

summer with little danger of burning. Ammonium sulfate is not such a fertilizer, but either cottonseed meal or soybean meal may be applied at a rate as high as 15 pounds to 1,000 square feet of turf with relative safety at any time of the year.

There is much to be said on the subject of acid- and alkaline-reacting fertilizers. There is much to be done from an investigational standpoint. Active investigations in this field should be encouraged.

The Size of the Fairway

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The very interesting article and instructive data on the size of the putting sward which appeared in the December, 1923, number of THE BULLETIN has no doubt resulted in the discovery that some putting greens are nearly half an acre in size. A matter of hardly less importance is the area of the mowed fairway; and judging from the standards set by different clubs, there appears to be considerable difference of opinion as to what constitutes an adequate size of fairway. Fairways averaging 70 yards and with little or no carry from the tee are mowed by some clubs, while other clubs go to the opposite extreme of 100 yards of rough from the tee and mowed fairways averaging 40 yards. The extremes can sometimes be found on the same course. As in the case of the putting sward, the fairway, as regards width, should have proper relation to the type of hole and should take into account the effect of ground contours upon the run or kick of the ball.

While it is deemed impossible to lay down standard measurements for anything in golf architecture, yet standard maintenance is a matter which is discussed and seriously proposed. Maintenance costs of various courses are compared and explanations sought for the seemingly unexplainable differences in expenditure; and in this connection the fact must not be lost sight of that while the areas mowed for fairways vary between 45 and 65 acres, and for putting greens between 5,000 and 9,000 square feet, the budgets of green committees must necessarily vary considerably.

Since every unnecessary yard of fairway means so much waste in labor, fertilizer, seed, and wear and tear of equipment, this subject deserves closer attention than it has received. Furthermore, quite apart from financial considerations and effect upon play, a well-defined and carefully planned fairway adds considerably to the appearance of a hole; a rectangular fairway is a blot on the landscape.

QUESTIONS AND ANSWERS

All questions sent to the Green Committee will be answered in a letter to the writer as promptly as possible. 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.

While most of the answers are of general application, please bear in mind that each recommendation is intended specifically for the locality designated at the end of the question.

1. FREQUENCY OF TOP-DRESSING; PATCHING GREENS WITH CREEPING BENT STOLONS.—Our greens, which were seeded last fall to fescue and redtop, are coming along fairly well this spring, but they have a considerable number of bare spots. We have compost available for use as top-dressing, but are uncertain as to whether it would be safe to attempt to force grass in this condition by top-dressing with compost to which ammonium sulfate has been added, more than once a month. Kindly advise us on this point. Our greenkeeper is planting stolons of creeping bent on the bare spots of the greens. He obtains these creeping bent stolons from the fairways, and the stolons are taking hold and spreading rapidly. (Maryland.)

ANSWER.—The permissible frequency of top-dressing with compost to which ammonium sulfate has been added depends largely on weather conditions. When there is much rain we believe it would be perfectly safe to top-dress at the rate given on page 111 of the May, 1924, BULLETIN as often as once every two weeks. We have top-dressed as frequently as once a week without deleterious effects, but we have not observed any greater benefits from top-dressing once a week than from top-dressing every two or three weeks. If you continue to top-dress your greens throughout the summer we would suggest that you water the greens thoroughly after each application, as we have found that during hot weather it is easy to burn grass unless the ammonium sulfate is thoroughly watered in. We believe you will obtain good results by planting creeping bent stolons in the bare spots of your greens.

2. RESEEDING AND OTHER PRACTICES IN THE RENOVATION OF FAIRWAY TURF; KENTUCKY BLUEGRASS, REDTOP, BENT, RED FESCUE, AND SHEEP'S FESCUE AS FAIRWAY GRASSES.—Two of our fairways were seeded in September, 1922, and were opened for play in May, 1924. The summer of 1923 was very dry in our locality and a poor season for growing grass. In consequence the fairways were badly burned and baked and made little progress. This year, however, we have had considerable rain, and these fairways have shown much improvement in the past few weeks. The fairways were sown to Kentucky bluegrass and redtop. Our architect has advised that the fairways should be thoroughly disked; seeded, and rolled with a fairly heavy roller, the seed mixture to consist of 60 per cent red fescue, 20 per cent sheep's fescue, and 20 per cent Kentucky bluegrass. How would it do to include bent seed in the mixture? (Pennsylvania.)

