

ition between relatively fine and relatively coarse soil particles (thereby creating a suspended water table) and a gravel layer and tile drainage system. The correct soil mixture is extremely important. It must be resistant to compaction and quite permeable to water even after compactive forces have been applied. The mixture must be used in conjunction with a layer which will produce a suspended water table; otherwise it will be droughty. Finally, the mixture must support a good stand of turf.

Examples of greens that have been

built according to the specifications outlined in the Green Section publication were reviewed. It was determined that in every case where the greens have failed to behave properly, there has been a failure to follow directions exactly. The omission of one step can cause failure.

It was again pointed out that each step in the process has been designed to fit with the remainder of the procedure. Unless one intends to follow directions exactly, he should not begin to build greens by this method.

PUTTING GREEN GRASSES AND THEIR MANAGEMENT — PANEL DISCUSSION

A. M. RADKO, Eastern Director, USGA Green Section, Moderator; J. B. MONCRIEF, Green Section Agronomist; LEE RECORD, Green Section Agronomist; DR. G. B. SHUEY, USGA Green Section Committee.

Many golfers believe that all grasses are alike, and that if the greens at one course are better than those at another, it is because the one superintendent is more capable than the other. Of course, there are differences in the maintenance capabilities of men, but there are also great differences in the habits and qualities of putting green grasses. They respond differently to conditions of climate, exposure, water supply, nutrient supply, mowing practice, traffic and all the other factors which are imposed in varying degrees on golf course turf.

This discussion concerns the grasses used on putting greens and some of the management practices required. Many of the first bentgrass greens were planted to South German mixed bent. They presented a blotched and patchy appearance because of many different types of grass, but the putting qualities were quite good.

Bentgrasses which are used for putting greens to an appreciable extent include two strains, Seaside and Penncross, which may be planted from seed. In addition, about 10 strains which must be established

vegetatively are used. Some of the attributes of the various strains are listed.

Seaside is perhaps the most widely distributed grass used for putting greens in the United States. Until the last few years, Seaside was the only creeping bentgrass of which seed was available. Seaside bent is a mixture of many creeping bent types. Because of this heterogeneity, some of the plants in the population derived from a Seaside planting will be adapted to almost any set of geographic, climatic, and management conditions that may be imposed. The individual plants which are best adapted are the ones which persist. An older planting of Seaside will take on a mottled appearance because of the development of individual plants.

Penncross creeping bent is the only other creeping bent presently available from seed. Penncross is a synthetic variety created by a plant breeding technique known as polycross. Three plant selections were made from a Seaside bentgrass population. These three plants were grown vegetatively until a sufficient quantity of material was available to produce the necessary

seeds. The three selections were planted in rows in such a way that free interpollination could occur. First generation seed of this cross are used to produce Penncross bent. While the population is quite variable genetically, it produces a turf which is uniform in appearance. Penncross is widely adapted, vigorous, and relatively disease-resistant. It requires a type of management aimed toward the prevention of mat and grain.

Creeping Bentgrass

Arlington (C-1): During the decade from 1930 to 1940, the USGA Green Section selected and evaluated nearly 100 creeping bentgrass selections. They were designated by "C" numbers. Arlington bent was the first of these. Its disease resistance is good; it is wear-resistant; texture is good insofar as leaf width is concerned, but the turf tends to swirl. It is seldom used alone on putting greens. Normally it is mixed with Congressional (C-19).

Congressional (C-19): Excellent dark green color; good texture; disease-resistant; early spring growth; cold-tolerant; not as wear-resistant as some other bents. In combination with Arlington (C-1), it makes an excellent turf which is adapted over much of the bent growing region of the United States.

Cohansey (C-7): Begins growth in early spring; displays upright growth; develops less thatch than most bents; very aggressive against *Poa annua*; excellent putting green turf; light green in color; does best in southernmost area of bentgrass adaptation; more susceptible to disease than other creeping bentgrass strains, but with a good preventive program of disease control, this is no problem.

Toronto (C-15): Dark green in color; finer bladed than most other creeping bentgrass strains; upright growth; cold-tolerant; excellent putting green turf; not as wear-resistant as some other bents; must be mowed

tight and often; well adapted to the Middle West.

Washington (C-50): Excellent putting green turf, but it goes off color in early fall with the first frost, turns a purplish color; greens up late in the spring; good growth in warm weather; upright growth; fine bladed bentgrass; characteristics similar to Toronto; disease resistance poor, but responds to a preventive program of disease control.

Old Orchard (C-52): Color and texture good; used on mid-western courses more than in the eastern area of bentgrass adaptation. One of the best bents where it is adapted.

Collins (C-27): Less aggressive than the C-1, C-19; this strain was used in combination with the C-1, C-19, and it blended in very nicely. However, C-27 is not on the market as widely as in past years and is no longer used in combination with the C-1, C-19.

Nimisila (selection made from Ohio): Dark green in color; upright in growth; good texture; becoming more widely used; good reports; appears to be doing quite well in southern areas of bentgrass adaptation.

Pennlu (10-37-4) (selection from Penn State University): Very dark green in color; it did not perform in the field on golf courses to match its performance at Penn State University where it was exceptionally good; reports that it became very fluffy and thatchy; very aggressive.

