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

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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 deducted 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 drawn 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
Strasser R.J., P. Eggemberg and B. Strasser (1996) in Bulletin of the Royal Society of
Liège. Vol 65 pp 330-349