

fore, that hormones might have some effect in accelerating the rooting of grass stolons, particularly those of the slow growing species such as *Zoysia* and velvet bent.

In addition, it appeared that some of these growth substances might prove to be valuable in midsummer when the failure of roots in turf is most pronounced. If, by adding them to turf at this time, root growth could be stimulated, injury from drought and other causes might be avoided. Also, it appeared that some of them might be useful in speeding up the germination of the seed of such slowly germinating grasses as Kentucky bluegrass when a quick establishment of turf is desired.

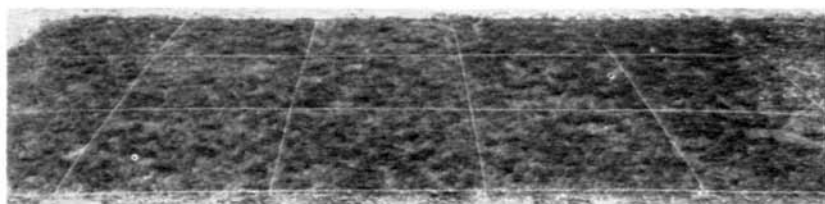
Therefore, during the past 2 years, the Green Section has been testing in a preliminary way the effects of a few of the growth substances on the rooting of stolons, root development of grass in turf, and the germination of grass seed. So far, no encouraging results have been obtained. The results have either been entirely negative or so inconsistent that no conclusions could be justified either in favor of or opposed to their use in the establishment or maintenance of turf.

#### HORMONES ON STOLONS

In three series of greenhouse experiments in the fall of 1938 and the spring of 1939, stolons of *Zoysia matrella*, velvet bent, and the Washington and Metropolitan strains of creeping bent were used. The bent grass stolons, about 2 inches long, were taken from mature growth in the center of nursery rows and the *Zoysia* stolons from the old growth of plants growing in a warm greenhouse. Although an attempt was made to select uniform stolons, there was some difference in the number of nodes per stolon planted. The nodes on the Washington stolons

were much closer together than were those on the other stolons.

Solutions of the commercial product, Auxilin (a beta indole-butyric acid preparation) as well as of beta indole-acetic, alpha naphthalene-acetic and ascorbic acids were used. In the first two series the stolons were immersed in the solutions to a depth of  $\frac{3}{4}$  to  $1\frac{1}{2}$  inches and in the third they were completely immersed. Treatments were made at greenhouse temperatures



Turf resulting from the use of Kentucky bluegrass seed which had been treated with various synthetic hormones, compared with that produced by untreated seed. Front row, left to right—talc dust containing 1,000 p.p.m. of indole-butyric acid, the same at 100 p.p.m., Rootone, Hormone powder, Auxan; center row—untreated seed, Transplantone, Hormodin, untreated seed, Hormonized dust; back row—talc dust containing 1,000 p.p.m. of naphthalene-acetic acid, the same at 100 p.p.m., thiourea, talc and untreated seed. The seeds were dusted thoroughly with the chemicals at the rate of 1 ounce of dust to 10 pounds of seed and were immediately planted in 4 by 4-foot plots on August 10, 1940. This picture, taken on September 3, shows no significant difference between the turf resulting from the planting of untreated seed and that resulting from the use of seed given any of these various treatments.

of  $80^{\circ}$  to  $85^{\circ}$  F. The time of treatment varied from 24 to 96 hours in the first experiment, 12 to 48 hours in the second and 4 to 24 hours in the third. For comparison purposes, similar stolons were soaked for equal lengths of time in tap water. Immediately following treatment, the stolons were planted in flats of sand. The bent stolons were kept in a relatively cool house and the Zoysia in a warm greenhouse at  $80^{\circ}$  to  $85^{\circ}$  F.

In the first two series of experiments the Auxilin was used according to directions at the rate of one-half measure to a

pint of water and the other substances at the rate of 10 parts per million (p.p.m.) of water. In the final series the rates were doubled.

