on sandy soils, particularly in the warmer sections of the country. Under these conditions it rapidly disappears, being utilized by the soil bacteria. If fine-textured soil is available and used with the humus material, the beneficial effects of the minute mineral particles will persist after the humus disappears.

Soils for use on greens should be selected on a basis of texture and not color. Black color is an indication of humus, but if clay is the predominating mineral constituent, a light-colored loam is much more suitable. Everything considered, the best soils are those of intermediate texture—the sandy loams, loams and silt loams. These require a minimum of supplementary material such as sand or organic matter to make them suitable for topdressing material. They have a large water-holding capacity, are provided with ample pore space, move water rapidly, and quickly develop a desirable soil structure. Sands have too low water-holding capacity and clay soils, even under the best management, are apt to become hard.

Clay soils require relatively large amounts of sand to effect material change in their structure and reasonably coarse sand must be used. Relatively less clay effectively modifies sandy soils. These are the same principles which underlie the grouping of soils into different classes.

It is almost hopeless for the average club to modify the texture of fairway soils by the addition of sand or clay, due to the great expense involved. Soils should be placed in the best possible condition prior to seeding. Heavy soils should be plowed only when moisture conditions are favorable, even at the expense of a few days' delay. If time permits plowing in the year preceding seeding, the structure will be materially improved by alternate freezing and thawing during the winter. A green manure crop, preferably a legume, plowed under, will add beneficial organic matter. If the soil is acid, the acid legumes should be used. When turf is once established and maintained in thrifty condition, it will materially improve structure on heavy soils. As new roots form the older ones die. Decay of the dead roots augments the humus supply, and as the mass of new roots push forward, granulation and development of desirable crumb structure takes place.

Experiences with and Opinions on *Poa annua* in Putting Greens

During this season the subject of *Poa annua* has attracted more attention and caused more discussion than usual. The fact that the putting greens at Oakmont, where the Open Championship was played, are largely composed of this grass and that the weather this summer, particularly in the North, was unusually favorable to its long continued growth probably accounts for the unusual interest shown. Its value as a putting green turf seems to be governed by local conditions, by the kind of turf invaded by it, and by personal opinion as to its own particular merits, concerning which there is by no means lack of controversy.

In the Metropolitan District, Mr. Robert White believes that it not only makes a good putting turf but that from 75 percent to 90 percent of the turf in old greens is composed of *Poa annua* until the middle of

June or the first of July, at which time the majority of the turf in evidence is bent. His observations have led him to conclude that drought is the factor chiefly responsible for the disappearance of *Poa annua* in June or early July.

Another correspondent in the Metropolitan District writes that, "*Poa annua* is undoubtedly properly classed as a weed so far as putting green turf is concerned. I have visited some courses during the past three years where *Poa annua* was a gift from the gods. If it were not for a luxuriant growth of that grass in the early spring the greens would be a sorry sight. I know of several greens that certainly look their best when *Poa annua* is in season. When the *Poa annua* died the turf became terribly thin until crab grass filled in the gaps. The first heavy frost killed the crab grass and the small amount of bent then got its first opportunity to spread."

Major R. Avery Jones, Manager of the Baltusrol Golf Club, has noticed a difference in the habits of *Poa annua* on different parts of the two courses at Baltusrol as indicated below:

"There is considerable variation in the behavior of *Poa annua* on different parts of the two courses at Baltusrol.

"On the higher slopes having a southern exposure *Poa annua* does not entirely die out after seeding. Some persists all through the summer.

"Last year an approach to one of the greens held a heavy growth of *Poa annua* right up to the frost. On the lower ground conditions seem to be less favorable to *Poa annua* and its normal habit there, is to seed between the first of May and the end of June, and then die out.

"In our velvet bent greens *Poa annua* does not make very much headway and with the increase in the development of the velvet bent it is decreasing every year."

