressing is well dissipated. Finally roll with a 250-pound roller. If followed by dry, windy weather, the surface should be kept moist by spraying, using a large rose-nozzle to prevent disturbing the new seed that is added with the compost. Do not cut the greens when wet, nor use the grass catcher for a week or more afterwards when cutting. If the turf is at all weak, the green should not be played upon for a week or more.

Everybody is now demanding low-priced golf in reach of the average fellow, and if a little good intelligence is used the thing is possible. The rich man must forego some of his golf habits. No more of this ten-dollar-a-hole stuff! To reach economy we all must practice economy.

Patching

C. V. PIPER and R. A. OAKLEY

Fine turf is maintained only by constant and intelligent attention. Even under the best of care it goes bad in spots which require more or less heroic treatment to bring about recovery. No putting-green is so perfect that it is not at some time in need of repairs. A season of trying weather conditions, disease attacks, weed incursions, and hard play, followed by a winter of disuse and more or less severity, frequently leaves the green at the beginning of spring ragged and rough especially in spots. The remedies that occur first to the green-keeper are to reseed and to top-dress. These are excellent homeopathic remedies, and as to the efficacy of the second there can be no doubt. But it often happens that weeds have established themselves in places or fungous diseases have completely denuded small or even large patches that can not quickly be brought back to good playing conditions by either remedy. Such patches can best be restored by replacing them with good sod. In recent years the hole cutter has been used very effectively for patching such spots as may be occupied by pearlwort, chickweed, or other pestiferous putting-green weeds. The weed-covered spots may be cut out by the hole cutter and a piece of good sod put in its place by the same means. It is really surprising how much improvement one man can make in a green in a day if he uses the hole cutter properly and has an ample supply of good turf from which to take plugs. This method of repairing greens is commonly called "plugging."

If the patches needing repair are too large to be handled by a whole cutter they may be sodded after the usual manner of sodding new greens, careful attention being given to taking out the old sod to a uniform depth and trimming the new sod so that it will fit evenly but not so snugly that it will buckle. Whether the patching be done by the hole cutter or the sod cutter and the spade, it should be the first treatment given in the spring. Certainly patching should precede rolling and top-dressing. If the patching is done while the surface of the green is in a loosened condition, due to the frost action in the soil, and if the green is then rolled and top-dressed judiciously, the result will be a true surface almost immediately ready for play. The greatest objection to much of the patching that is done is not due to the mechanical work, for this is frequently as neatly done as the piecing of an old-fashioned patch-work quilt, but it is due to the quality of the sod that is used. More than once it has happened that the sod selected for patching was little better than the sod removed from the green. Generally speaking, it is a poor practice to transfer the sod from the near approach to the green and replace the sod thus removed with the discarded weed-infested or the disease-infected turf. This is too frequently done when the hole cutter is used, and the result is a focus of infection from which weeds and diseases later may spread through the greens.

If clubs would only maintain well-kept turf plots from which to draw patching material, their repair work would be much more simple and satisfactory. Such plots, several in number if necessary for convenience, could easily be provided by propagating a good strain of carpet-bent vegetatively. The method is simple and those who have tried it have found the results convincing. Turf thus developed has two outstanding qualifications for repair work. It is of excellent quality so far as texture

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and trueness are concerned, and it establishes itself in its new position with aggressiveness. Vegetatively planted areas for supplying repair sod are so easily established and maintained that a club located in the northern turf-grass belt can not afford to be without them. If a good strain of carpet-bent is selected and a little intelligent care used, a supply plot may be maintained indefinitely, since the grass will soon returf the places from which sod was removed. Some clubs already have established vegetative repair plots and have found them exceedingly useful; a considerable number have signified their intention of doing so. For the benefit of those who may not be familiar with the vegetative method of progagating bentgrass turf, attention is called to the July 20, 1921, issue of THE BULLETIN. The time is drawing near when the maintenance of plots of good turf for repairing putting-greens will be just as much a regular feature of golf courses as is the making of compost piles.



Harvesting bent seed in Germany. Note that the grass is growing in open woodland and that the crop is gathered by very simple methods

Rate of Seeding Fine Grasses

C. V. PIPER and R. A. OAKLEY

The rate of seeding any broadcasted crop may be determined in two different ways. The first method and the one commonly used by agronomists is to sow like plots to different amounts of seed. For example, a series of ten one-tenth acre plots may be sown respectively with 2, 4, 6, 8, 10, 12, 14, 16, 18, and 20 pounds of seed. By observations on these plots and by comparing the yields, the best rate of seeding is determined. This method is frankly empirical and the conclusion is reached regardless of any theory. Indeed the best rate of seeding is found to be different in different places and on unlike soils.

The second method of determining the rate of seeding is purely theoretical. If it be found that a perfect stand of alfalfa averages 15 plants to the square foot, an acre will contain 6,384,000 plants. As one pound of alfalfa seed contains 240,000 seeds, a little more than $2\frac{1}{2}$ pounds should suffice to plant an acre.

As a matter of fact, the average rate of seeding alfalfa in the West is 10 pounds per acre; in the East, 20 pounds per acre. If the theoretical method were true, the farmer is wasting from 75 to 87 per cent of the seed he sows.

