

subsequent damming, and stocking the lake with ducks or swans. Dragging water weeds with a heavy chain is a rather slow, cumbersome process which is not always successful. For cutting the weeds a sharp scythe blade, saw, or similar instrument may be used, and is often attached to the end of a row boat or launch with wire ropes, chains, or wire, and dragged at an angle of about 30 degrees. A submarine saw especially designed for the purpose is manufactured. This may be operated by two men, one on each bank. It is a ribbon-like, flexible saw, weighted in such a manner that it cuts the plants close to the bottom.

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. Fall and winter applications of ammonium sulfate and bone meal.—In the last paragraph of the article ending on page 232 of the BULLETIN, October, 1925, you state that ammonium sulfate may be applied to turf during the winter. I have always understood that readily available fertilizers, such as ammonium sulfate, were of value only during the growing season and that their value was lost if applied when the grass was not in a growing state. Our fairways are very poor. They were never worked up, as far as I can learn, and were cut from the natural field of farmed-out clay, which is very thin and underlaid with gumbo clay. All wet locations we have now well drained. Compost soil is scarce here, and we have enough only for the greens and approaches. We have, however, purchased 10 tons of bone meal, which we are planning to spread this fall. Would it be advisable to mix ammonium sulfate with the bone meal when we use it? (Ohio.)

ANSWER.—It is true that the most economical use of ammonium sulfate is made during the growing season of grasses. Occasionally, however, it is advisable to apply this fertilizer rather late in the fall. The growing season moreover varies with latitude, extending in places quite into midwinter. Growing conditions in the fall are especially favorable to fairways in the crab-grass belt, as at that time of the year crab grass is dormant, and anything to stimulate the growth of turf grasses at that time of the year tends to thicken the turf for the following season. Bone meal is a slowly acting fertilizer and requires some time to become available. Experience has indicated that in your latitude it is used most economically when applied in February, and we would advise you to defer its use until that time. We would advise you to use ammonium sulfate only when conditions are favorable to the growth of grass. Accordingly, we would not consider it economical to mix ammonium sulfate with bone meal, as the two are best applied at different seasons of the year.

2. **Bent as a winter grass in the South.**—While we know that as a general thing the bent grasses are not adapted to warm climates, we should like to have your opinion with regard to growing them in the South as winter grasses. If they might be killed back by the summer heat, would they revive in winter? (Georgia.)

ANSWER.—After considering all the evidence we have with regard to the behavior of bent under conditions similar to yours, we are of the opinion that it would be unwise to go to any expense in trying to grow bent as a winter grass in the South. We believe that under ordinary conditions the effect of the summer heat would be so disastrous that the turf would not recover satisfactorily in the winter, and that the expense of special care given to it in the summer to keep it in good condition would not justify the results that might be obtained.

3. **Getting rid of marsh pennywort.**—Our greens have become heavily spotted with a running plant which is practically smothering the Bermuda grass on one or two of the greens and is beginning to appear on a few others. Some of these weed patches are 6 feet in diameter. We dislike to dig the patches of weed out on account of the bare spots that would be left; moreover, the weed makes a putting surface practically as good as clover. The roots of the weed form an interlaced mass, and the leaf stems are so tender that it is practically impossible to make any impression by hand weeding. I am sending you a specimen of the weed, and shall be glad for any advice as to how to get rid of it. (Florida.)

ANSWER.—The plant you send is one of the marsh pennyworts (*Hydrocotyle*). It is one of three very similar species which occur in your region, but the exact species we can not determine without its flowers and seed. A very similar species occurs in the North, introduced from India, which is illustrated and described in THE BULLETIN, November, 1921, page 220. As you point out, its putting qualities are about like those of white clover. On some of the greens in the South it has been rather favored. Very little experimental work has been done in connection with the eradication of this weed, and all that we can suggest is that the patches be cut out bodily. The infested turf may be lifted to a depth of an inch or more and replaced with good turf. The pennywort may then be destroyed by composting the infested turf for a year or two, or it may simply be spread on the fairways, where the weed is not objectionable. The flowers of this plant are so close to the ground that it will probably form seed even under putting green conditions. After the greens are rid of the weed, care will have to be exercised in keeping them free of it. The seed of the weed is apt to be introduced on the greens again in applications of topdressing or soil, and particularly so if woods soil is used.

