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A MONTHLY PERIODICAL TO PROMOTE THE BETTERMENT OF GOLF COURSES

ISSUED BY THE GREEN COMMITTEE OF THE UNITED STATES GOLF ASSOCIATION

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The Turf Grass Seeds to Buy and How to Buy Them

C. V. Piper and R. A. Oakley

If there is one subject more than another pertaining to the making and maintenance of a golf course upon which there is the need for a clear-cut understanding, it is the one pertaining to fine grass seeds. From the first steps in the making of a course to the end of its existence, seed is an important factor to its success as well as a considerable item of expense in its construction and upkeep. There may be important features in the making and maintenance of a golf turf that can not be greatly improved and in connection with which the following of the most efficient practices would result in only a relatively small saving. But in the matter of seed, golf clubs have an opportunity to avoid large worse-than-useless expenditures of money and at the same time reduce to the very minimum the delay in obtaining first-class results. The opportunity for economy in funds should appeal to a large majority of our golf clubs and for economy in time should surely appeal to all.

It is a matter of only secondary concern why there is so much misinformation current on the subject of turf grass seeds. This condition exists and is the basis of most failures or half successes in the development of greens. Incidently the inheritance of European ideas and notions together with the fact that commercial concerns have for the most part constituted the chief source of information is largely responsible for the present state of knowledge on the part of a great many of those charged with golf turf work.

It is purpose of this article to reduce the subject of fine turf grass seeds as it applies to northern courses to its simplest terms, confining the statements to facts that have been conclusively proved to the satisfaction of our best golf experts who are well known for their practical experience and who have no interests to serve other than those seeking the betterment of golf turf. Knowledge concerning fine turf grasses is by no means complete, but there are at hand enough facts to disclose clearly the wasteful and discouraging practices that are too generally followed today. It is upon these facts that the gospel of good greens is founded and any club which does not accept this gospel will find itself wondering why its greens are not among the best, even though it spends money freely.

The Best Turf Grasses

There is nothing mysterious or uncertain regarding the kinds of turf grasses for our Northern golf courses. The fine bents and red fescues are pre-eminently the ones for putting greens and no substitutes should be accepted where it is possible to get either. For the fairways Kentucky bluegrass and redtop are highly satisfactory. It is not intended to discuss the exact range of adaptation of any of the grasses other than to say that the fine bents can be grown successfully farther southward than can the red fescue and are generally to be preferred to the fescues for putting greens except possibly on sandy soils north of the latitude of Philadelphia.

The Seed Supply

Good seed of the fine bents and red fescues has been more or less difficult to obtain since 1915, but supplies are now becoming more plentiful. Commercially speaking there are seeds of three kinds of fine bents now on the market, namely: (1) creeping bent or German mixed bent as it is now preferably called; (2) Rhode Island bent; and (3) Colonial bent, the last two being practically identical as to species and variety. The first, as the name implies, comes from Germany, the second is produced in the New England States and the third is imported from New Zealand. Good commercial seed of these bents gives highly satisfactory results on putting greens. The consensus of opinion is that German mixed bent is somewhat preferable to the other two but there is little choice between them.

There are two commercial red fescues: German or European and Chewings. Seed of both is fairly plentiful on our market, the former being imported from Germany and the latter from New Zealand. These strains of red fescue are very similar indeed, but tests indicate the German strain to have a somewhat wider range of soil and climatic adaptation than the strain from New Zealand. Seeds of Kentucky bluegrass and redtop are both of domestic origin and abundantly plentiful.

The Buying of Commercial Mixed Seeds not Recommended

The foregoing in brief are the simple facts with regard to the grasses and grass seeds for Northern golf courses and they are the facts that need to be recognized by green committees who, if they would function intelligently, cannot be ignorant of them. But the truth is a large number of golf clubs are prone to buy putting and fair green mixtures, especially those that are extensively advertised by dealers who have made it a conspicuous part of their business to establish themselves with the golfing fraternity. In rare cases mixtures of the red fescues and the fine bents may be advantageous. In a great majority of cases, however, these grasses should be used separately. Mixtures of Kentucky bluegrass and redtop are recommended for the fairway *but under no circumstances should mixtures, for either putting or fair greens, be purchased.* This should be put down as a cardinal principle. Where it is desirable to use mixtures the constituent parts should be bought separatively and the mixing done in well-known rational proportions to suit the conditions at hand.