ANSWER.—If your turf is even of a very mediocre quality it can be vastly improved by top-dressing and fertilizing. Seeding in turf, with or without disking, is usually a waste of money, and certainly so if red fescue or sheep's fescue is used. Sheep's fescue has no place on the fairways under any conditions. It is marvelous what can be accomplished with relatively poor turf by proper treatment, namely, by top-dressing and fertilizing. In our judgment it is never justifiable to sow seed on established fairway turf, except bent seed, and the use of bent seed needs to be carefully considered on account of its high cost. It is very difficult to get a stand of red fescue by seeding it on established turf. There is practically only one good fairway grass that can be seeded on established sod, and catch, and that is bent grass, either German mixed bent or Rhode Island bent. On account of the high cost of bent seed we do not think you would be justified in using it on large areas. It might be well, however, to use it on the important parts of the fairways—that is, where the tee shots or second shots fall, sowing it at the rate of about 1 pound to 1,000 square feet. The most dependable and most economical

seed mixture for fairways is 3 or 4 pounds of Kentucky bluegrass and 1 pound of re-cleaned redtop, seeded at the rate of 3 pounds to 1,000 square feet. If bent is to be used in the mixture, $\frac{1}{2}$ pound of the bluegrass might well be replaced with $\frac{1}{2}$ pound of bent seed. Unless the areas to be re-seeded are prepared so as to get a good seed bed, we are afraid you will have difficulty in getting first-class results from re-seeding. In case you have a good supply of compost top-dressing we would also advise you to utilize the top-dressing as far as you can by mixing the seed well into the compost top-dressing and apply the mixture when you reseed, provided the seeding rate above indicated is maintained.

3. PRODUCING BENT TURF ON STIFF CLAY SOIL.—We have been trying for several years to make a putting green on stiff clay soil, but without much success. We first sowed the green to a mixture of red fescue and redtop, but last year sowed considerable German mixed bent seed along with some redtop, and also top-dressed liberally with sand. At the present time the grass is very thin and the soil very hard. We have thought of removing one or two feet of the clay soil and replacing it with black loam. What would you suggest in the matter? (Minnesota.)

ANSWER.—While it is desirable to have good top soil for a putting green, in our judgment the need for such a soil has been greatly exaggerated. It seems to be in the minds of many that a good top soil should be 6 or 8 inches or even 18 inches deep. Our experience indicates that 3 or 4 inches is ample, and that it is even possible to establish good greens on any ordinary soil. We have accomplished this on a stiff clay soil in the following way. A well-prepared seed bed is made and in the latter part of August or early September sowed to bent seed at the rate of 3 to 5 pounds per 1,000 square feet. The following spring the green is top-dressed with compost consisting of one-fourth good clay loam or loam, one-fourth well-rotted manure, and one-half sand, to which ammonium sulfate has been added at the rate of 15 pounds per cubic yard. The compost is applied at the rate of 1 cubic yard to 5,000 square feet of green. Frequent top-dressings are also applied during the growing season (every 30 days, if possible) with the omission of the ammonium sulfate. This latter should not be applied oftener than three times a year—once in early spring, once in late spring, and once in early fall. At the time of applying compost containing ammonium sulfate, a thorough watering should be given to wash the chemical into the soil. Pure sand as a top-dressing causes the soil to bake; it does not relieve the stiff condition; and we have seen many greens made thin by top-dressing with sand alone, which is particularly the case where the sand contains enough silt to cause it to bake and form a crust. If you have a reasonably good stand of bent grass we believe you could improve the green wonderfully by following the method we have outlined but without even disturbing your present turf. If, however, you decide to prepare an entire new seed bed, it would of course hasten the development of your turf if you would apply 3 or 4 inches of good top soil before seeding.

4. IMPROVING PUTTING GREEN TURF BY THE INTRODUCTION OF BENT SEED.—Our soil is poor and sandy. The turf on the greens is simply the natural grass, which under constant mowing and rolling has become of fair quality. Can you suggest any method by which we could improve this turf without going to the expense of reconstructing the greens? (New York.)

ANSWER.—A great deal can be done to improve your greens by not disturbing the soil at all. Your best method would be to seed, where.

necessary, with German mixed bent seed, about the middle of August in your latitude. At the same time the condition of the soil should be improved by frequent top-dressing with compost. An application of ammonium sulfate in the spring and fall of each year at the rate of 3 to 5 pounds to 1,000 square feet will also do much to encourage the spread of the bent grass.

5. IMPOSSIBILITY OF GETTING PURE CREEPING BENT SEED.—We have a letter from a seed firm guaranteeing to furnish us with seed which has been tested and found to be "86 per cent creeping bent." Is this a misstatement, or can it be true? (Illinois.)

ANSWER.—The "creeping bent seed" of the trade is in reality South German mixed bent seed, which consists of about 85 per cent Rhode Island bent, 15 per cent velvet bent, and a mere trace of true creeping bent. Your seed firm's statement is an error, due perhaps to a misunderstanding. There is no straight creeping bent seed on the market. The only practicable method of establishing putting greens of straight creeping bent is the method of vegetative planting, using selected strains for the purpose. The Rhode Island bent and velvet bent obtained from the German mixed bent seed are good putting green grasses, but they do not possess the pronounced spreading habit of creeping bent.