4. **Winter use of putting greens.**—We have used our greens in the fall after the grass has become dormant and until the freezing and thawing made them slippery, without apparent injury. Is there any objection to continuing this practice through the winter at periods when the ground is not covered with snow or ice? (Wisconsin.)

ANSWER.—Most golf clubs now use their greens throughout the winter except at times when the ground is freezing and thawing. at

which time temporary greens should be made on the fairways. Putting greens should never be used when subject to intermittent freezing and thawing, nor when in a soggy condition in the winter.

5. Standards for length of golf holes.—We are getting the ground in shape to put in 18 holes next spring, and would like to know if there is a regulation as to length of holes; and if not, we would like to know what lengths would be best to give a variety of play. (Oklahoma.)

ANSWER.—In recent years there has been a marked tendency to standardize on the length of holes. The present ideas are that from 6,200 to 6,500 yards is the ideal length. Three-shot holes (that is, holes over 500 yards in length) are disappearing, but they may be used where they are especially desirable for the topography. The length of the hole, of course, varies with the slope of the green, the character of the soil, and other conditions; but in general a typical golf course would be about as follows: 1 hole from 130 to 140 yards in length; 2 from 165 to 180 yards; 1 of 225 yards; 5 from 320 to 370 yards. The holes in this group are of the drive-and-pitch type. Where the ground necessitates it, there may be a hole of 280 to 310 yards. This would be a hole of the elbow type; that is, the drive should reach about 240 yards for the second or pitch shot to reach the green. In holes of this type there is commonly a severe hazard in the angle of the elbow for the purpose of making a very difficult shot for the man who makes the short drive. The eight other holes are of the two-shot type, and they vary all the way from 400 yards to 480 yards, and sometimes up to 500 yards. In general, this series of holes should vary by about 10 yards difference in length. Of course, this can not be done accurately, but must be determined on the basis of the topography.

Length is not the only consideration. One architect has made the statement, which seems to be quite true, that a good golf course consists of 18 holes, each a good one of its type. The ideal of 6,000 to 6,500 yards has been over-emphasized. Doubtless American golf courses would be better if there were more 1-shot holes; but this unfortunately slows up play so much that the limiting of 1-shot holes to four or five holes is almost universally adopted. Where there are too many full 2-shot holes they become monotonous. There is much more variety of play possible on the drive-and-pitch type of hole, and therefore at least five of these would seem desirable, although more would do no harm.

Bear in mind that this is all very general, as it would be impossible, in the case of a golf course, to lay out any such definite specifications as an engineer would lay out for a bridge or a building.

6. Drainage and brown-patch.—Last summer we built a green in what had been a small valley of virgin timber. The place was very soggy, with a couple of springs. We raised the green $2\frac{1}{2}$ feet above the level of the springs, and completely circled it with two small brooks. The soil was very black. From this soil we made the top four or five inches of the green, and beneath this is 2 feet or more of blue clay. Below that level there seems to be a good deal of seepage

water. We also tilled the green at a depth of about 1 foot, and at intervals of about 20 feet. After a rain this tile shows good drainage. The green was planted with creeping bent stolons the first week in September. The growth was at first much better on the raised portions, but this last spring it became uniformly good. From that time, however, it has not done well at all. It was seriously attacked this summer with large brown-patch. We treated it with both Bordeaux mixture and mercury compounds, and topdressed frequently but lightly. In putting in the cups we found that the top two or three inches of the soil had packed down very hard and that beneath that the soil was fairly soggy and of a disagreeable odor. We tried a light dressing of lime, which counteracted the odor to some extent. On the hillside just above the back of the green is an old tree which overhangs a portion of the green. Smaller trees surround the green on all but the approach side. The hollow is so far below most of the rest of the course, and has so many trees, that there is undoubtedly a certain amount of air-pocketing. We have, however, cut away some of these trees. Lately we have been spiking the green and topdressing with 90 percent sand in the hopes of opening up the hard crust. The creeping bent on all of our other greens has given excellent results. (Ohio.)