At first sight it seems very puzzling why there should be such great discrepancy between rates of seeding as determined theoretically and as worked out practically. It must be borne in mind that seedlings have to contend against many difficulties, including drought, insects, diseases, weeds, etc., and that many of them inevitably perish while young. The more seedlings, up to a certain maximum, the better are the chances of securing a full stand. The farmer can not afford the risk of an imperfect stand for the cost of ample seed. Perhaps the greatest enemy of all to contend against is weeds, and a dense stand of the crop plant desired is one of the best methods of retarding the development of weeds.

In the accompanying table is given the ordinary farm rate of seeding broadcasted forage crops, with calculations showing the number of seeds sown on each square foot. It will be noticed that the number is large and that it varies greatly with different plants. Were such plants allowed to develop undisturbed by weeds, only a small portion of the seed would be required to give a satisfactory stand. It is difficult to determine what constitutes a perfect stand, but the numbers given are based on the room necessary for the full development of a young plant.

| TABLE | SHOWING | THE | GENERAL | RELATIONS | BETWEEN | NUMBER | \mathbf{OF} | SEEDS | Sown |
|-------|---------|-----|---------|------------|---------|--------|---------------|-------|------|
| | | | А | ND FINAL S | STAND. | | | | |

| (1 | Average rate of seeding to the acre counds) | Number of seeds to the pound. | Number of seeds sown to the square foot. | Average number of plants to the square foot for a perfect stand. |
|---------------------|--|-------------------------------------|---|--|
| Red clover | 8 | 250,000 | 47 | 15 |
| Crimson clover | 15 | 130,000 | 45 | 15 |
| Alsike clover | 8 | 700,000 | 130 | 15 |
| Alfalfa | 20 | 240,000 | 95 | 15 |
| Sweet clover | 25 | 235,000 | 140 | 15 |
| Timothy | 15 | 1,100,000 | 350 | 90 |
| Kentucky bluegrass | 25 | 2,400,000 | 1,400 | 130 |
| Orchard-grass | 20 | 450,000 | 210 | 90 |
| Brome-grass | 20 | 137,000 | 65 | 60 |
| Redtop | 10 | 4,000,000 | 930 | 140 |
| Meadow-fescue | 20 . | 250,000 | 115 | 90 |
| Italian rye-grass | 30 | 270,000 | 215 | 90 |
| Perennial rye-grass | 30 | 270,000 | 215 | 90 |
| Tall oat-grass | 40 | 150,000 | 140 | 90 |

The rates of seeding ordinarily used are purely empirical—the result of experience or of experimental field trials. The effect of the heavy seeding is to secure a dense stand of young plants, which in a measure restrains weeds, and which further insures that in competition with the weeds a majority of the survivors will be the plant desired. This dense stand is especially necessary in perennial grasses where the seedlings are slender and in their early stages grow but slowly, and thus are relatively inefficient against broad-leaved, vigorous weeds.

It is scarcely possible to seed perennial grasses and clovers so heavily that the resultant vield is seriously affected. With annuals, however, too dense seeding reduces the size of the individuals so much that the yield to the acre is also diminished.

In general the rate of seeding is least in regions where the crop is best adapted; that is, where the individual plants are most vigorous and the natural mortality therefore least. The weediness of the soil is also an important factor.

Where seed can be drilled, the amount necessary to secure a good stand is about 25 per cent less than when broadcasted. The reasons are evident; namely, the covering of the seed uniformly to the most favorable depths, as well as its more even distribution.

With the grasses used for fine turf there is not a very large body of definite experience or of accurate experiments. In general the seeding for fine turf should be relatively heavy, as the disappointment of a failure or partial failure is of far more consequence than the use of perhaps an unduly large amount of seed.

We have consistently advocated using for each 1,000 square feet of surface 3 to 5 pounds of redtop or Rhode Island bent or South German mixed bent; 7 pounds of Chewing's fescue; 3 to 5 pounds of Bermuda grass. Redtop contains about 4,000,000 seeds per pound; Bermuda grass, 1,800,000; Chewing's fescue, 500,000. Pure seed of the two fine bents has as many seeds per pound as redtop, but in the chaffy form in which they occur on the market probably only 1,000,000 to 2,000,000 seeds per pound.

From many trials we know that these amounts give excellent results. It may be possible to reduce them somewhat and secure equally satisfactory turf, but we have doubts whether the saving effected would compensate for the risk.

How Frequently Should Putting-Greens Be Mowed?

A Discussion

The following answers to the above question by fifteen different men, all of long experience, ought to be strongly suggestive, if not fully convincing. Probably all of the northern greens concerned in these answers are wholly or mainly bent grass; the two southern courses included have Bermuda greens:

I would unhesitatingly say, "Every day, if possible; remembering first that upon the character of the grasses will depend whether your greens are to be cut very short or longer. Bent grasses in this climate do better when cut very close throughout the season. Bluegrass, redtop, and fescue thrive better when not cut a clear but cherded be so close, but should be cut just as often; naturally they make slower greens. I am positive that down in this extreme climate it is injurious to allow any of these am positive that down in this castolic than at other times. grasses to grow longer in excessively hot spells than at other times. W. S. HARBAN,

Columbia Country Club, Chevy Chase, Md.

At the Detroit Golf Club we cut our putting-greens every week-day after the season gets under way.

At the beginning of the season we set our blades up somewhat higher, and gradually work them down to about three-eights.

You will find a considerable difference of opinion as to how closely a puttinggreen should be cut, but our experience has been very satisfactory at threeeighths during the hot months.

