

SITES OF ACTION OF BORON DEFICIENCY ON PHOTOSYNTHETIC APPARATUS OF SUGAR BEET (*BETA VULGARIS L.*) LEAVES

C. HERMANS and M. EYLETTERS

Laboratoire de Physiologie et d'Agrotechnologies Végétales, Université Libre de Bruxelles, 50 av F.D. Roosevelt
CP 169, 1050 Bruxelles, Belgique.

Boron is an essential trace element in the mineral nutrition, due to the significant troubles caused by its deficiency in the growing of vascular plants. Different roles of boron were deduced by studying plants metabolism disorders. The most studied role is the maintain of integrity of cell wall through binding to pectic polysaccharides (Matoh and Kobayashi, 1998). However, as boron deficiency does not seem to have specific impact on the primary photochemical reactions, therefore few data exist about the boron effect on photosynthesis on the whole plant.

The aim of our work is to establish an early diagnostic of the deficiency before the outbreak of the visual symptoms. The study has been extended to identify the spots of action of this stress on the photosynthetic apparatus of *Beta vulgaris L.*

The hydroponical culture allows to induce the deficiency and maintain a total control on the mineral nutrition of plants.

Among all the physiological investigation methods, the fast fluorescence transient of chlorophyll (Stasser *et al.*, 1996) turns out to be an effective and non intrusive tool to diagnose and quantify the loss of vitality during the installation of the deficiency. The conclusion down from the fluorescence measures shows that the boron deficiency stimulates, at the first place, the primary photosynthetic metabolism, and then is characterised by a final stage of exhaustion due to the prolonged stress action. This exhaustion stage comes out as a decline of the photochemical performance of the whole plant, mainly due to a deficient electron transport.

The imperfect adequacy between the primary photochemistry and the carbon dioxide assimilation seems to be the origin of an oxidative stress, which is generated by an electron diversion between the two photosystems.

During the exhibition of the whole plant to an excessive light intensity, compare to the intensity it is exposed to during the natural growth, research proved that the damages to the photosynthetic apparatus is greater (the boron deficiency occurs in the fields on very sunny days in clearer manner). Electrophoresis shows the amplitude of the oxidative stress that the deficient and photoinhibited plants are subjected to, this is shown by the activity of the detoxifying enzymes of the reactive species of oxygen, such as the superoxide dismutases.

The recently developed diagnostic techniques and the experimental results obtained, should lead to a better understanding of the boron deficiency spots action on the photosynthetic apparatus, as well as providing on an agronomic level, the possibility to follow through this deficiency.

References

- Matoh T. and M. Kobayashi (1998) *J. Plant Res.* 111, 179-190
Strasser R.J., P. Eggenberg and B. Strasser (1996) in Bulletin of the Royal Society of Liege. Vol 65 pp 330-349