United States, Dr. Sprague has attempted to give in a clear, non-technical style the principles underlying the various turf management practices. This is done in the belief that an understanding of these principles should make possible the solution of particular problems as they arise in connection with turf maintenance under any particular set of conditions. The book is easily read and understood, and is fully illustrated with photographs, drawings, charts and tables.

The author considers that the successful establishment and maintenance of turf "depends on choosing grasses that are suited to the light conditions and other climatic factors, improving the soil to suit the needs of the turf grasses, and following the types of treatment—mowing, watering, fertilizing, etc.—that are necessary for healthy growth of the grasses under the use being made of the turf."

Accordingly, one chapter was wisely devoted to descriptions and sketches of the various grasses as they appear in turf, by means of which the reader may readily identify the grasses in his turf. Such descriptions are given for five species of *Poa* (bluegrasses), four of *Agrostis* (bents), five of *Festuca* (fescues), two of *Lolium* (ryegrasses), and *Trifolium repens* (white clover).

Other chapters deal specifically with soils, soil acidity and the use of lime, the use of fertilizers, seed germination, controlling weeds in turf, and controlling diseases and insect enemies of turf, in addition to more general chapters on planting new lawns, renovating poor turf, and general maintenance practices such as rolling, mowing, spiking, etc.

SOIL CHARACTERISTICS AFFECT TOXICITY OF HERBICIDES

It has long been recognized that the rates at which herbicides must be applied to be effective vary with the soil as well as with the weed to be destroyed. A. S. Crafts and his collaborators in California have been working with various herbicides on some 80 different soils. They are primarily concerned with killing all vegetation in weed-infested soils rather than with selective action such as we are working for in turf where the aim is to kill the weeds and leave the grass. The results which they have obtained concerning the effect of fertility and texture of the soil on the toxicity of the herbicides, however, are equally as applicable for our purposes as for theirs.

In the Journal of Agricultural Research and in Hilgardia, Crafts and

his associates have published the results of their tests with arsenic compounds, borax, and chlorates. They have tried the toxicity of these chemicals at various concentrations on Kanota oats plants growing in numerous different soils and in the absence of soils in solutions containing various nutrient compounds.

From experiments with widely varied soils, the conclusion was reached that the toxicity of arsenic varied with the textural grade of the soil but not with soil fertility. Arsenic was found to be extremely toxic to plants grown in water culture in the absence of soil. Even the coarser soils reduced the toxicity many times, so that 10 to 100 times as much arsenic was needed to produce a toxic effect in soil comparable to that produced in water culture, depending on the texture of the soil. The finer the soil particles or the heavier the soil, the less was the toxic effect of arsenic. This collaborates the observation which has been made repeatedly by the Green Section that other conditions being equal, turf on sandy soil can not tolerate arsenic at as heavy rates as can similar turf on heavy clay soils.

Experiments with boron compounds such as borax gave results comparable to those with arsenic except that they seemed to leach out of the soil more quickly than the arsenic compounds. The toxicity evidently varied with the textural grade, being lower in the heavy soils, and seemed unrelated to fertility. The content of boron rather than the particular form of the compound appeared to be the major factor involved in toxicity.

With chlorates, apparently the soil texture or water-holding capacity of the soil had very little effect on toxicity, whereas the nutrients in the soil, particularly the nitrates, influenced it decidedly. The higher the nutrient content of the soil, the lower was the toxicity of the chlorates both in water and in soil cultures. Among the potassium and ammonium salts, the nitrates reduced chlorate toxicity the most, followed in order by chlorides, sulfates and phosphates, the effect of the latter being quite unpredictable.

It is believed that probably the organic matter in the soil may affect chlorate toxicity through the nitrates which are produced from it by bacterial action. In spring, the nitrate content of the soil is lowest because of the leaching which takes place during the winter and because of the slower bacterial decomposition during the cooler months. The authors also found that spring and fall were the most favorable times of the year

for killing weeds with chlorates. It is not unreasonable that this may have been associated, particularly in the spring, with the low nitrate content of the soil. The authors concluded that the nitrate effects on the toxicity of the chlorates seemed to outweigh the concentration effects resulting from different moisture-holding capacities which are associated with soils of different texture.

CENTIPEDE GRASS LAWN FROM SEED

In connection with experiments concerned with improving the germination of seed of southern grasses, G. W. Burton considered the possibility of getting a centipede grass lawn from seed. An attempt was made to harvest a small quantity of seed to be used in the experimental seeding of a lawn. Five pounds of seed were harvested, cleaned, and threshed at a cost of 40 cents a pound. Samples of the seed were then scarified by treatment with 50 percent hydrochloric acid and 35 percent sodium hydroxide for 5- and 10-minute periods, with the result that germination at the end of 40 days was increased from 26 to about 35 percent by all of the treatments except the 10-minute exposure to sodium hydroxide. The 5-minute treatment with hydrochloric acid apparently gave the best results after 20 days, which was a 10 percent germination, as compared with 3 percent in the untreated seed.

On February 22, 1938, the 5 pounds of centipede grass seed, two-thirds of which had been scarified in 50 percent hydrochloric acid for 5 minutes, were used to seed 10,000 square feet of lawn surface at Tifton, Ga. From this seeding a satisfactory stand of grass was obtained, which was able to compete favorably with crabgrass and other annuals during the summer of 1938, although this was the driest season on record at Tifton.

These results were published in the Journal of the American Society of Agronomy along with studies of scarification of seed of other grasses, including Bahia grass, Dallis grass, Bermuda grass, Vasey grass, and carpet grass. A 5-minute treatment in concentrated hydrochloric acid increased germination of Bermuda grass seed. However, even after this treatment only 20 percent of the seed had germinated at the end of 50 days, as compared with 13 percent in the untreated seed. Seed of carpet grass germinated 74 percent after 32 days without scarification, and all scarification treatments seriously reduced the germination.