We went through the long, hot, dry spell of last summer without having a single case of burning on any one of our 36 holes.

Many green-keepers advocate close cutting in order to help keep the weeds down. We eliminate our weeds by hand work or spearing with sulfuric acid.

A. J. HOOD,

Detroit Golf Club, Detroit, Mich.

I believe the best results are obtained by cutting the putting-greens close every day. Our practice is to begin cutting the greens as soon as the grass shows signs of growth in the spring and to repeat every day until the grass box shows no clipping, which event usually does not occur before the grass stops growing in the fall. From the beginning the mower knives are pushed down to the lowest notch and kept there without change.

- Our reasons for this practice are:
- (1) To avoid a "slow green," which we consider unsatisfactory for good putting.
- (2) To prevent a stubby condition and to develop a fine surface texture of grass, which only daily and close cutting will accomplish.
- (3) To maintain an even grass surface. Putting-greens frequently, and perhaps usually, contain several kinds of grasses, and some of them grow more rapidly than others. Even where the green is composed entirely of one kind of grass there is often a difference in growth owing to varying soil and moisture conditions in different parts of the ALFRED E. MCCORDIC. green.

Indian Hill Club, Winnetka, Ill.

I think the frequence of mowing putting-greens depends upon the character of the soil of the course and also the season of the year. In general, I should say that during the growing season the greens should be cut every day, and there are times when some greens on certain courses with very rich soil really ought to be cut twice a day. Then again, in dry weather between growing seasons, and after the growing season is over in the fall, a day may be skipped without harm to the play. My general feeling is that greens should be cut every day, but not cut so short that the plants will be crowned and the grass burned out by dry weather. ALAN D. WILSON,

Merion Cricket Club, Haverford, Pa.

I say, without hesitation, under normal conditions they should be cut every day. The texture of the grass will be finer, the surface smoother, which makes for truer putting, and the mat of roots will be thickened and strengthened. What more could be desired?

It has been our practice to cut one day north and south, the next east and west, and the third day day diagonally, which keeps the grass always standing up; and we have no grain to putt against, as is the case where the cutting is JAS. L. TAYLOR, less frequent.

The Ekwanok Country Club, Manchester, Vt.

During the heavy growing season we mow the greens at Glen Echo every morning. During the middle of the summer when the growth is not so vigorous we drop off to every other day, and, of course, in early spring and late fall there are times when twice a week will be found sufficient. It is our opinion that if greens are allowed to grow for two or three days without mowing during the intensely growing season, the grass becomes coarse and does not form as desirable a mat and putting surface as it does when mowed daily.

W. C. FERGUSON, Glen Echo Country Club, Normandy, Mo.

During the playing season we cut our greens every day, including Sunday. Formerly we did not cut them on Sunday, but the last few years there has been such a demand from the players that we have cut them seven days in the week. The reason why we have cut them so often is, in my opinion, that that is the only way to keep them in perfect condition. If you skip a day in the growing season the grass becomes long and the green, therefore, is slower. It is the aim of every green-keeper to keep the greens as nearly uniform from day to day as possible. Therefore it is necessary to cut them every day.

WM. F. BROOKS.

Minikahda Club, Minneapolis, Minn.

I believe that putting-greens should be mowed every day, with no more rolling than is necessary to keep the surface smooth. Any variation in the

mowing made necessary by weather conditions should be accomplished by changing the setting of the machines, rather than by less frequent mowing. The benefit of mowing is twofold: first, it results in greens of finer texture; and second, it makes it possible to maintain about the desired putting speed with little variation from day to day. With us too much rolling results in a "crusted" surface, which, of course, is bad from every point of view.

N. S. CAMPBELL, Agawam Hunt Club, Providence, R. I.

I find the more a putting-green is mowed the finer the grasses will show up and the more uniform a green will become. Close cutting also develops and en-

and the more uniform a green will become. Close cutting also develops and en-courages the growth of fine grasses. Of course, if the grasses are not growing, there is no need for mowing a green. That is for the green-keeper to decide. There are a great many golf courses which could develop very fine putting-greens in a very short time if they would cut their greens closer. Many green-keepers have the idea that their greens would not stand close cutting in hot weather, but we find that they are just as easily kept cut closely as if we left them grow longer.

Greens should not be cut too closely at the first mowing. The machine should be set down by degrees so that the grasses can grow to suit the conditions.

At Oakmont, where our grass grows very strong, we mow our greens every day during May, June, and July. In August they are mowed about four times a week; the other three days we water and fertilize, which keeps them in a good healthy condition. Then in the fall they are mowed every day until the grass stops growing when the frost comes.

Last year our greens were mowed until the middle of December, which was an exceptionally long growing season for grass.

E. F. LOEFFLER,

Oakmont Country Club, Oakmont, Pa.

The ideal to be attained is uniformity-eighteen greens of uniform putting texture and greens that are alike throughout the season. Continuous close cutting is essential to the development of proper putting-green turf.

The minimium is cutting three times a week; the maximum is cutting every day.

There can be no hard and fast rule applicable to any course or to any number of courses. One green may be thin and another rank in growth. The grass may be growing luxuriantly, as in the spring, or it may be practically dormant.

The cutting must be determined by good sense and careful supervision. Cutting every day is probably the standard basis to assume, with omissions when conditions warrant. Three times a week is the minimum. The pocketbook should be considered. It all depends on conditions.