It is a significant fact that the dealers who have purchased the most advertising space to convince the golfing public that they are the best and most reliable sources of supply of fine turf grass seeds are not the one from whom it has been possible to obtain the really fine turf grass seeds so badly needed. Instead they have advocated and delivered to their patrons their own special mixtures for putting greens where only the very best grasses should be used. And of what are these mixtures composed? The chief constituents of the putting green mixtures that were on the market during the past year were redtop and Kentucky bluegrass. The remainder of these mixtures was made up of the red fescues, rye grasses, crested dog's tail, timothy and white clover. In a large number analyzed there was no fine bent seed found and with the exception of one there was only a very little seed of the red fescues. In the light of our definite knowledge of fine turf grasses, is there anything to recommend such mixtures for our putting greens? The answer is emphatically no.

The Purchasing and Testing of Seed

The best putting and fair green grasses for the Northern part of the United States have been discussed briefly, likewise the seed supply. A composite description is here given of the putting green mixtures on the market and extensively advertised in such a way to convince the uninformed green committees, but there is yet one other and very important purpose of this article, namely, to offer suggestions to prospective purchasers as to the safe and intelligent course to follow in buying grass seeds. This applies to Southern clubs as well as Northern clubs. In fact to clubs generally, throughout the country. It is a function of the Service Bureau to assist the clubs supporting it with advice and suggestions regarding seed. When a club is in doubt as to the kinds of seed it should buy, it should write the Service Bureau. This is a point upon which positive advice can be given. The Service Bureau will give the information promptly and will suggest sources from which seed may be obtained. Knowing the kinds of seed to buy and the sources from which they can be purchased, the next step for the green committees to take is to write to the dealers for samples and prices. Then, and this is exceedingly important, they should send the samples to the Service Bureau for examination to determine trueness to name and purity and germination. Critical identity is of vital necessity in the case of the seed of the fine bents, since redtop has been and still is extensively substituted for them and only the most expert analyst can distinguish fine bent seeds from redtop. Only a small quantity of seed of the fine bents was imported last year, yet the quantity of seed offered under their names was enormous.

Purity and germination tests are likewise very useful. The percentage of weed seeds and inert matter should be known by the purchaser and especially in the case of the red fescues the germination is very important. All seeds should be tested for viability, particularly the fescues. The viability of seed of both the European and Chewings strain of red fescue is exceedingly precarious. Even practically fresh seed may have a very low vitality. But the testing should not end with the samples. The bulk seed upon arrival at the club and before it is paid for should be tested in a similar manner so that positive knowledge of the kind of seed, its viability and purity, may be had before it is sown. To save time clubs are advised to make germination tests themselves. They can make these tests sufficiently well for all practical purposes, by sowing the seed in boxes containing shredded peat moss, pulverized cocoanut fibre, good soil or even sand. The boxes should be kept moist and in a warm place. More reliable tests can be made counting out 100 or 200 seeds, putting these between clean, fresh blotters and keeping them moist and warm. By this method the number of seeds that germinate will represent the percentage of germination of the samples or bulk lot. Blue grass seeds require approximately twenty days for a complete test; the fescues from ten to fifteen days; the bents, redtop and white clover six days.

The Specific Points to Consider

The following are the points, then, that a green committee, if it would serve its club intelligently, must bear in mind:

1. *The fine bents and the red fescues are the only grasses that should be used on putting greens in the northern states.*

2. *Seeds should be sown seperately and not in mixtures, excepl possibly in special cases.*

3. *Kentucky bluegrass and redtop are generally the most satisfactory grasses for the fairway.*

4. *Under no conditions should mixtures for either putting greens or fair greens be purchased, since they are for the most part entirely unsuited for the purpose intended and the purchasing of them is not an economical practice.*

5. *No seed should be bought without first having it tested for trueness of variety or kind and for purity and germination.*

If the green committees will only act upon the suggestions herewith offered much of the useless waste now involved in the making and maintaining of golf courses will be obviated. Assistance in the selection and testing of seed will be gladly given by the Service Bureau.

