SPECIAL ARTICLES

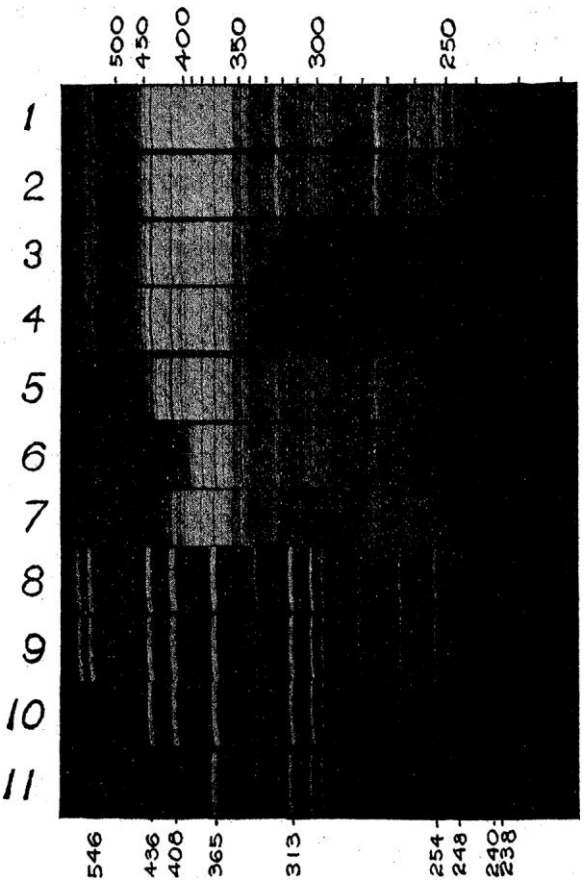
A NEW ULTRA-VIOLET TRANSMITTING GLASS

NUMEROUS attempts have been made toward the development of glasses, or suitable substitutes, capable of transmitting ultra-violet radiations shorter than the region neighboring 300 μμ. The number of possible applications for the use of ultra-violet light, especially full sunlight, has increased markedly during recent years and it has been the absence of materials of a required transparency within a reasonable price which has been largely responsible for their retarded development. Fused quartz glass possesses high transparency, but even with the great improvement in manufacturing methods the cost of covering a limited area is high. C. Fritsch has described a glass of boric oxide and fluospar which is claimed to transmit the 185 aluminum line. F. A. and C. L. Lindermann prepared a lithium borate glass showing no appreciable absorption above 200 μμ. In publishing the results of experiments leading to the development of Uviol, E. Zschimmer gives glasses transmitting to 186 μμ. In general, however, the glasses showing a marked increase in ultra-violet transparency over ordinary glasses sacrificed a great deal in resistance to weathering, or were melted under conditions which were impractical in general production. Hence no glasses other than quartz showing a high transmission in the region of 290 μμ were commercially available.

At Corning Glass Works there has been developed a new glass, 980A, transmitting to 200 μμ in three mm. thicknesses. Its transmission for wave lengths of 290 μμ, the extreme limit of the sun's rays through the atmosphere, is 86 per cent. through a two mm. thickness (uncorrected for surface reflections) as measured by the Bureau of Standards. For purposes requiring a full transmission of ultra-violet light from the sun, therefore, this glass is practically the equal of clear fused quartz. The accompanying spectrograms obtained by a quartz prism spectograph illustrate its transparency as compared with other glasses.

The glass may be prepared in various colors to produce unusual spectral filters. G985B is a blue transmitting the ultra-violet, but completely eliminating the green mercury line. G984B is green, giving a distinct absorption band in the ultra-violet. G986A is nearly opaque to visible rays, yet quite transparent in ultra-violet.

The drop in the transmission curve in the ultra-violet for glasses and other transparent bodies is not a sharp one, but covers a region of some 80 μμ in sweeping from nearly full transmission down to the extreme limit of transparency. For this reason the limit of transmission may be a misleading measure



The transmission of 980A and other glasses for ultra-violet radiation from an iron arc, and of a few unusual spectral filters for radiation from a quartz mercury lamp.

(1) Open iron arc
(2) 980A 3 mm.
(3) PYREX glassware 2.8 mm.
(4) Window glass 2.7 mm.
(5) 985B 4 mm.
(6) 986A 4.9 mm.
(7) 984B 5.3 mm.
(8) Open mercury arc
(9) 980A 3 mm.
(10) 985B 4 mm.
(11) 986A 4.9 mm.

of the value of a material for purposes requiring transparency. A glass transmitting to only 270 μμ is very apt to absorb a large portion of valuable energy in the neighborhood of 300 μμ.