No rule can be devised that will obviate the use of common sense. Μv answer is, something between three times a week and every day, depending on conditions and pocketbook. W. J. ROCKEFELLER,

Inverness Club, Toledo, Ohio.

"How often should a putting-green be mowed?" is like so many other questions asked in connection with green-keeping. There is no specific answer that can be made. It depends upon climate, soil, kind of grass and amount of water applied, to say nothing of the extent to which purely artistic considerations and personal idiosyncrasies are given weight.

Club members demand and are doubtless entitled to putting-greens that are true, of uniform velvety texture, and with turf of resilient consistency. Beyond this, however, arise differences of opinion that are really but matters of taste, such as whether the putting surface shall be so lively that every putt is merely a trickle; whether the color of the surface shall be of unvarying shade; whether

the grass shall be of so vivid a green that it betokens hot-house forcing, etc., etc. All of these matters enter into the determination of how often the greens shall be cut, for the more grass is fertilized, watered, and forced, the faster it will grow and the oftener it must be cut. It is certain that greens are, as a rule, watered more than is necessary to keep the grass growing well in a normally healthy condition. It would seem to be common sense that to keep the grass up to this standard and to go no further with any measures that tend to force the growth, would in the long run be the best plan to follow; it would produce

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a constant growth, make a putting surface that could be kept true and provide everything needed to insure the desired reward for good putting.

If this plan were universally followed, one would immediately be face to face with the difficulty that the vast majority of putting-greens in America have not been properly laid, and the result would be that golf would be played, as a rule, upon greens that have practically no "bite" whatever, and the great joy of having a well placed, boldly played high approach-shot stop dead upon the green would be denied us.

The most common substitute for the needed care and attention to what constitutes a proper germinating layer and what drainage should be installed at This produces some "bite," but also introduces all the evils that give rise to the agitation regarding the "mud-on-the-ball" rule. It, of course, adds to the cost of maintenance and necessitates more frequent cutting.

Climatic conditions, as well as construction problems, have much to do in determining how often a putting-green should be mowed. If "weather" requires daily watering, daily mowing will be the rule. In many sections of the country these conditions do not obtain, and yet too frequent watering and cutting is practiced. The aim of the Green Section in eliminating waste expense and reducing generally the cost of maintaining golf courses is worthy of vigorous and universal encouragement; and in the matter under discussion there is a large field for education that should have good results.

large field for education that should have good results. The most important things for an ideal putting surface are trueness and uniformity of texture. The length to which the grass is permitted to grow varies with individual taste, but, as a rule, the grass on putting-greens in America is cut too short for real skill in putting. However, whether the grass is to be left long or short, it is necessary to cut the greens oftener than the fairways in order to attain uniformity and constant trueness. It is absolutely unimportant that the grass should be the same length on the greens day after day; but on any one day it should be of uniform length throughout the green. When different grasses and different soil conditions are generally to be found on the same green frequent moving is unavoidable if

generally to be found on the same green, frequent mowing is unavoidable if uniformity is to be secured.

There is waste in this branch of our green-keeping that should be corrected; but it does not lie in the mere frequency of mowing alone. It is so in all of the matters closely related to the propagation of turf for putting-greens.

FREDERIC C. HOOD, The Country Club, Brookline, Mass.

This is a question that interests the chairmen of the green committees and the members of the clubs of the United States exceedingly, for a good part of the pleasure of playing the game depends upon the condition of the greens. It seems to me that the problem of the cutting of the putting-greens can be divided into two parts; first, the method of cutting, and second, the reasons for the method.

Conditions in the different parts of the United States vary so much that what is satisfactory practice at one place will not give equally good results in another. In describing what we do here it is well to state that we have a reasonable amount of rain regularly coupled with considerable heat in the middle of the summer-apparently a very satisfactory locality for the growth of the finer grasses. Our soil is a good farm land, but particularly well drained by the gravelly subsoil. In the spring of the year, when the grass first starts to grow on the putting-greens, and until the grass obtains its regular summer rate of growth, we cut for two or three weeks, depending upon the rapidity of the growth-possibly once the first week, and then two or three times a week thereafter. During the time of regular growth we cut seven days a week, and also roll the greens seven days a week, as I believe that regular rolling is conducive to better turf conditions. When the fall season comes and the growth of the grass is materially slowed down, we stop the daily cutting, first by cut-ting every other day, and later still less frequently, as the conditions seem to warrant. While the growth of the grass is slowing up, we gradually raise the height of the blade on the putting-green mower so that at the end of the season the turf is at least one-quarter of an inch higher than during the regular season, in order to allow the grass to make a heavier mat for the winter.

Here we have been believers in the relatively fast green, provided there is a good, thick turf; and in order to have this fast condition we have cut the grass seven days a week. Our program of cutting is to divide the eighteen greens among three men, each man having the same six greens to cut daily. Each man starts out at seven o'clock, and by ten-thirty or eleven o'clock his greens are mowed. The size of our greens runs approximately thirty vards in diameter. By having the same men cut the same greens we believe that a feeling of interest or pride in the condition of the greens he cuts is instilled into him. This condition of mind certainly induces him to do his best. We use a cutter 17 inches wide with eight blades to the mower, as, we believe, the more blades to the cutter, the smoother the surface of the greens can be kept.

I have always believed it is possible without injury to properly fertilize greens to keep them up to really tournament-playing condition the whole season through; and to maintain this condition regular close cutting is certainly necessary.