Winter Work on the Golf Course

DR. WALTER S. HARBAN

Winter work on a golf course may be dividel into two distinct kinds: first, the work on the course during open-weather conditions; second, work in the barns when impossible for the men to work on the outside. In each instance there is a large variety of work which can and should be done: in the one case, development and improvement of the course; in the other, proper preparation for the operations to follow later in the year. To present more clearly, as well as to demonstrate the actual workings of this system, it has been thought wise to make clear the plan that has for years been pursued at the Columbia Country Club, where the Open Championship is to held in July. Recognizing the importance of a trained, efficient, skillful green-force, led to the permanent employment of a half dozen or more of the most desirable as well as useful employees. To give these men adequate employment to justify their retention during the winter months, has developed a plan of work more than commensurate with the outlay, and therefore economical in the end.

The summer activities, such as cutting greens and fairways, watering, worming, etc., usually end by the first of November, as it is better to let the grass become a trifle longer in order to withstand winter use. Winter trampling and kneading is believed to be beneficial rather than detrimental where there is a strong, well-matted turf. The Columbia course, therefore, is never closed to play except upon rare occasions, and then only when very soft, usually following the spring thaw. The months of October and November and part of December is the best time to build greens and to transfer sod. It is at this season that most of the greens have been built and remodeled, from one to three each year. Those built in the spring, especially as late as May or June, have not done so well, perhaps due to insufficient rootage before the summer season. At any time during the winter months when the ground is open, bunkers and tees can be more easily built, and even sodded, than at other seasons, and with far less interruption and inconvenience to play. The clearing of land both for use and for beautification, making drains and ditches, etc., are among the operations we have been able to take care of during the winter months. Again, at convenient times in the fall, the soils for the composts are placed

in the barn utilized for that purpose, where they are kept dry. During inclement weather these soils are screened and mixed in sufficient quantity for spring and summer dressings. During the latter part of December the greens are dressed with sharp sand at the rate of from two or three yards each, according to size. The winter trampling helps to work the sand into the soil, and at the same time perhaps does more to prevent the so-called "winterkilling" than any other treatment. Dressings of manure on the weak places of the fairways are applied late in February, just before the thaw.

The barn or indoor work is supposed to be done at times when the weather is unfit for outdoor work. A large barn for the storage of compost is almost indispensable, as this material should be kept dry and ready for early use in the spring, and can be prepared on days when the men cannot work on the outside. Another large barn is essential for the storage of machinery, tools, and implements, where they can not only be protected from the weather but where ample space is afforded for inspection, cleaning, and repairing. There is nothing more desirable in green-keeping than perfect machinery. A worn-out machine or tool should be discarded, as it only means loss of time and delay, nowadays involving financial loss or imperfect work. Everything possible under the care of the greenkeeper should be repaired, if necessary, and made ready for its immediate use when the time comes. Tee boxes, benches, flag staffs, wagons, carts, rollers, etc., look better and last longer after a little paint has been applied. It is well to take an inventory of all property for comparison with that of the preceding year, so as to check up the losses, if any. You may be surprised how many things have disappeared, perhaps "borrowed," to say the least. We consider the indoor work of the greatest importance to facilitate the operations that come later in the year, when there are so many more things that should be done promptly. The chairman of the green committee will act wisely by visiting the barns at irregular intervals, especially on bad days, to see that the work is being carried out.

To those who have not adopted and conducted this sort of winter campaign, I believe the results will prove a revelation both as to the great benefit as well as to the amount of work that can profitably be gotten out of the way, making it easier to conduct the later operations with a smaller summer force.

To sum up.—Keep your trained men regularly employed, so as to insure having a good summer force. Plan and develop certain improvements to the course each year. Do all the repair work on bad days in winter when nothing else can be done. Finally, be prepared to do, without interruption, the things that must and can only be done in summer.

Number of Seeds in One Pound

The number of seeds in one pound varies considerably depending on the amount of chaff and trash as well as on the quality of the individual seeds. The figures given below are in many cases average of several determinations:

German Bent	4,000,000	Timothy	1,200,000
Rhode Island Bent	4,000,000	Sheep's Fescue	800,000
Redtop	4,000,000	Red Fescue	600,000
Kentucky Bluegrass	2,400,000	Italian Rye Grass	270,000
Bermuda Grass	1,800,000	Perennial Rye Grass	270,000
Fine-leafed Fescue	1,250,000	White Clover	700,000

Spring Work at Inverness

W. J. ROCKEFELLER

Every professional greenkeeper should be pleased that the Green Committee of the United States Golf Association has been organized and made up of scientists and earnest active amateurs. These are the men who advance the standard of greenkeeping. We who are at it every day and hour come to accept conditions as we find them and go our way confident that nature will come to our relief sooner or later. We apply our stock remedies and treatments and let nature take its course. The amateur, however, is not content. He wants to find out what it is all about and the "why" of it, and though he may do some foolish things and make mistakes, his very earnestness often leads to important discoveries. The professional greenkeeper therefore should assist the Green Committee of the United States Golf Association by putting at its service all the practical knowledge and experience he has. Both will benefit.