The new glass has a density of 2.64, a refractive index for the D line of 1.539, a dispersion of .009 for $N_f - N_c$, a linear expansion coefficient at nearly $.0_41$, and possesses a stability within the range of ordinary glasses. The cost of producing the glass is somewhat above that of window glass, but is far below that of quartz.

Several hundred plates of the glass have been manu-

factured and quantity production in the near future is assured.

H. P. HOOD

CORNING GLASS WORKS

NITRATE UTILIZATION BY ASPARAGUS IN THE ABSENCE OF LIGHT[1]

DURING the winter and spring of 1926 asparagus plants were grown in the greenhouse in quartz sand culture and in solution culture. Part of the plants were subjected to continuous darkness and others to the seasonal light conditions as they occurred in the greenhouse. The plants in the light and some of them in the dark were given a complete nutrient solution containing nitrates, while others grown in the dark were given a nutrient solution containing no nitrogen.

It has been found by several careful trials that an aliquot portion of an asparagus root crown of about 10 per cent. may be removed for analysis, while the remaining 90 per cent. may be used for experimental purposes. Quantitative analyses have also shown that the 90 per cent. and the 10 per cent. fractions are practically identical with respect to their percentage composition. Accordingly, the composition of asparagus crowns at the beginning of an experiment may be computed.

On an absolute amount basis, quantitative data have been secured which would indicate that asparagus may not only take in nitrates in the dark, but so long as there is a carbohydrate supply present plants seem able to build up nitrates to higher forms of nitrogen. This assimilation of nitrates seemed to occur as rapidly in the dark as in the light. Microchemical tests of plus nitrate series have consistently shown an abundance of nitrates in the fibrous absorbing roots, with none at all, or extremely small amounts of nitrates, in the storage roots. The rapidly growing spears in the dark contained no nitrates, except occasional traces in the lower parts of the spears. There were no nitrates in the spears which were grown in the light, except when the rate of vegetative extension was decreased by approaching maturity or as in the field by cold weather, at which times there was a large accumulation of nitrates in the tips and butts. At no time were nitrates found in any part of the minus nitrogen series.

As would be expected, the growth of the minus nitrogen series was associated with a decrease of protein and an increase of the nitrate free soluble nitrogen fraction, while in the plus nitrate series the growth was associated not only with a decrease of protein but as well with synthesis of nitrates to higher forms of nitrogen.

[1] Paper No. 296 of the Journal Series, New Jersey Agricultural Experiment Stations, Department of Horticulture.

In the dissection of the nitrate free soluble nitrogen fraction there was determined proteose, polypeptide, amide, amino and humin nitrogen fractions. The carbohydrate fractions determined include total sugars, reducing sugars, sucrose, polysaccharides,[2] hemicellulose and fat. These data and further details concerning them will be given at another time.

Analysis of the roots of the several series show, as would be expected, that there was a considerable loss of carbohydrates associated with growth of spears. It would seem particularly significant that there was a much larger loss of carbohydrates in the plus nitrogen dark series than in the minus nitrogen dark series. Presumably, the larger loss of carbohydrates in the plus nitrogen dark series was due to the fact that the carbohydrates were used in assimilation of nitrates.

The experimental conditions obtaining would seem to minimize the possibility of bacterial action affecting the results secured and the work of Liman[3] and others would also tend to make such seem unlikely. In addition, the following observations would seem significant. Root crowns in plus nitrate solution culture grown in the dark and with tops removed daily had an abundance of nitrates in the fibrous absorbing roots and none in the storage roots. These crowns, after thorough washing, were placed in distilled water, and frequent observations of all parts of many crowns showed that nitrates disappeared in about two hours at 20° C. Like roots at a temperature of 10° C. still contained traces of nitrates in the fibrous roots after a period of about twelve hours. That there was no loss of nitrogen from the roots was indicated by macrochemical analysis of the residual distilled water for total nitrogen, ammonia and nitrate nitrogen.

Further data are being secured from field and controlled experiments. A study is also to be made of extracts of plant tissue and their effect upon nitrate solutions under varying conditions, in order to determine if the apparent utilization of nitrates by asparagus is in part enzymatic in nature.

G. T. NIGHTINGALE

L. G. SCHERMERHORN

N. J. AGRICULTURAL EXPERIMENT STATION,
NEW BRUNSWICK, NEW JERSEY

[2] Tanret, Georges, Compt. rend. 149: pp. 48–51 (1909). The asparagus plant contains no starch but contains an inulin-like polysaccharide, "asparagose," which upon hydrolysis yields 93 per cent. levulose and 7 per cent. glucose.

[3] Lipman, C. B., and Taylor, J. K. "Do Green Plants have the Power of fixing Elementary Nitrogen from the Atmosphere?" *Jour.* Franklin Institute, Vol. 198, No. 4, pp. 475–507 (1924).