Velvet bent produces a very fine-bladed, upright growing turf. It has a limited area of adaptation in the United States. It requires careful management to prevent formation of thatch and is subject to iron deficiency chlorosis. When well-kept, the turf is the finest kind of putting green surface.

Southern Grasses

In the South, most putting greens are either common bermudagrass or Tifgreen. A few other grasses, such as Everglades, Bayshore and Texturf

1F, are grown to a limited extent.

Common bermudagrass is a coarse grass very difficult to manage. Putting greens require frequent, generous topdressings and vertical mowing. Common bermudagrass putting greens are very rapidly being replaced by the finer-leaved types.

Tifgreen (Tifton 328) is the South's most widely-used putting green grass. It is fine textured, vigorous and disease-resistant. Management problems involve the tendency of the turf to thatch and its attraction for sod webworms. These insects seem to consider Tifgreen an irresistible delicacy.

In most parts of the South, putting greens of bermudagrass are overseeded with cool-season grasses. Among the species used for overseeding are creeping bent, colonial bent, *Poa trivialis*, bluegrass, creeping red fescue, redtop and ryegrass. Opinions vary with respect to the value of these grasses for the purpose of producing winter turf. In a great many cases, mixtures are used, but again there is lack of agreement as to which species and how much of each should go into the mixture.

Perhaps some day we will have a hybrid that will incorporate the good qualities of bentgrass and bermudagrass to provide a grass for greens that will do equally well in both the North and the South. Some of these qualities would be—the heat tolerance of bermudagrass, the cold tolerance of bentgrass; the soft texture of bentgrass, the wear resistance of bermudagrass; the fine-leaved turf provided by bentgrass, the coarse rhizome and deep root system of the bermudagrass; the tolerance of bermudagrass to herbicides, the spring color of the bentgrass, and the summer color of the bermudagrass—to mention a few.

Bentgrasses respond to maintenance practices in spring and fall. During hot months they must be handled very carefully. Operations such as aerifying and vertical mowing are best con-

fined to the periods when grass is making rapid growth.

Bermudagrass management is a different matter. Its best growth period is the summer season. The season of careful management is the time of transition from warm to cool-season grasses in the fall and the change back to the warm-season grass in the spring.

The handling of water is one of the most important matters in putting green management, no matter what the grass may be. This implies that irrigation practices and drainage of excess moisture are both important. A large percentage of the troubles on putting greens are somehow connected with a shortage of water or an excess of water. Faulty irrigation and faulty drainage are the twin specters that haunt the putting green manager.

Fertilizing Practices

Fertilization practice varies because of grass type, length of season, other related and interacting maintenance factors, and because of the philosophy of the superintendent. Bentgrass is fertilized at rates varying from 5 to 20 pounds of nitrogen per 1,000 square feet per year.

Bermudagrass is fertilized at rates of 1 to 2 pounds of nitrogen per 1,000 square feet per month during the growing season. About one-third as much phosphorus and about two-thirds as much potash as nitrogen, a 3-1-2 ratio, is representative of common practice.

During the winter of 1962-63 winterkill was very serious in both the bentgrass and the bermudagrass growing regions. Many theories have been advanced to explain the damage. Without attempting to evaluate the theories, these practices may be recommended:

1. Assure good drainage and aeration.
2. Control snowmold and Fusarium patch.
3. Do not over-fertilize with nitro-

gen. Avoid lush growth. On the other hand, turf should enter the winter season in a vigorous, healthy condition.

4. Be sure there are adequate supplies of potash during the latter part of the growing season.

5. Do not allow putting green soils to dry out to the extent that desiccation will occur. Remember moisture in the form of ice may be removed from the soil through the process of sublimation. It does not have to melt to dry out.

6. Prevent the formation of ice sheets if possible. If they form, try to break them enough to permit aeration of the turf and soil.

More precise answers for the prevention of winterkill may become available when a greater amount of definitive research on the nature of the problem has been done.

Putting green management requires more skill than any other agricultural pursuit. The fact that putting greens are so universally excellent is high tribute to the men who keep them.

A New Tee at Pine Valley

By **ALEXANDER M. RADKO**, Eastern Director, and **LEE RECORD**, Northeastern Agronomist, Green Section, The United States Golf Association.

To construct a new tee at a golf course normally is a major task, a project that requires the cooperation of committees, the golf course superintendent, the professional and an architect. Many times, however, the club officials mentioned do the job on their own. Eb Steineger is such a superintendent . . . he tackles such a job with enthusiasm and vigor. Last winter he tackled the job of building a new tee on the 12th hole at the famed Pine Valley Golf Club, Clementon, N. J. To do it, he moved 2,800 cubic yards of soil. The site selected for the tee added 50 yards

to the hole but it was in a deep ravine. He scraped some soil and plants, and "blanketed" the steep slopes with natural vegetation such as evergreens, dogwood, blueberry plants, and some laurel.

The entire teeing area now looks so natural one would never know it was new. We would not have known, except for the fact that there was no sod on the tee when the picture was taken. The new tee makes the hole 380 yards long, to add to the problems of playing Pine Valley.

Eb Steineger raising a "blanket" of vegetation lifted from adjacent areas to cover slopes of the new tee, giving it that "natural look."



Vegetation in front and behind Steineger was newly laid; only the tee surface remained to be sodded.