The ordinary individual can plan his season's work with a feeling that he can adhere fairly closely to his program, but the poor greenkeeper, especially in the spring, is lucky if he accomplishes the half of what he plans. First it snows, then it rains. The day it rains all the workmen appear, and if the day is clear they all stay home because the baby is sick or the almanac predicts snow.

March may come looking like a lamb to some, but it is doubtful if any greenkeeper ever saw it otherwise than as a lion.

Nevertheless, wind and weather permitting, this is what is planned for Inverness this spring. It might be well to say that our machinery and equipment has been overhauled during the winter and is ready for use. The tee boxes and benches have been repaired and painted so they look like new and to give the members something to think about, the tee box of each hole having more than one tee has painted on it the distance from the different tees. New flags and poles are ready. Plenty of sand was hauled into the bunkers and traps during the winter. Our supplies for the season have been purchased. When gentle spring does come, we shall be ready with our paraphernalia if nothing else.

We usually open our regular greens to play at Inverness very early, often before the first of April, so it is apparent no favorable time for work can be wasted.

Our Green Committee has fixed May 15 as the day after which no construction or alteration work may be done. We are not to be allowed to let construction work interfere with the full enjoyment of the course by the members this season, at it is thought they made enough sacrifices last year in preparation for the National Open to be entitled to everything we can give them. Before the date fixed, we must complete a considerable amount of grading and turfing around our number eighteen green which could not be completed last year, and we must do all we can toward the completion of a long list of big and little items of changes required to satisfy the Green Committee.

Just as soon as the condition of the course permits, it will be thoroughly raked—sacrified, you might say—with forged rakes, the notion being that by this means the dead material is removed, the grass roots are loosened or cultivated, and a strong early growth is fostered. It may be this is an extravagance, but the Committee believes it is desirable.

Fertilizer in the form of well-rotted barn manure will be applied at the rate of about four tons to the acre. Last fall we top-dressed the whole course with mushroom soil at the rate of about ten cubic yards to the acre, so we hope with even reasonable weather conditions to have a satisfactory turf this season, but the greenkeeper does not live who can grow grass without rain. All the fairways will be rolled with a six hundred pound roller.

The rough, bare or thin areas in the fairways will be given a thorough "going over" and will be seeded and given an extra heavy top-dressing of compost. We have about one thousand cubic yards of compost ready for use and will be able hereafter to fertilize and top dress with our own materials and avoid the use of more expensive and less satisfactory substances. The fairways were seeded in the fall so that our spring seeding will be limited to the few spots requiring special attention. Our seed, by the way, was bought on sample, which was tested for identity and germination at Washington, and the quality of the shipment will be verified by a like test.

All the old scars left from last year's unrepaired divots will be cut out with an ordinary hole cutter and filled with good turf taken from some out-of-the-way place in the rough. It is surprising how quickly and economically a lot of ugly and annoying holes can be repaired in this way.

The first time the grass is dry enough early in the spring the rough will be burned over to remove the dead grass so that our mowing machines can be worked on it next year without becoming clogged up. We intend also, if we can find the time, to skin some of our rough by removing the turf and some of the top soil after which we shall sow sheep's fescue, thus getting material for our compost pile and, we hope, producing a rough that will be more suitable and require less attention.

We are inclined to the view that we may be applying too much fertilizer at one time and that a too luxuriant growth of grass is possible. A course with a perfect turf and no bad lies is more of a park than a golf course. The game, without occasional bad lies, is not golf, but nevertheless, nothing pleases the members more than a soft, deep, heavy turf, and after all the members are the one who pay the rent and our theories must give way.

All our greens and approaches for say up to forty yards will be raked and cross-raked with special care, harrowed or sliced two ways with a Velvet Lawn Seeder and seeded at the rate of about eight pounds of German bent to a green and an equivalent amount on each approach. Here we look with more favor on the re-seeding of greens in the spring than in the fall for the reason that the seed is subjected to less disturbance and is more likely to germinate on that account. Fall seeding should be done here late in August or early in September, at a time when the course is under the heaviest play of the year. The point is that the fall seeding discommodes players, and the seed itself has not so good a chance to germinate as if sown in the spring.

