BRIEF COMMUNICATION

Effect of Leaf Age on the Translocation Movement of 4-Chloro-2-Methylphenoxyacetic Acid (MCPA) in Hordeum distichum L.

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For determining the sensitivity of individual plant species to herbicides complete plants are usually employed and the herbicides are applied in the form of sprays. We have observed that in barley treated with higher concentrations of 4-chloro-2-methylphenoxyacetic acid all leaves have not been affected to the same extent: With plants in the third-leaf phase, necrotic spots appeared on the first leaf. The second leaf was less affected and the third leaf remained unaffected. This observation served as the basis for studying the sensitivity of individual leaves in the course of their ontogeny.

As a criterion for the evaluation of the ability of leaves to translocate herbicides the formation of anomalies on the developing spike of the first shoot was used. It is known that barley is resistant toward the effect of MCPA but a sensitive period was shown to exist during its ontogeny when the herbicide acts as a morphoregulator (Olson et al. 1951, Large and Dillon Weston 1951, Derscheid 1952, Woodford and Kasian 1956). Moreover, the beginning of such sensitive periods in which aberrations in the development of the spike can take place coincides with the onset of the reproductive stage. Barley is a plant with a very short functioning of the vegetative apex period. In plants with 2 - 3 leaves the vegetative apex passes into a further stage of ontogeny and changes into a floral apex. As the formative effect of 4-chloro-2-methylphenoxyacetic acid is restricted to the earliest phases of spikelet formation, the detection of abnormalities is conditioned by acropetal development of the spike. If the herbicide is applied sooner, the abnormalities appear at the spike base, while later on they shift toward the apex.

In order to make it possible to apply the substance at precisely determined spots it was made up in lanoline paste and applied in amounts of 2 mg. MCPA per plant. The treated plants were in the third-leaf phase and the spike of the first shoot exhibited 6 - 7 double ridges. The application was carried out by the following technique: (1) The substance was brought to the centre of the blade of the first, second and third leaves; (2) the entire quantity used was applied to the first leaf; (3) the entire quantity of herbicide used was applied to the third leaf; the experiment was performed with control variants simultaneously using pure lanoline (4) and without any treatment (5). In the second and third variants the concentration used was three times higher than in the first variant. After 18 days the experiment was found to have progressed as follows: (1), without abnormalities, a weak inhibition in the spike development; (2), formation of abnormal spikelets after 8 - 9 normal ones (Fig. 1); (3), formation of abnormal spikelets after 16 - 17 normal ones (Fig. 2); (4), (5), without abnormalities, a total of 30 - 32 spikelets being formed (Fig. 3).

Although the whole quantity of substance applied to one plant was the same as in the second and third variants and although the possibility of penetration was even greater because the substance was applied to a surface three times larger, the spike showed no formative but rather only inhibitory effects of the substance applied. The same quantity of substance applied to the first leaf had, however, an immediate formative effect; on applying it to the third leaf the reaction

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Fig. 1, 2, 3. Young spikes 18 days after treatment with MCPA. 1. Treatment of the first leaf — abnormalities after 8 normal spikelets. 2. Treatment of the third leaf — abnormalities after 16 normal spikelets. 3. Untreated control plant.
took place after a certain lag. From the above observations it follows that young immature barley leaves cannot transport MCPA to the spike. Therefore on applying the substance to all three leaves the effect of the inhibitor was not additive in nature.

In general, slower translocation of herbicides in monocotyledonous plants is explained by the presence of intercalary meristem at the base of the growing leaves and individual nodes which makes the movement of the herbicide through the phloem impossible (FANG and BUTTS 1954, ASHTON 1957). Isotopic tests also revealed that young leaves cannot translocate labelled phosphorus (KOONTZ and BIDDULPH 1957). If it is taken into account that the leaf develops together with its function and if one considers the results obtained by CRANST (1961) who discovered that the herbicide used is moved together with assimilation products from the region of food synthesis to the region of its utilization it is evident that the correlation between leaf age and the movement of MCPA in plants is connected with metabolic activity of the leaf.

References

ASHTON, F. M.: Absorption and translocation of radioactive 2,4-D. — Plant Physiol. 32 : XLII (suppl.), 1957.


Při aplikaci kyseliny 4-chlor-2-metylfenoxoctové na první tři listy ječmene se podle formativního činíku na klas ukázalo, že nedospělé listy nejsou schopny zprostředkovat transport MCPA k vzrostnému vrcholu. Tento vztah souvisí zřejmě s metabolickou aktivitou listů.


Nánosenie 4-hlor-2-metylfenoxoctové kyseliny na první tři listy ječmene působí nebo nezpůsobuje, z toho vznikne něco, které nepřesně lze spojit s transportem a koncem k corby, že nesevící listy nesje schopnost transportu MCPA k konusu napříč. Na toto působení je spojeno s metabolickou aktivitou listů.