ANSWER.—We think the trouble on your green is poor drainage, both as regards the soil and the surrounding air. It is on such greens that brown-patch is always the worst. The air drainage should be corrected as much as possible by the removal of any trees which obstruct free circulation of air over the surface of the green, and the soil drainage must be improved at all hazards if continued trouble with the green is to be avoided. The best way to improve the soil drainage is to build up the green so that you have at least 3 feet of well-drained soil above the water-table. The use of tile is not necessary if the 3 feet of soil is of such a character that water will seep through it readily.

7. Topdressing with sand for winter protection.—A greenkeeper of considerable experience has advised the use of a topdressing of sand to carry our bent greens through the winter. What is your opinion in this matter? (Illinois.)

ANSWER.—Our experiments with topdressings of sand have been very unsatisfactory, indicating that they are harmful to turf. When sand is used as a topdressing the tendency is to use it altogether too liberally. A very light topdressing of sand would probably do no harm, although we can not see that it would do any good. Moreover, when used on heavy loam soils, there is a tendency in sand to form a sort of cement-like, hard crust. We would advise you to use only a topdressing of a loamy consistency, preferably a compost of loam, well-rotted manure or some similar organic matter, and a proportion of sand so as to make the mixture relatively light. This dressing should be applied evenly, at a rate of about 1 cubic yard to 5,000 square feet. What is, however, vitally essential to maintain greens over winter is adequate drainage, and we would suggest that above all things else you provide suitable drainage—surface drainage if that will answer, and subdrainage if necessary—for any spots on your greens which are not adequately drained already.

8. Winter covering of putting greens with straw or manure.—We planted two putting greens with bent stolons the middle of September. The stolons started to grow very well, but recent dry weather and cold nights have stopped their growth. Would you advise covering the turf with straw or light straw manure for the winter? (Maryland.)

ANSWER.—While the covering of putting greens with straw or manure over winter has seemed to give good results in certain cases farther north, we would not advise it for your latitude. Often such coverings, instead of benefiting the turf, kill it out in spots by smothering the grass. A fairly good topdressing with compost for the winter months is all that is needed for your greens.

9. Time required in acidifying soil for effective weed control.—Our soil is only very slightly acid, the ph. reading being 6.1. Have you any information that would indicate the length of time that would be required under the usual treatment with ammonium sulfate to render this soil sufficiently acid to prevent the growth of white clover, chickweed, and other weeds? (Indiana.)

ANSWER.—The acidity of your soil is approximately the same as was the acidity of our soil at Arlington Experimental Farm at the time we started using ammonium sulfate on the plots. It has required about three years there to get rid of clover by using ammonium sulfate at the rate of 6½ pounds per 1,000 square feet applied six times during the growing season at intervals of one month. We would not, however, advise you to use ammonium sulfate on your greens at a 6½-pound rate. To avoid burning, the applications should not exceed 5 pounds per 1,000 square feet in the spring and fall nor more than 3 pounds during the hot summer months. The lighter applications can be used more frequently than once a month, and in all cases should at once be followed by sufficient sprinkling to insure that the chemical is entirely washed off the leaves of the grass, otherwise burning is very apt to result.

10. Barnyard manure substitutes.—We are building a new golf course, and the architect specifies a large quantity of stable manure to be used on both the greens and the fairways. It is impossible to secure stable manure here, and to attempt to buy it and have it shipped in carloads would be prohibitive. We are securing from time to time the little we can get in the neighborhood, for composting in connection with the upkeep of our old course. What fertilizer would you recommend as a substitute for the manure? (Pennsylvania.)

ANSWER.—In the past there has been a tendency to use too much manure in preparing soil for putting greens. A modest amount is all right. As for the actual fertilizing of turf, this can be controlled from above by applications of ammonium sulfate or ammonium phosphate and topdressings. Your attention is invited to the article in *THE BULLETIN*, Vol. IV (1924), page 141. In the absence of barnyard manure we would recommend tankage or fish scrap as the organic fertilizing element for your soil. Our results with bone meal are not altogether satisfactory. Bone meal contains lime to such an extent that it greatly encourages the growth of weeds, and the use of lime in any form should be avoided.