If a regular and definite program is not followed it means that the height of the grass to be cut will vary. On the properly kept putting-green, grass should grow rapidly and thickly. There is a tendency for the putting-green mower to cut unevenly, so that as you look across the surface of the greens you will see alternating ridges and hollows. This, we believe is due to allowing the grass to get a little too long, and also to the fact that as the mowers grow older there is a tendency for them to do poorer work. We have kept it a policy here for a number of years always to start the season with three new puttinggreen mowers, using the discarded ones for the work on the tees and other places where it is necessary to cut the grass only fairly closely.

To sum up briefly the reasons for seven days a week of close cutting, I believe that the main points are as follows:

There is a smooth, uniform surface on all the greens, comparing each green to all the others. Where the turf is cut each day, it does not grow as long: consequently it is easier on both the men cutting and on the machines. Being easier for the men to cut, it naturally follows that it is done more ouickly. Grasses such as the fescues and bents, cut closely regularly, tend to make a retter and thicker mat of turf. Of course, if the green is not properly fertilized, there may be injurious effects due to the severe daily cutting of the plants. We have found that a closely cut regular green plays approximately the same whether it is dry or wet. With the definite cutting program, the average memher of the club, who is not a putting expert, has a condition to face which is approximately the same on all the greens: and it is certainly for him that the rolf course is maintained, for he is the backbone of any club. Anything we can do to make playing conditions fair for him, unquestionably is very much appreciated.

SHERRILL SHERMAN, Yuhnandasis Golf Club, Utica, N. Y.

I believe the ideal condition would be the mowing of a green every other day: but some greens should be mowed every day. If a putting-green is mowed every day, the chances are that the grass will be cut so short that it will not have enough air through it for natural breathing; such treatment also bleeds the grass to a very considerable extent. I find that my best Bermuda greens are secured by mowing every other day.

THOMAS P. HINMAN, Druid Hills Golf Club, Atlanta, Ga.

Of course, what we say regarding Bermuda grass is quite different from the treatment of the northern grasses. Here we have to cut the grass at least once a day during the entire growing season, to prevent runners and to keep the tender shoots coming through. About once every month the Bermuda greens have to be top-dressed, as they get coarse about that often, so that really we are playing on new grass all the time and not a mat of grass like you have in the north. The first frost, about November 12, stops all growing, and Bermuda becomes dormant, and we do not have to cut it again until about an average date between the 1st and 15th of April.

C. B. BUXTON, Dallas Country Club, Dallas, Tex.

Bermuda Grass

(Cynodon dactylon or Capriola dactylon)

C. V. PIPER

Bermuda grass is the most important grass of the southern States for pasture, as well as for lawns. On rich lands a good deal is eut for hay. It is originally native to India and perhaps other tropical and subtropical areas of the Old World, but now occurs in every region of the world where it will survive. As would be expected from its wide distribution, it has numerous names; in India, doob and hariali; in Virginia, wire-grass; in Europe, dog's-tooth-grass; in the West Indies, Bahama grass and Scotch grass; in Australia, couch-grass; in California, devil-grass. The name Cynodon means dog's tooth; Capriola comes from the Latin word for goat, therefore goat-grass.

Bermuda grass was introduced into the United States early in the nineteenth century. A story still current is that it first appeared back of a store where packing rubbish was scattered. The same story is also told in reference to other introduced plants, and therefore is to be regarded with suspicion. As a matter of record, there are authentic accounts of Bermuda grass being well known in the South in 1807. Bermuda grass now occurs generally distributed from the southern line of Pennsylvania westward to central Kansas and south to the Gulf of Mexico; also in Texas, New Mexico, Arizona, and California. (See map.)



Fig. 2—Map of the United States, showing the distribution of Bermuda grass. The upper line indicates its northern limit, but the grass is of most value in the shaded area

Bermuda grass is peculiar in that the stems often appear as if they have two to four leaves at each joint. There is really only one leaf at each joint; but very commonly several adjoining joints are very short, so





Bermuda grass. Cynodon dactylon (Linnaeus) Persoon; Capriola dactylon (Linnaeus) Kuntze. A, Entine plant showing habit; B, Part of a flowering branch showing the arrangement of the spikelets; C, Spikelet much enlarged; D, Junction of blade and sheath, showing the character of the ligule

the leaves are crowded. The short joints are succeeded by two or more long joints one to three inches long, which, in turn, may be followed by several short joints. This arrangement of alternating short and long joints is very common, but by no means uniform.

Bermuda grass prefers clay or loam soils. It will grow in sandy soils, but never makes so dense or so vigorous growth. It does best in welldrained land, and rarely thrives in wet soils or where the water is too near the surface. It will not grow at all in shade; it must be exposed most of the time to the sunlight. With the first touch of frost the leaves turn whitish and growth ceases until the weather again becomes warm.

At the base of the leaf-blade is a circlet of long hairs on the inner side, one of the conspicuous "earmarks" of Bermuda grass.

Common Bermuda grass has abundant jointed underground stems or rootstocks. These are white and as large as a goose-quill. At the tip they sometimes come to the surface, and then become leafy creeping stolons, which root at each joint. Similar stolons arise from the base on the surface of the ground. In one variety of Bermuda grass there are no rootstocks; this form is called St. Lucie grass, but it is tender and grows only in Florida.