6. QUACK GRASS AS A TURF GRASS; SEEDING A POLO FIELD.—We are preparing to seed a polo field and want to use a grass which will stand hard wear. Would Kentucky bluegrass or quack grass, or the two mixed, be good for the purpose? We seeded the field to redtop and Kentucky bluegrass some time ago, but these do not stand the wear, whereas a small patch of quack grass in the field stands the knocks better. The soil is quite heavy. (Ohio.)

ANSWER.—While quack grass is fairly tough, our observations lead us to think that under fairly close cutting it would tend to thin out and not make a good covering. If mixed with bluegrass, however, these two grasses might answer your purpose. Since you are on rather heavy soil, we are inclined to advise the use of a mixture of 4 pounds Kentucky bluegrass, 1 pound German mixed bent, and 1 pound re-cleaned redtop seed, sowed the latter part of August or the first of September at a rate not less than 100 pounds to the acre, and preferably at a somewhat heavier rate.

7. INADVISABILITY OF USING RED FESCUE IN MIXTURE WITH BENT.—We are ready to seed three new greens and are wondering whether it would be advisable to sow these with a mixture of red fescue and bent. Red fescue seems to do very well here. (Pennsylvania.)

ANSWER.—We consider it a mistake to sow a mixture of red fescue and bent. In our experience, the former grass will not survive the close cutting that is necessary for good results with bent in putting greens. Moreover, the bent is certain to crowd out the red fescue plants in a relatively short time, so that the use of red fescue seed would be a waste of money.

8. SPIKED ROLLERS AND WEED CONTROL.—We cut out the chickweed and yarrow in our putting greens, by the use of a hole cutter where the weeds are that size, and replace with creeping bent turf from our nursery, of which we have one acre. It has been suggested to us that we use a spiked roller and sow bent seed on the greens as a means of crowding out weeds. Which do you think is the better method? (Pennsylvania.)

ANSWER.—The method you are pursuing of cutting out perennial weeds and replacing with good turf is absolutely the best method to use in fighting weeds on putting greens. Spiked rollers will not remove weeds whether followed by seeding or not. All of our experiments with spiked rollers and similar devices have resulted in injury to the turf. In the light of our present knowledge we do not advise using them except in an experimental way, spiking a portion of a green and comparing the behavior of the spiked portion with an unspiked portion.

9. USE OF SALT FOR KILLING WEEDS IN BUNKERS.—Could you give me any information with regard to killing weeds in bunkers? We have a power sprayer. (Oregon.)

ANSWER.—Probably the most convenient and effective preparation for killing most kinds of weeds is common salt. If applied dry, 30 to 50 pounds per 1,000 square feet should be used. If applied in solution, make the solution as strong as possible, using about $3\frac{1}{2}$ pounds to a gallon of water, and apply with a sprinkler or sprayer at the rate of 6 to 9 gallons per 1,000 square feet.

10. DESTROYING WEED SEEDS AND PLANTS BY COMPOSTING.—Can the plants and seeds of pearlwort be killed by burying them in a covered pit for two years? (Massachusetts.)

ANSWER.—Seeds and plants of pearlwort and other weeds are killed by composting them. If the compost pile contains manure, a period of one year will generally suffice for killing the weed seeds and plants.

11. FAIRWAYS AND PUTTING GREENS WHERE WATERING IS IMPOSSIBLE.—Can you recommend any grasses that would make satisfactory fairways and putting greens in this section where no facilities for watering are available? (Washington.)

ANSWER.—Your proposition is a difficult one. On the whole we would think you would find Kentucky bluegrass satisfactory for your fairways. Brome grass will make a coarse sort of turf on even drier ground than will bluegrass. White clover may well be added with the bluegrass, as it will help out greatly, particularly in spring. There is however no grass which will not dry up during the long dry season under the conditions you propose. Where there are areas of the fairway which are thin in the fall we think it would pay to sow these spots with redtop and Italian ryegrass as early as possible in the spring, or, even better, to sow the seed on top of the snow in the winter; both of these grasses grow rapidly and will help out during the spring and early summer. Without water for your putting greens you had better not try to have grass greens, but resort to sand greens.

12. ERADICATION OF KNOT GRASS.—We are having considerable trouble throughout our course, particularly on the fairways, with a weed we believe to be "hog grass," although in all probability you may have another name for it in the classification of weeds. We are sending you a specimen of this grass. What method can we use in exterminating this weed? (Ohio.)

ANSWER.—The weed you send is knot weed, sometimes called knot grass, but not a true grass but a member of the buckwheat family. Scientifically it is known as *Polygonum aviculare*. The plant is readily eaten by hogs and by cattle, and often is very abundant along roadsides and other hard tramped ground. On golf courses it rarely occurs excepting where the ground is thin and poor, and any treatment which results in a dense turf will practically do away with any further trouble from the knot weed. It is an annual, and where necessary can easily be eradicated by hand-weeding.