After this our greens will be top-dressed with mushroom soil. The top-dressing will be worked in with the backs of wooden rakes and by dragging steel mats across the greens. Our top-dressing of greens will be comparatively light as we expect to top-dress lightly once a month during the season with mushroom soil and occasionally with common yellow sand. We think much better results, better turf and better putting

surface can be expected from frequent top-dressings than from infrequent dressings with nitrate of soda or other inorganic stimulants.

If the Green Committee of the United States Golf Association ever arranges a contest in top-dressing, we propose to enter our "Old Mat," as he can do a better job than any one we know. Any golfer may well envy the ease of his back swing with a shovel and his follow through is marvelous, the punch in his swing comes at just the right moment and his finish is beautiful. The top-dressing goes on fast, smooth and even.

This program seems to us well calculated to produce results, but after all no amount of care, work or material can obviate the burning and destruction of a long dry season. Nothing will take the place of rain. We do not anticipate having an excessive amount of leisure from the time the snow leaves until this work is done and after that all we shall have to do will be to cut the greens nearly every day, cut the fairways once or twice a week, keep the bunkers raked, fight dandelions, pearlwort, buckhorn, chickweed, grubs, moles and ants, chase the neighbors' hogs out every now and then, keep the tee boxes filled, patch up leaky water lines, and listen to the advice of members and apologize for not having moved tee markers.

NOTE—The soil at Inverness is a sand loam.—ED.

Pounds not Bushels

Buy grass seeds by the pound and not by the bushel. The number of pounds to the bushel is not definite, and the purchaser has no means of knowing just how much seed he will get if he purchases it by the bushel. The recognized weight per bushel of many of the turf grass seeds is considerably lower than the actual weight of properly cleaned seed. Some states have established weights per bushel of grass seeds, but the federal government has not done so; therefore this has resulted in much confusion, as the weights fixed by the different states are not the same.

Mowing the Putting Green

It is well to establish a proper level of cutting putting greens as early as possible in the spring, as it is quite difficult to lower the level when it is once established. Especially is this true during the hot months of summer. Under such conditions, if the grass is crowned it recovers very slowly.

Sheep's Fescue

Sheep's fescue, where it can be grown, makes an excellent covering for bunker mounds. It is possible to get a very good covering of sheep's fescue, both on newly-constructed bunkers and old ones, by dibbling-in pieces of turf an inch or more in diameter; these can be placed approximately eight inches apart. This method is productive of quick results and is not an expensive one.

View of the Olcott Turf Garden, South Manchester, Conn., as it appeared about 1910

Courtesy of the Macmillan Company

The First Turf Garden in America

C. V. PIPER

The illustration gives a view of the Olcott turf garden at South Manchester, Connecuticut, as it appeared about 1910, after the originator, Mr. J. B. Olcott, had been at work studying turf grasses for twenty-five years. As early as 1885, long before the development of American golf, Olcott conceived the idea that greenswards could be developed of as fine quality as the exquisite small patches of turf that can be found in nearly every lawn. He began by selecting the best mats of turf he could find and multiplying them by vegetative methods until he had enough to plant small plots. Olcott was strongly prejudiced against the use of seeds, as he believed that seeds produced a more or less mongrel lot of grasses. Therefore all his work, from first to last, was by vegetative methods. After the work was fairly developed, he was assisted in its prosecution by the Connecticut Experiment Station.

During his work Olcott selected many hundreds of mats of turf, but he promptly discarded all that did not appeal to him. In the course of his work he traveled in Europe, Australia, New Zealand, and from every place he went he chose a bit of turf. When I first saw the garden, in 1910, the great majority of the plots consisted of strains of red fescue, but a few were of bents. One of his red fescues was especially beautiful, and the plot of this was large; besides he made from it the lawn about his house. This turf was purchased by the late Fred W. Tayler and transferred bodily to his home at Highland, near Philadelphia. It made an exquisite lawn in fall and spring, but in midsummer was badly attacked by "brown patch." Indeed, its susceptibility to this disease is its only fault.