Of ordinary Bermuda grass there are numerous strains, some of which make much finer turf than others. About twenty of these have been tested for putting-green turf. The best of all is Atlanta Bermuda grass, a form abundant on several golf courses about Atlanta. It is a paler green color with much denser turf than the ordinary forms and does not produce many surface runners or stolons. This variety alone should be used for putting-greens.

In the south Bermuda grass rarely produces seeds, and so farmers generally plant it vegetatively. Usually the turf is cut into small pieces and placed in furrows in plowed ground or simply scattered on the surface, which is then rolled. Practically every piece takes root and grows.

For putting-greens for golf courses the best plan is to have a nursery of Atlanta Bermuda grass and treat it exactly as described for creeping bent.* This method will insure a uniform turf of the most desirable strain.

In dry countries Bermuda grass produces abundant seed. The commercial supplies come from Arizona and Australia. The seed should be broadcasted on a carefully prepared seed bed at the rate of 10 pounds per acre, and then rolled. It must not be buried deeply. The seed may be sown at any time from corn-planting time until August. Later sowings are not desirable, as the grass will scarcely have time to make a sod before cold weather. It must never be sown during the cool or cold seasons.

On clay or clay-loam soils most excellent putting-greens of Bermuda grass may be secured, but it is almost impossible to do this on loose sandy soils. On the clayey soils the sod will become very dense; on sandy soils it inclines to remain thin. Bermuda putting-greens require much care to maintain a high quality of turf. The surface runners continue to be produced, and these are often thick enough to deflect the course of a putted ball. This difficulty is easily prevented by frequent top-dressings. Disking the green both ways to cut the runners off, and then raking the green, is good treatment to precede the top-dressing. Watering should be reduced to the minimum necessary to keep the grass green and growing. Moderate use of fertilizer is to be preferred. In no case should a Bermuda green

^{*} See THE BULLETIN, Vol. I, pages 124 to 126.

be top-dressed with sand, as the loam or clay-loam soil is by all odds the best.

The average quality of Bermuda grass greens will be enormously improved when clubs build their greens with loam or clay-loam soils for the surface six or eight inches, and use only the Atlanta strain for planting.

In regions where frosts occur the Bermuda grass becomes unsightly in winter. A good green surface can be maintained all winter, however, by sowing redtop or Italian rye-grass on top of the Bermuda grass sod about one month before the first frost. The redtop is preferable. Both it and Italian rye-grass will grow all winter in mild climates, and disappear in the hot weather of spring, when the Bermuda is again vigorous.

Questions and Answers

All questions sent to the Green Committee will be answered as promptly as possible in a letter to the writer. The more interesting of these questions, with concise answers, will appear in this column each month. If your experience leads you to disagree with any answer given in this column, it is your privilege and duty to write to the Green Committee.

1. Choosing between carpet bent and velvet bent.—Which grass, carpet bent or velvet bent, in your opinion, is the better grass for the putting-green all the year round?—(Maryland.)

Carpet bent and velvet bent both make exquisite greens, the latter being the finer in texture. Carpet bent succeeds better than velvet bent in the latitude of Washington and is not quite so susceptible to brown-patch. On some courses in New England, however, velvet bent has dominated and pure greens of this grass may be seen. Under New England conditions we would strive for pure velvet bent greens, because it makes the finest of all turf. Farther southward we should prefer the carpet bent.

2. Planting putting-greens by the vegetative method.—In planting our turf garden, our idea was to produce a complete putting-green surface ready for transplanting and then remove it directly onto a green in exactly the same way that any sod is handled, and not to produce stolons to be planted in a bare green and to be allowed to spread of their own accord; that is, our plan was to grow fine turf off the course, and then transplant it to the place where it was needed. While this might cost a little more, the convenience to the players would certainly be worth the additional expense. With this in view, we cut out mats from the fairways and putting-greens, and had them cut up into divots about one inch square and set out just as one would set out onion plants in a vegetable garden, in rows about twelve inches apart, and individual divots twelve inches apart. The idea in setting these so closely together was that as soon as each of them had spread six or seven inches from its original center we would have a complete turf. Are we right? Will we get what we are striving for ?—(Missouri.)

The idea you have in mind is entirely practicable and one that we have used in experimental plots. When you have grown your sod it can be transferred to a putting-green and be ready to play upon in a very few days. We doubt, however, if the method of planting the sod garden is nearly as good as that of using chopped-up runners, as recommended in the July, 1921, BULLETIN. By your method you are sure to have many strains of bent instead of one pure strain. Furthermore it requires a longer time for the sod to knit in a solid whole by your method than by the other. At Inverness very beautiful turf was grown by the chopped-up-runner method and the sod later transferred to a green. Several other clubs have now adopted the same plan.

3. Improving fairway turf which has been invaded by moss; disking; topdressing; fertilizing.—Our course of nine holes was constructed about six years The land is moderately rolling and, as we believe, well drained all over. ago. The soil is a sandy loam, and had previously produced very good crops of corn and hay. Neighboring farms now produce wheat, oats, and corn to good ad-vantage. Our greens, which were seeded to Chewings fescue, are remarkably good, but we are concerned about our fairways, which, after having been reasonably well prepared, were sown to bluegrass and redtop, but which are now very tufty in many places, the redtop, which dominates, growing in little bunches, leaving cuppy places between. There is a good deal of moss in different places in the fairways, and from reading your BULLETIN I am of the opinion that this is due to poverty of the soil. We have ordered a disking machine with small blades running close together set on a slight angle, which we plan to pull back of our tractor in the early spring for the purpose of cutting through these tufts or bunches of grass, and incidentally to make a seed bed. We then expect to seed the fairways again with bluegrass and redtop in about equal proportions, and roll. We expect to disk crosswise on hilly places to prevent the seed from Last fall we scattered crushed limestone over the entire fairways, washing. about two tons to the acre, but did not apply any of this to the greens. The particular question we wish to ask is, can we not use sulfate of ammonia, or something not too expensive, in the spring when we are doing this other work, to enrich the soil so as to get rid of this mossy condition?-(Indiana.)