In the Philadelphia District it has been frequently noticed that *Poa annua* does not seem to injure the putting quality of seeded greens but that the same can not be said in the case of vegetatively planted creeping bent greens. At the Merion Cricket Club, Mr. Joseph Valentine has observed that where experimental work in fairway fertilization and watering was conducted the growth of *Poa annua* seemed to be stimulated to a greater extent than was Kentucky bluegrass.

Another interesting experience in this district is that of Norman L. Mattice, Manager of the Pine Valley Golf Club, which we quote:

"The *Poa annua* remained very vigorous and strong until the hot wave hit us about the first week in July. Then it died out in less than a week's time and made the fairways look as if they had been hit by brown-patch. However, it disappeared on the greens about the middle of June, so that there were no brown patches appearing on the greens when the hot wave struck us. I feel that wherever arsenate of lead was used rather extensively, or approximately 5 pounds per 1,000 square feet once each month, other grasses crowded out the *Poa annua* early enough in the season to eliminate any bad effects when the hot season approached."

At the Country Club of Atlantic City, Mr. H. Kendall Read has noticed that *Poa annua* improves the old seeded greens, blending uniformly into the permanent turf, but in the vegetatively planted creeping bent greens it tends to form clumps which had the effect of giving the greens two distinct speeds, fast over the bent but slow over the clumps of *Poa annua*.

In the Pittsburgh and Chicago districts *Poa annua* seems to be more popular than elsewhere, and men experienced in course maintenance in these two districts believe that topdressing and watering are the principal factors in its long continued growth, being of the opinion that at least in their districts hot weather is not necessarily fatal to success with this grass.

In St. Louis it is generally regarded as undesirable. It disappears early in the season and its place is soon taken by crab grass and other undesirable grasses and weeds. It is reported that in this district sulfate of ammonia has been of value in lessening the quantity of *Poa annua* found in putting greens. In some cases fairways have been plowed up in order to eliminate it.

The experience of Mr. Spencer M. Duty, the Green Committee Chairman of the Canterbury Golf Club, Cleveland, Ohio, is in many respects the most instructive we have heard of, for the reason that his club has greens of three kinds, seeded greens and vegetatively planted bent greens of both unsatisfactory and satisfactory strains. In the first two cases his experience has been that *Poa annua* was a blessing, but in the case of his finest turf he has very wisely decided that *Poa annua* shall be eliminated as soon as it appears.

In the South where *Poa annua* grows throughout the winter months, and in some sections from early fall to late spring, the problem is entirely different from that of the northern courses. Where permanent greens are in use throughout the year *Poa annua*, or any other grass sown on the dormant Bermuda, has a decided tendency to retard the recovery of the Bermuda grass in the following spring. Where temporary greens for winter play are in use *Poa annua* can not be regarded as injurious, for it reinforces the yearly seeding of northern turf grasses and makes possible the heavy topdressing of the regular Bermuda greens, which prevents such serious competition of *Poa annua* with the Bermuda turf.

Improving Turf on Sandy Soil

By H. Kendall Read, Chairman, Green Committee, Country Club of Atlantic City

There must be a number of old courses in this temperate latitude where the soil is of a distinctly light or sandy texture and where the problem of fairway turf is of first importance. In most cases it is not practicable to throw the course out of use and attack the problem in a radical way. This would be the simple and direct method.

It has been proved beyond doubt that the most satisfactory turf, including bluegrass and bent, can be produced on old fairways of sandy subsoil. It has been done at Pine Valley and the Country Club of Atlantic City and other places. But you will not succeed until you bring about the necessary change in the texture and quality of the topsoil which actually forms the seed bed. You can grow fescue on loose, sandy soil, but I do not believe that you will ever produce a first-class fairway of closely knit turf from this grass. Many clubs have spent a lot of money trying to do this, but I think it is a hopeless job.

I never saw a really first-class fairway in the North that did not contain bluegrass or bent or both in substantial proportion, but neither bluegrass nor bent will grow satisfactorily on loose, friable soil. You are therefore faced with the problem of introducing a binder that will stiffen up the topsoil and bring about a condition