

of member clubs in adopting some system of distributing labor costs, whether it is their own or some other club's system, so that the experience of many can be available as a basis for the construction of a standard system next year.

It is hoped that the article will induce many clubs to attempt something in the way of a cost system and that there may be a general discussion of the subject through the columns of THE BULLETIN and otherwise, so that at the end of the year we shall have the material to use in making up something in the way of forms that can be accepted as standard.

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. *Please bear in mind that the recommendations given apply specifically to the locality designated at the end of the question.*

1. Economizing in seeding by use of mixtures for northern greens, fairways, and rough; wheelbarrow seeder vs. hand-sowing; rate of seeding; red fescue, bent, redtop, bluegrass, Pacey's rye-grass, orchard-grass, tall meadow-oat-grass, meadow-fescue, sheep's fescue.—You advise for fairways bluegrass, 4 parts, fancy re-cleaned redtop, 1 part; for greens, German creeping bent and fancy re-cleaned redtop in equal proportions. As you know, prices are unusually high this year, and I would like to cheapen this a bit if it can be done without great harm. Red fescue at 50 cents a pound is much cheaper than creeping bent at \$1.40. Could I use 25 per cent fescue, 25 per cent bent, and 50 per cent redtop? Our soil is a fairly rich clay-loam, not a bit sandy; I know fescues are sand-lovers. Will 5 pounds to 1,000 square feet be heavy enough? We are seeding new greens, not reseeding old ones. Is there any mechanical hand-sower that will insure sowing this seed more evenly and more economically than simply by hand-sowing? I presume a wheelbarrow seeder would be inadvisable for greens. Now, as to the fairways, can I cheapen my mixture a little by adding English rye, meadow fescue, or orchard-grass? If I use rye-grass, would the short-seeded or Pacey's rye-grass be better than the other grade? I am quoted the same price for either grade. What is the very cheapest seed I can use for new rough? I had thought of orchard-grass, meadow-fescue, and redtop. I am not striving to get a hard rough, but just grass on it so the general appearance will be good and so that should we want at any time to change fairways we could do so without much trouble. White clover is native to this section, and on old sod we find it abundant, and it will naturally creep into all our fairways.—(Pennsylvania.)

Our advice would be to effect your economy by using some redtop, but not to use fescue. In our experience it has been almost useless to seed fescue mixed with the bents, as in the end the fescues never endure in competition with the bents. You can reduce your bill therefore by seeding with a mixture of 75 per cent redtop and 25 per cent bent. The fescue will eventually disappear so that you will have pure bent. The fescue, we feel sure, will not give you this result. The bent seeds, including redtop, are very fine seeds, about 4,000,000 to a pound. Bear in mind that the rate we advise means about 20,000,000 seeds per 1,000 square feet, or 20,000 per square foot. Really one can get along with much less seed than this, but in our experience it is not advisable to reduce the seeding to a smaller amount, as it may take much longer to get a dense, well-knitted sod.

Wheelbarrow seeders are very satisfactory either on the greens or on the fairways. On the greens you can seed in about four directions across the green before you will use 5 pounds to 1,000 square feet.

On your fairways there is no objection to using rye-grass or meadow-fescue, but we would not advise the use of orchard-grass. Meadow-fescue is satisfactory in the moister soils. Rye-grass will grow in practically any soil; but bear in mind that rye-grass seeds are about fifteen times as large as redtop seeds, so that it is questionable whether you will get any economy by using rye-grass. Do not use rye-grass on the putting-greens, as it lasts too long there. Pacey's rye-grass is merely smaller seed screened out. We have no data on the relative economy of using these smaller seeds.

In your rough, sheep's fescue is ideal, but the seed is scarce. The next best thing, in our judgment, would be a thin seeding of orchard-grass and tall meadow-oat-grass. Both of these grasses make bunches and afford a very satisfactory rough. Tall meadow-oat-grass seed is, however, more expensive than the orchard-grass.

2. Testing seeds for germination.—What simple method or methods can we use in making germination tests here at home? Do germination tests properly bear any relation to purity determinations? For instance, a lot of seed might show 80 per cent purity, the remaining 20 per cent consisting of chaff or foreign seeds which we might not be able to distinguish from the true seed in selecting specimens for germination tests. In other words, if the germination test is carried out properly, should the specimens for that purpose be selected only from the 80 per cent of pure seed? This would be a difficult matter to accomplish in a test conducted at home.—(Indiana.)