In the first experiment, 3 days after the last of the stolons were planted, counts were made of the number of nodes which had no roots and the average number of roots to a node. On the Washington bent, roots were found on three to five of the nodes of each stolon, Metropolitan bent developed roots on one to two of the nodes of each stolon and velvet bent usually formed roots at only one node on each stolon. In the second and third experiments, only velvet bent and *Zoysia* stolons were used and counts were made 12 and 4 days respectively after the last stolons were planted.

Stolons of Washington and Metropolitan creeping bent, velvet bent, and *Zoysia matrella* were used in the first experiment. Those stolons which were planted with no treatment produced fewer roots per node and had a greater percentage of nodes with no roots than either the stolons which were soaked in water or in Auxilin solution, except in a few cases where the stolons had been soaked in the Auxilin for 96 hours. In general the stolons treated with Auxilin solution gave results similar to those soaked in water, but in some cases the number of roots per node was greater and the percentage of nodes with no roots was smaller than in the water-treated stolons. However, in an equal number of cases, the reverse of this was true, particularly following the Auxilin treatments for the longer periods of time.

After the results of the first series had been obtained, the creeping bent stolons were dropped from all subsequent series of experiments, since such stolons normally start growth rapidly within a few days after planting. The *Zoysia* and velvet bent

stolons are much slower to establish themselves under field conditions and therefore they alone were used in the second and third series of experiments. In these experiments beta indolebutyric, alpha naphthalene-acetic and ascorbic acids were used in addition to the Auxilin and water treatments of the first experiment. Much the same results were secured in the second series as in the first except that the stolons planted without treatment produced a lower percentage of nodes without roots. In fact in this series the untreated stolons were as good in this respect as were the treated ones. Also, the untreated stolons produced as many roots per node as the treated ones, and in some cases more. As in the first series, there was a great deal of variation in the number of roots per node, so that the differences in average numbers could not be considered significant.

In the third series of experiments, however, all of the treated *Zoysia* and velvet bent stolons gave results far superior to those with untreated stolons in that they had many more nodes producing roots. All the treatments, including the water, doubled the number of roots per node in the *Zoysia* stolons. Most of the hormone-treated stolons of *Zoysia* produced more roots per node than did the water-treated stolons, but the number per node in all cases was so variable that differences in averages could not be considered significant. All of the velvet bent stolons which were treated in this series produced an equal or greater number of roots per node than did the freshly planted stolons. In most cases the chemical treatments produced a slight increase in the average number of roots per node, over water-soaked stolons, but again the individual numbers were so variable that this increase was not considered significant.

In May, 1938, stolons of *Zoysia matrella* and *Zoysia japonica* and the roots of three selected strains of Kentucky bluegrass

were soaked in Auxilin solution for a 24-hour period before planting in field plots. The solution used contained beta indolebutyric acid at the rate of 10 p.p.m. Comparable lots of stolons and roots were soaked in water for the same period of time. As a check against these soaking treatments fresh stolons of *Zoysia* and fresh bluegrass roots were planted at the same time.

Before being soaked, the *Zoysia matrella* and *Zoysia japonica* stolons were stopped to two degrees of fineness, some being coarsely chopped and others merely shredded. In addition, some of the *Zoysia japonica* stolons were also finely chopped. Fresh stolons were chopped in the same way and planted without soaking.

The stolons and roots were then planted in soil which was low in fertility and contained but little organic matter, and all plots received the same treatment following planting. The following fall estimates were made of the percentage of cover on each of the plots. The stolons which had been soaked in water had produced the densest turf in all plots except those planted with coarsely chopped *Zoysia matrella* stolons. In no case did the Auxilin-treated stolons or roots produce a denser turf than did corresponding material soaked in water, although in most cases the turf was denser than on those plots planted with fresh stolons. In some cases, however, the turf produced by fresh stolons was significantly superior to that produced by Auxilin-treated stolons or roots. In these cases the Auxilin apparently inhibited the growth of the grasses.

There were no significant changes in the density of the turf on any of the plots the following spring. During the summer there was no significant difference in vigor or drought resistance on any of the plots.