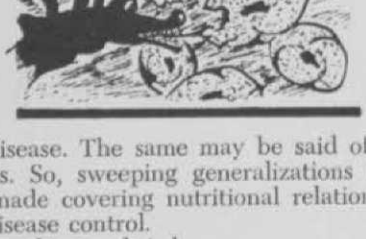
zyme substances go unchecked, they not only slowly kill the cell but break down structural material between cells. This enables the fungus to spread through the entire plant.

Different species and strains of turf have varying nutritional requirements for strong growth and by-product resistance



to disease. The same may be said of soil types. So, sweeping generalizations can't be made covering nutritional relationship to disease control.

But this much is known:

Nitrogen in proper amounts promotes vigorous growth that enables turf to outgrow the slowly developing fungus infections. In excessive amounts, though, nitrogen stimulates production of thin walled cells that become easy prey to invasion by harmful organisms.

Phosphorous reacts with carbohydrates to produce building blocks for new cells and tissues. Because of this function, growth stimulation brought about by nitrogen when phosphorous is deficient, results in poorly balanced nutrition and the likelihood of increased disease susceptibility.

Speeds Up Synthesis

Potassium in adequate amounts speeds up synthesis of essential disease resisting and growth substances in grasses. Deficiencies of it weaken cell walls and lay them open to penetration by disease organisms.

Calcium strengthens intercellular areas and helps to contain the spread of fungus in a plant. Its balance with potassium is important. It also neutralizes acids and possibly other growth by-products. Calcium deficiency in turf is not common although it must be conceded that weak turf is often tied in with acid-heavy soil conditions.

The secondary elements, magnesium and sulfur, and the minor elements, iron, boron, manganese, copper, zinc and molybdenum, are known to have important regulatory functions within the plant. It is reasonable to assume that their presence in adequate amounts favors disease resistance.

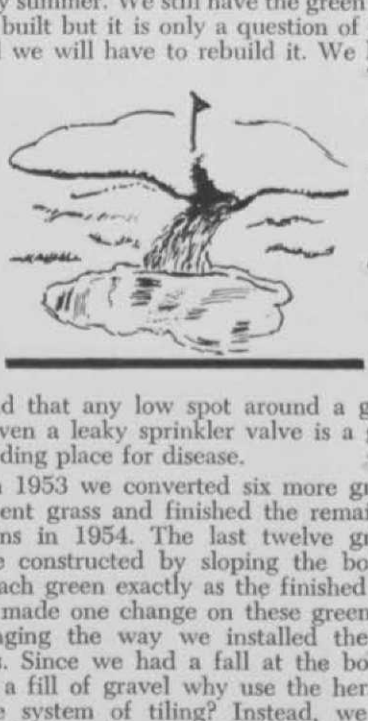
What should be kept in mind so far a good growth, and resistance to disease ar concerned is that it is not the presence o nitrogen, potassium and phosphorous i adequate amounts that is so important a the proper balance and absorption of thes elements in relation to one another.

Drain Green Over Its Entire Width

By CHARLES DANNER
Supt., Richland CC, Nashville

One of our six new greens was built s that excess water was channelled off th green in a narrow area. It didn't take lon to find out that excess water must be drained off the green over the entire widt of the front or sides and not channelled of Another green was built with ample su face drainage with a one way fall towar the front which drained excess water dow to a flat fairway. The result here was th the front approach would become slopp during wet weather. This was a goo breeding place for disease.

This green has been our problem bab every summer. We still have the green as was built but it is only a question of tim until we will have to rebuild it. We hav



found that any low spot around a gree or even a leaky sprinkler valve is a goo breeding place for disease.

In 1953 we converted six more gree to bent grass and finished the remainin greens in 1954. The last twelve gree were constructed by sloping the botto of each green exactly as the finished to We made one change on these greens b changing the way we installed the ti lines. Since we had a fall at the botto and a fill of gravel why use the herrin bone system of tiling? Instead, we pu one tile line along the low front and sid

of the green. This seems to be as efficient as the herringbone. By this time we had become convinced that the most important thing in building a green is to provide for surface drainage without channelling and to provide for drainage away from the green so as to not have any low spots or flat areas close to the putting surface. Our last twelve greens were built to provide ample surface drainage off and away from the greens. I am happy to say that none of these greens has ever given us any trouble.

Used Concrete Mixer

From our experience with soils, we think that any mixture with high sand content, soil and peat will be good if they are thoroughly mixed. At Richland we used a concrete mixer.

The answer to keeping bent grass greens through Southern summer months is water management. The green should be built to provide for subsurface drainage with tile lines sloped at the bottom. A blanket of gravel, well mixed topsoil and good surface drainage are very important. Water will not move through any soil very fast and the best way to take care of excess water is through surface drainage. If ample surface drainage is not provided for, or if low spots exist, or if excess water is channelled off, disease very likely will result.

Temperature and Light in Growth of Turf

By VICTOR B. YOUNGNER
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Some factors affecting grass growth are almost completely outside the range of the supt's influence. The most obvious of these are the climatic factors, temperature and light. Directly or indirectly they are related to every aspect of turfgrass management.

From the moment the grass seed is placed in the soil, it comes under the influence of weather and other environmental factors. For example if the soil temperature is too high or too low, germination will be poor and many seedlings will be deformed. And, so, throughout the life of the turf, every phase of grass growth and development is being primarily controlled by weather and climate.

The activities of the supt., particularly in timing of operations, can work with nature to develop better turf. But if incorrectly done or improperly timed, these same activities may work with nature to weaken or destroy the turf.

Controlled Environment Observations

The recent development of new techniques for the study of environment and plant growth has opened a future full of promise for greatly increasing this knowledge. Such a new technique is the creation of the "phytotron," controlled environment

growing rooms, like the one recently constructed for the UCLA Dept. of Floriculture. With the phytotron we can regulate accurately the temperature, day length, light intensity, etc. at which the plants are grown to study the effects of specific conditions on growth of the grass plant.

Research work of recent years indicates that with many of our cool season grasses root and top growth are opposing growth phases. That is, conditions which promote top growth are not the same as those that promote maximum root development. This is especially true when we superimpose mowing, as we do in turf culture, over all other conditions.

If we recognize three temperature points in respect to growth; minimum, optimum, and maximum, we find that the three points for root growth are several degs. lower than for top growth for many cool season grasses. This is confirmed by field studies which have shown that maximum root development occurs during the late winter and early spring in temperate climates before much top growth is evident and again in late fall when top growth is slow. In late spring and early summer, the period of maximum top growth, root development has practically ceased.

Food Reserve Depletion

Food reserves, carbohydrates stored in roots and other plant parts, increase during the period when top growth is very slow. On the other hand, during periods

(*Continued on page* 110)