Olcott, like many another pioneer, was ahead of his time. Few recognized the significance of his work, as at that time there did not exist the great body of golfers who have learned to appreciate really fine turf. The method he used is, however, the correct one to select the best strains of fine grasses. As applied to such grasses as creeping bent, velvet bent, Bermuda grass, and even red fescue, the method is simple and not expensive. By its means putting greens of superlative quality can be secured. It is safe to predict that in the very near future the best golf courses will plant their greens by the vegetative method, which will insure perfectly uniform turf of the highest quality. While Olcott's work did not lead to this modern development, it must be conceded that he clearly recognized the true way in which to secure perfection in turf.

Experience and Experiments

C. V. PIPER AND R. A. OAKLEY

When the methods on any golf course give satisfactory results as indicated by general excellence of the greens, the methods command respect. On many golf courses, however, the methods used are very complicated and it is practically impossible to determine which treatments or processes are really effective. Thus if the putting greens are treated at various times during the season with diverse substances such as lime, muck, manure and nitrate of soda, no one can say just what are the effects of each, even though the end result be highly satisfactory. Indeed some of the teratments may be truly harmful but their effects are masked by other treatments that are beneficial.

Herein lies the value of an experiment, in which treatment with a single substance or with an implement say for one-half of a green is compared with the other half left untouched. Only by this method is it possible to ascertain whether a particular substance or process is desirable or unsatisfactory. Such simple experiments are particularly valuable to reach correct conclusions. Indeed there is no other method nearly as good.

Stones in the Fairway

If fairways are at all stony the best time of the year to remove them is early spring, just as the frost leaves the ground and before the grass starts to grow. When stones are removed at this time practically all the holes are smoothed out by rolling. Fairways need this rolling every spring to compact the loose surface soil caused by freezing and thawing.

Burning the Rough

The question is often asked, Should the rough be burned? There are different opinions on this subject. It is quite generally agreed, however, that burning improves the rough, especially if there is a large accumulation of coarse dead material or if there is an invasion of shrubby plants. Generally speaking, it is quite probable that burning at least once in two years is helpful.

Make New Holes Frequently in Spring

In early spring, if the soil on the putting green is at all soggy, the hole should be changed frequently. If this is not done the continuous trampling about the hole is very hard on the turf. Sanding helps to protect the soil from too great compaction with consequent injury to the grass.

Drainage

Early spring is a good time to determine which greens are most in need of drainage. The soil becomes in good condition first on the well drained greens and remains soggy longest on those poorly drained. Drainage is never adequate if a soggy condition remains more than a day or two in good weather.

Earthworms.

Earthworms begin to be active with the first warm days in spring just as soon as the earliest grasses take on a live green color. The number of the casts is a good index to their abundance. If they are numerous the green should be wormed just as soon as the soil is fairly dry so the poison will go down into their holes. It is inadvisable to treat the green while the soil is still full of water.

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 privilige and duty to write to the Green Committee.

1. *What is the best way to destroy dandelions on putting greens? H. B. V.*

Three methods are practicable, as follows: (1) By digging out each individual plant, a plan that has evident disadvantages, as more or less grass is necessarily injured or destroyed. (2) By killing them with sulphuric acid, applying the acid with a sharp, stout, stiff wire rod stuck into the middle of each plant. Acid is a disagreeable substance to handle. If used, the acid should be in a broad-mouthed bottle, such as a pickle bottle, fixed to the middle of a board or tray. In taking the rod from the bottle is should be drawn over the mouth of the bottle to remove excess acid. The tray will prevent drops of the acid from falling on the grass. (3) By killing them with gasoline injected into the crown—a very neat method. The gasoline can be applied by an ordinary oiler with a sharp-pointed tip. A special implement to apply gasoline, costing $1.00, is on the market, and on application the address of the manufacturers will be furnished by the Service Bureau.

To combat dandelions in lawns and on fairways, spraying with a solution on iron sulphate is worthy of trial. The solution consists of one and one-half pounds of iron sulphate, also called copperas or green vitriol, to one gallon of water. As iron sulphate corrodes metals, the solution should be mixed in wooden vessels. It is best to use a spraying outfit mounted on wheels, and which will throw a fine mist-like spray. At the New York Experiment Station nearly all of the dandelions were destroyed by spraying five times, the first spraying just as the plants begin to bloom in May, the second and third sprayings three and six weeks later. In addition two sprayings were given in late summer. Practically all of the dandelions were destroyed, and also white-clover, heal-all, plantain, and buckhorn. The grass is but little injured, but it is desirable to stimulate it into vigorous growth by the use of fine, well-rotted manure, bone meal, or nitrate of soda.