Germination tests are usually made on the basis of pure seed; that is to say, 100 seeds are taken from a sample and the percentage of germination is based on the number that prove to be viable; therefore, a sample might have a germination percentage of 90, even though it contained only 10 per cent of pure seed, the remainder being inert matter. In selecting the seed for the test, however, an effort is made to get a sample that is representative of the bulk; in other words, caution is used not to pick out the plumpest and best-appearing seeds. Usually 100 seeds are selected for a test, so that the number of plants resulting represents the percentage of germination. The unit of measurement selected, however, is purely arbitrary, and if one knows what is desirable in the way of a stand from the seeding of any particular grass, it is quite easy to make a test by less exact methods. For instance, with creeping bent for putting-greens it has often been said that an ideal stand of seedlings is about seven seedlings to the square inch. If seed of the bents sown at the rate of one-quarter ounce to a test plot of 5 square feet accomplishes this result, we would regard the germination as satisfactory. This same rate of sowing would also apply in the testing of redtop seed. For fescue or bluegrass the rate for a test plot of 5 square feet would be one-half ounce of seed.

3. Southern limit of the range of bent and fescue for putting-greens.—I have recently read that by preparing the soil with certain special precautions good putting-greens of creeping bent or of red fescue can be grown anywhere in the southern States. Will you please advise us if such advice is reliable?—(Florida.)

One of the rather puzzling phenomena connected with all temperate perennial plants is that every one of them has a fairly definite southern

limit. Thus timothy can not be cultivated successfully farther south than about the northern limit of the cotton-belt. Apples are cultivated a little farther south than timothy, while both the pear and the peach succeed considerably farther toward the equator. The southern line of creeping bent and red fescue is about that of timothy. Curiously enough, in the drier half of the United States all these plants succeed farther southward than they do in the eastern part of the country. It is not at all safe, however, to assume that because fescue is good in southern California it will do equally well in Florida. Theoretical explanations of the phenomena involve temperature, humidity, and length of daily illumination, and are too technical to discuss here in detail. As yet no one has succeeded in making an all-the-year putting-green of either bent or fescue in the South. While we would not care to say it can't be done, the chances of success are very small. Until it has been accomplished the question you ask is purely of academic interest.

4. **Watering Green.**—Our club borders on a lake and our course is situated some 1,600 feet from the shore of the lake and on an elevation of 115 feet, so that we consider our drainage exceptionally good. What amount of water in gallons per square foot should we use to keep our greens in perfect condition?—(New York.)

We fear your question is an impossible one to answer in the way you ask it. The amount of water required to keep a green in the best condition depends upon a great many factors, including the quality of the soil, the surface drainage, the sub-drainage, and the elevation. These factors are so variable as to make it impossible to state the amount necessary to use in terms of gallons of water. Furthermore, these vary at the different times of the year and under different weather conditions. In our opinion the important principle connected with watering greens is to soak them thoroughly when you do water them. Thorough soakings every two, three, or four days, as may be necessary, are much to be preferred to light sprinkling every day. If both your surface drainage and sub-drainage are good, there is little to be feared from overwatering. If on the contrary your drainage conditions on the greens are not good, there is bound to be trouble regardless of how you water.

5. **Corrosive sublimate, copper sulfate (Bordeaux mixture), and slaked lime in mixture.**—Will a solution of corrosive sublimate mix with a solution of copper sulfate and a solution of slaked lime, and will each retain its active properties if mixed as above?—(Illinois.)

Our chemist reports on this as follows: "Solutions of copper sulfate and mercuric chloride (corrosive sublimate) in moderate concentrations do not show any visible reaction or change. Mercuric chloride solution is, however, apparently decomposed by Bordeaux mixture. This is, no doubt, due to the action of the excess lime in the Bordeaux mixture, since alkaline solutions precipitate reddish brown basic salts from mercuric chloride solutions. The supernatant liquid from a Bordeaux mixture produces this reddish brown precipitate when added to mercuric chloride solution." From the foregoing it appears that corrosive sublimate can be dissolved in a solution of copper sulfate without chemical change. If, however, it is put in Bordeaux mixture or in lime water, chemical changes result which doubtless influence the effects of both.