AUXIN IN RELATION TO LEAF BLADE ABSCISSION

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(WITH ONE FIGURE)

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It is a common observation that a leaf stalk usually abscises shortly after the removal of its blade. LA RUE (**2**) delayed this abscission of debladed leaf stalks by the application of indoleacetic acid to the stalk. Compounds related to indoleacetic acid also have delayed the premature abscission of leaves and fruits (**1, 3**). These observations suggest that the auxin normally present in an organ is an important factor in delaying its abscission, and that a decrease in this auxin precedes or accompanies abscission. To test these ideas, determinations were made of the auxin content of bean leaves of various ages. This paper presents the results of the auxin determinations and a discussion of their significance.

The first trifoliate leaves of Black Valentine beans, grown in the greenhouse, were used in this investigation. In beans an abscission zone lies between the blade of each leaflet and the leaf stalk. Thus blades differ from stalks in relation to the leaflet abscission zone; tissues of the blade are distal to the zone and tissues of the stalk are proximal to the zone. Samples of blades and stalks were taken from the plants at each age studied, 15, 30, 40, 60, and 70 days after planting. At 15 days the leaves were immature, the blades only partially expanded. At 30 days the leaves were fully expanded. At 70 days the blades were turning yellow and showing other signs of approaching abscission.

Each sample was treated in the following manner: Immediately after cutting it was weighed, put into a container, and frozen at – 15° C. As soon as convenient it was dried in a lyophilizer. The dried material was ground through a 40-mesh screen in a Wiley Mill, and weighed. Each sample was put into a separate 250-ml. Erlenmeyer flask containing 100-ml. of freshly distilled cold ethyl ether, and the flask kept for two hours in a refrigerator at 0° C. The material was then filtered through No. 1 qualitative paper and the residue washed with three 2- to 3-ml. portions of fresh ether. The ether extract thus obtained was evaporated to a few milliliters and with a pipette transferred to a small test tube where it was evaporated to dryness. A measured amount of 1½% agar was added to this dried extract, the mixture shaken vigorously for a few minutes, poured into a $10.8 \times 8 \times 1$ mm. brass mold, and cut into 12 blocks. These blocks were placed on Avena

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coleoptiles, following the standard method described by WENT and THIMANN (5).

The results are summarized in the accompanying figure. The auxin is expressed in indoleacetic acid equivalents (VAN OVERBEEK'S formula) (4). As shown, the immature blades, compared with the corresponding stalks, had a high concentration of auxin. By the 30th day from planting, when the leaves had become fully expanded, their auxin concentration had dropped to a level which stayed constant through the 60th day. By the 70th day when the blades were turning yellow and showing other signs of approaching abscission, their auxin concentration had dropped to the level shown by the stalks. In the stalks a similar but lower level curve of auxin concen-

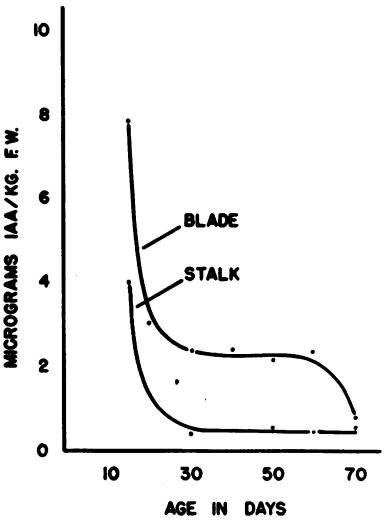

FIG. 1. Changes in the auxin concentration in bean leaf blades and leaf stalks with age. Auxin was determined by the standard Avena assay and is expressed in micrograms of indoleacetic acid per kilogram of fresh weight.

tration was maintained until the 60th day, but did not show a drop at the approach of abscission on the 70th day.

These results show (1) the maintenance of a moderately high auxin concentration in the leaflet blade throughout the period of its normal functioning, a concentration which is approximately three times that in the leaf stalk, and (2) the fall of this auxin concentration to the concentration of auxin in the stalk, occurring as the leaflet yellows and approaches abscission. Thus there is an auxin gradient across the abscission zone while the leaf is active, a gradient which is lost immediately preceding abscission. Experiments with excised abscission zones recently conducted in this laboratory indicate that the auxin gradient, rather than the absolute amount of auxin, controls abscission. These results will be submitted in a later paper.

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