At the Colorado Experiment Station very similar results were secured but the most effective treatment was spraying three times in August and September at intervals of two weeks. No irrigation should be given for 24 to 48 hours after spraying. The grass was injured slightly, but with good treatment soon recovered. White clover was completely killed by the three sprayings.

At Arlington Farm, Virginia, it required five sprayings to kill the dandelions, but this also resulted in much injury to the grass. The bents were much more injured than was bluegrass.

In the light of present evidence, the iron-sulphate spraying method is well worthy of extended trials and is likely to prove much more effective in some localities than in others. Iron sulphate gives a rusty stain to cement walks and walls and therefore care should be taken not to spray or spill the solution on them.

2. *Please report on the sample of muck sent herewith and advise as to its value on golf courses. W. S. F.*

The sample sent is in texture and color a fine sample of muck, but whether or not it contains toxic substances is best determined by sowing bent or fescue seed in a shallow box of the material. If the seedlings grow well the muck is desirable; if not, it can be bettered by mixing in finely ground limestone, 100 to 200 pounds to a ton of muck, and allowing it to weather some months. Sometimes weathering alone will remove the toxicity. As a rule, the surface of muck deposits is much better than the deeper material. Good muck is excellent material to mix in the soil of a new putting green, especially if the soil is very clayey or sandy; large quantities may then be used to advantage. Muck alone is not desirable as a topdressing, as it dries and blows away and its effects are not striking. It may be used with good results in compost heaps, building these of alternate layers: the first, muck mixed with lime; the second, good garden loam or sod; the third, barnyard manure. After being thoroughly composted for at least three months, these layers, mixed and sifted, make excellent topdressing material for putting greens.

3. *Can nitrate of soda be applied as a fertilizer dissolved in a solution of corrosive sublimate to destroy earthworms? W. T.*

There is no chemical change brought about by mixing solutions of these two substances; so there is no theoretical objection to using these two in a mixture. Some of the nitrate will, of course, be washed pretty deeply into the soil by the water used to get the poison to the worms, but the loss of nitrate by this means will not be large. It will be of interest to learn how the scheme works in actual trials.

4. *What are the relative desirabilities of carpet grass and Bermuda grass for fairways in the South? J. R. I.*

Both of these grasses make superb fairways in the South on soils to which one or the other is adapted. Carpet grass is well adapted to soils that have a good moisture supply near the surface. In general, carpet grass is best on sandy soils, especially those that are relatively level and not too dry; but it succeeds well on rolling lands with sandy soil at the surface and a shallow clay subsoil. Even on clay soil carpet grass is often more vigorous than Bermuda grass. Bermuda grass is to be preferred, as a rule, on clay soils and other soils not moist enough for carpet grass. The seeds of both grasses are available on the market, but Bermuda grass is often planted by the vegetative methods.

5. *What grass seed would you advise be sown on putting greens in the South where the course is used only in winter? C. J. B.*

Redtop, by all means. The seed is cheap and of high quality, especially the recleaned grade. It is a waste of money to sow fine bents and fescues, as the seed is expensive, and young redtop turf which results from seeding each fall is fully equal during the winter to turf made by the fine bents. The grass all dies out in the South during the hot summer weather. Many clubs still use rye-grass, either Italian or English; but the redtop is immeasurably superior.

6. *Is there any danger of introducing weeds into putting greens through the application of stable manure or compost? M. T. O.*

There is very little danger if the manure is reasonably well-rotted or the compost has remained in the stack or pile for a few months. Stable manure, leaf mold, peat, and similar organic materials sometimes carry weed seeds; but it is a very easy matter to determine whether or not viable weed seeds are present. Simply put a small quantity of the material in a tray or a box, such as an ordinary cigar box, and keep it moist and warm. This will afford suitable conditions for germinating any live seeds that may be present. If seedlings do not appear at the end of a week or ten days it may be assumed that the material is safe to use as a topdressing. The danger of introducing weeds by the use of humus topdressing has been much over-estimated; nevertheless, precaution should be exercised to avoid the unnecessary introduction of weeds into the greens.