If your fairways were seeded to redtop and bluegrass and you obtained a thin, bunchy stand, it would indicate to us very poor soil. Your plan to disk the turf on the fairway ought to be beneficial if it can be done without tearing up the turf. However, we are inclined to think you will get the best results by top-dressing your fairway with rich soil or with compost. This is a little expensive on account of the large quantity of material necessary unless you have it conveniently at hand. The next best thing to this is to top-dress with a fertilizer, and we would suggest you use an organic fertilizer and scatter it over the fairway just about the time the grass begins to show signs of new growth. We would suggest that you use bone-meal or fish-scrap, although there is no objection to using sulfate of ammonia. The organic fertilizers are, however, very effective and much more lasting than the chemical fertilizers, and there is no possible danger of doing harm by not being sufficiently careful in applying them. We are interested in what you say with regard to the appearance of moss between the tufts of grass. If you will send us a small sample of the moss we may be able to indicate in part where your trouble lies.

4. Ice remaining on turf.—The Peripatetic Golfer says, don't worry if you see an inch of solid ice over a putting-green, as it will do no harm if the drainage is good, but if the drainage is bad it can never be a good green anyway. Please explain how a green can be covered with ice if both the surface and subterranean drainages are good ?—(Minnesota.)

A so-called ice-storm may cover a whole golf course with a sheet of ice even if the topography be very rolling. In the case the Peripatetic Golfer had in mind, the sheet of ice was due to the alternate thawing and freezing of snow which in January and February, 1919, covered the courses about Washington for a period of seven or eight weeks. On one golf course, for fear the greens would be killed, an attempt was made to break the ice and remove it, but this process was so injurious to the turf that it was abandoned. When the ice finally melted the turf was found not to be injured at all. 5. Green construction: soil preparation; drainage.—We are inclosing you a rough sketch representing our No. 2 and No. 18 greens, with which we are having considerable trouble. These greens have been reconstructed several times in the past six or seven years. The last reconstruction took place about four years ago, and at that time the reconstruction was the surface where the sketch shows as 10 inches of black loamy dirt. For about a year it appeared to us that the greens were entirely too porous, and two years ago we added on top the clay soil, as designated, which was 26 inches at the height running down to a point meeting the fairway. During the past two years we naturally have developed a few inches of good soil from fertilizers and top-dressing, but we are still without a good stand of grass and cannot develop a good smooth putting surface. We believe that it will be necessary entirely to reconstruct these two greens in the fall, although it may not be necessary, but we would appreciate it very much if you could advise us or give us any information which might help us in properly developing these two greens.—(Missouri.)

While we would not like to say definitely that the construction has been responsible for your poor turf, we certainly would advise strongly against following the definite-layer type of construction in the future. Experience has made us very much opposed to construction of this type. We have tried it, and have seen a great many greens that have been built in this way, and we do not regard the method as satisfactory. In our judgment the ideal soil for a putting-green is a good, rich, deep clay loam, well drained in both surface and subsurface. If your soil is not of this character we would suggest that you use liberal quantities of well-rotted manure or mushroom soil as described in BULLETIN No. 4, Volume I. The best practical way to incorporate this with the soil is to plow or spade it in thoroughly. If your soil is a heavy clay loam, lighten it with sand or good soil of a lighter texture. This can best be done by working the sand or light soil. Definite layers apparently interfere with the normal processes which take place in soil. We would abandon cinders and crushed limestone and would mix the sand and loam thoroughly with the clay, provided, of course, the clay is the natural soil; if loam is the natural soil it is quite probable that it will not need modifying except probably with We note that your greens are tile-drained. manure. This is doubtless necessary. If there is any doubt whatever about the underdrainage, tile should be used. Many think that because a green does not overwash or has good surface drainage, it is well drained. It frequently happens that a green is flanked by a hill and gets a considerable amount of seepage, which renders the use of tile absolutely necessary. You cannot be too careful in regard to ample drainage.

6. Possible variance in effect of fertilizers on different turf grasses growing in mixture.—The opinion has been expressed that in growing turf grasses in mixture, a fertilizer that will be beneficial to one grass will be detrimental to another grass in the mixture. Is there any truth in this statement?—(California.)

The reactions of the different turf grasses to fertilizers are apparently not greatly different and we doubt very much that you would secure any results such as you suggest.