7. *How can I become an expert greenkeeper? O. B. F.*

At the present time there is no educational institution where instruction is given in greenkeeping. We would suggest that you study thoroughly the best books dealing with the subject, and at the same time get your practical experience by working on a first-class golf course. At the end of a year, if you are studious and diligent, you should have a good foundation. One year's experience is not much, as the conditions may have been either exceedingly good or very bad. Until a man has had four or five year's experience under different conditions of soil and climate he can hardly call himself expert. The salaries now paid to efficient greenkeepers amply justify thorough training for the work.

8. *What are the effective substances that worm-killers contain? J. C. S.*

The effective poison is nearly all the worm-killers on the market is corrosive sublimate (bichloride of mercury). This substance makes up but a small part of the commercial worm-killers, most of it being a filler of various kinds. One worm-killer formerly on the market consisted in part of the poisonous pulp made by crushing the seeds of *Bassia latifolia,* and East Indian tree. Another, with a special name and not very efficient, consists largely of sulphur compounds, particularly sodium polysulphide and sodium thiosulphate. Many substances will irritate the worms so that they come to the surface, including lime water and probably all weak alkalies, vinegar and perhaps all weak acids, and kerosene emulsion. Some new substances are now under test which promise to be more efficacious than any of the older ones.

9. *Is this sample of soil from our putting greens sour? If so, what treatment is desirable? W. J. H.*

The best grasses for putting greens—that is, the bents and the fescues—make the finest quality of turf on soils somewhat sour or acid. If the reaction of the soil is changed by adding lime, the result will be a great increase of the various turf weeds, and consequently a poorer quality of turf. For this reason lime should rarely or never be used on putting greens composed of bents or fescues. Naturally acid soils are, in the light of present evidence, the most desirable for fine bent. It is very difficult to change a neutral or alkaline soil into one with acid reaction, various experiments thus far made with this object in view having given unsatisfactory results. Even when sulpheric acid was used, the increased acidity of the soil was very transitory. Sulphate of ammonia has long been known

to bring about an acid condition after long use; but when applied to the turf it must be used cautiously, as it will burn grass severely. Attempts are now being made to secure the desired degree of acidity by adding the ammonium sulphate to the soil before seeding or planting. Nitrate of soda, which is very commonly used, gradually brings about an alkaline condition of the soil—just the reverse of ammonium sulphate. In testing with litmus paper, make a moist ball of the soil, break this in half, put a strip of blue litmus paper on one-half and cover with the other half, pressing them closely; if the soil is acid the paper will turn pink by the end of five minutes. Or put a strip each of blue and pink litmus paper in the bottom of a tumbler and fill it half full of moist soil, pressing it down firmly. The change in color, if any, can then be watched. If the blue litmus turns pink, the soil is acid; if the pink litmus turns blue, the soil is alkaline; if no change takes place, the soil is neutral. If you must test out the effect of lime to satisfy yourself, try applying it just to one-half of a putting green and then watch for any changes you can detect between the two halves.

10. *Is humus good for grass on greens where there is a heavy clay soil? E. M. V. V.*

A good content of humus in the soil is a necessary condition to secure really fine turf. Incidentally it tends to increase the "springiness" so desirable on putting greens. By humus in the broad sense is meant more or less completely decayed vegetable matter. The best form of humus for turf is stable manure, preferably composted and well-rotted. Mushroom soil, if it can be secured, is probably best of all. Humus should be abundantly incorporated in the soil in building a new putting green, and thereafter should be applied several times a year as a topdressing. Peat and muck humus, sold as a commercial article, is to be viewed with suspicion. Frequently it is very toxic, and injures grass greatly, at least temporarily. (See also answer to question 2 above.)

Relative Response of Turf Grasses to Fertilizers

Turf grasses are not all alike in the degree to which they respond to fertilizers. In other words, some make more growth than others when given an application of the common fertilizing materials, such as barnyard manure, bone meal, nitrate of soda, sulphate of ammonia, potash, and acid phosphate. The order of their response is as follows: Kentucky bluegrass, fescues, bents. There is a marked difference between the effect of fertlizers on Kentucky bluegrass and their effect on the fescues and bents; bluegrass not only responds more quickly and markedly but it is affected for a greater length of time than are the other two. However, the turf grasses are essentially alike with regard to the season of the year during which they respond to the application of fertilizers. All respond with a reasonable degree of definiteness in the spring and fall, and all show lack of definite response in the summer.