7. The use of muck and lake-bottom soil; composting it with stable manure: redtop, fescues, and bents for northern putting-greens; rate of seeding redtop.— In constructing 9 of our putting-greens last spring we used a top-soil which we mixed up as follows: 70 per cent muck, 20 per cent black dirt or clay loam, and 10 per cent sharp sand. We did not incorporate any fertilizer, but in the fall applied 150 pounds of hydrated lime with a top-dressing of muck, clay loam, and sand in about the same proportions as used in constructing the greens. In May we sowed 50 per cent redtop and 50 per cent Chewings fescue, 125 pounds to the green, averaging in size 80 by 80 feet. Owing to a very hard summer for want of rain and the great and continued heat, we could do nothing to bring forward what seed germinated. We covered the greens with hay to protect them, but all to no purpose; and not until after the fall seeding did we get any growth; and still the lack of rain was a great handicap. We saw no signs of the fescue coming up except for a few blades here and there; but the redtop was excellent and formed a dense growth, but later, toward the end of November, turned yellow and thinned out and generally looked sickly. We accordingly decided to experiment with the use of acid phosphate, nitrate of soda, and muriate of potash, on patches of about two yards square on different parts of the green, with different compositions of the above fertilizers, and found a very great change by using the three in equal proportions, the grass on the treated plots becoming of good color and healthy. What I desire is to get a condition of soil which will not bind and will allow a ball being pitched right up to the hole and staying "put" without the necessity of having the green, as heretofore, in a sodden condition. I would also like to know what grasses will thrive on a soil such as we have here. We also have available for use about 1,500 loads of the top surface of the bottom of one of our lakes,—(Minnesota.)

The chief difficulty in using muck is the inert condition of the material. Muck is liberally supplied with plant food, but the food is locked up or unavailable for plant use. Plants will thrive in it only after it has decayed. This decay is effected by the introduction of microscopic life, which is best accomplished by the application of stable manure. If you had used several loads of stable manure in preparing this mixture we believe you would have had much better results. As regards commercial fertilizers to be used on the greens you have constructed, we would invite your attention to the article on this subject in the October, 1921, BULLETIN. Ammonium sulfate is to be preferred to sodium nitrate in that the former discourages the growth of clovers and certain weeds while, at the same time, encouraging the development of the bent and fescues. We would also advise you to compost your muck and clay loam with stable manure, and the more stable manure you put in the compost pile, the better. After the mixture becomes thoroughly pulverized through composting we would then advise your using it as a top-dressing. In the meantime the use of commercial fertilizers will keep the grass growing until the plant food in the soil is liberated.

In regard to seeding putting-greens, we consider that you used too much redtop for best results. We recommend as a maximum rate 5 pounds to 1,000 square feet. If the fescue you used had been of reasonably good germination it would have been better not to have used any redtop at all. Redtop makes a very vigorous growth at the start and gives the appearance of being a very fine putting-green grass, but it afterwards becomes coarse and the turf open and poor. We believe, however, that the bents will give you a much better turf than the fescues.

In regard to the top-surface soil you have taken from the bottom of one of your lakes, we would strongly advise you to compost this with stable manure before using.

8. Ridding sand greens of weeds.—We desire to kill all the vegetation within a space of about 12 feet around our sand greens. Salt or creosote have been suggested to us for this purpose. Is there anything better?—(New Mexico.)

Where oiled sand greens are used, as described on page 109 of the Bulletin for 1921, there is no difficulty in regard to weeds. If sand greens without oil are used, salt is the cheapest thing to keep out weeds.

MEDITATIONS OF A PERIPATETIC GOLFER

A well-kept nine-hole course with the dues \$20 a year. That's the ideal! On this entirely feasible basis every town of 5,000 people or more will have its golf course and the game will grow as never before.

A dub golfer in high glee over a "birdie." I wish the clubs would get as enthusiastic over Nature's living birdies as the player is over the one he gets occasionally. A golf course without provision for the birds will get in bad with the Audubon Society—and that means most of the ladies of the country who are backing it to the limit.

One club we know prohibits the wearing of metal-spiked shoes on its course, because of the injury to the turf. Hooray! There are plenty of reliable rubbersoled golf shoes now available.

Everybody is now demanding low-priced golf in reach of the average fellow, and if a little good intelligence is used the thing is possible. The rich man must forego some of his golf habits. No more of this ten-dollar-a-hole stuff! To reach economy we all must practice economy.

Two ardent lovers in a beautiful grove of trees on the course. The boys object, as they say it seriously handicaps their playing. Evidently an exception to "all the world loves a lover."

A beautiful green that slopes away from the approach. How the Dickens did the architect expect the fellows to play that hole?

Two short holes in succession. No wonder the course is always congested at this place.

A green full of pox marks where the crab-grass had been allowed to grow too long. It is so much easier and cheaper to remove when young.

Tom, my green-keeper friend, has a rather startling theory about grass that I will not divulge. I suggested an experiment to test the truth of his idea, but he demurs. What's the use of taking a chance and perhaps spoiling a perfectly good theory?

"Extravagance" is the middle name of too many golf clubs. There is a ray of hope that soon a lot of them will be competing to see which one can make the best showing of good upkeep at lowest expense.

"This golf course cost \$135,000," a benighted member boasted. If the club has paid no more than half this sum it could still have been called an "easy mark." How long are clubs going to be bamboozled into paying two or three times as much as necessary to build a course?

A screen of shrubs properly arranged around an exposed green can be very attractive. Besides, it may keep thousands of weed seeds from blowing onto the green and taking root.

The Green Section of the United States Golf Association, judging by the letters received, is striking the favorable attention of hard-headed business men all over the country.

A green-chairman who carried a pocketful of wooden pegs, which he uses to peg down loose divots. Then he scatters a little seed out of a can which he carries "on the hip." "Atta boy!"