The Effect of Two Cytokinins on Metabolism and Technological Quality of Vegetative and Stored Sugar Beet

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The effect of foliar application of two exogenous cytokinins on the growth, development, metabolism, yield and technological quality of sugar beet was studied in three experimental years (1994–1996) during the vegetation and post-harvest period. The following cytokinins were employed: N^6-(*m*-hydroxybenzyl)adenosine (cyt R) and N^6-benzyladenine (BA).

Both exogenous cytokinins were applied by spraying in three time variants:

A. At the time of full cover by growth – in June.

B. Repeatedly in June and 6 weeks before harvest – end of August.

C. Only 6 weeks before harvest.

During measurement of the rate of photosynthesis (P_N) higher values were observed directly after the second spraying, i.e. variants B and C. The cause involved was probably a retardation of senescence of plants. At th same time, an increased content of chlorophyll $a + b$ and a decreased content of carotenoids referred to unit dry weight and unit leaf surface area was established.

The content of natural (free, native) cytokinins in leaves examined throughout the vegetation period of sugar beet was markedly increased only after the late application of exogenous cytokinins, i.e. again in variants B and C. Native (free) cytokinins are represented first of all by N^6-(D^2-isopentyl)adenosine and N^6-(D^2-isopentyl)adenine which account for 95–99 % of metabolic pool of all free cytokinins in leaves. The total content of cytokinins in sugar-beet leaves is relatively high in comparison with other plants (tobacco, soybean, maize).

A pronounced inhibitory effects was demonstrated on respiration rate both of growing and stored sugar beet after harvest. Endogenous respiration rate of sugar-beet samples both in leaves and in roots, measured gasometrically and by Warburg manometry, shows that both exogenous cytokinins depress the respiration rate by 17–33 %, the effect being greater on young plants. In particular, the inhibition was pronounced with immature beet plants. This important observation was then confirmed in subsequent experiments done during storage in the sugar refinery when losses of sucrose were sharply reduced during prolonged storage, by as much as 40 %.

The effect of exogenous cytokinins on quantitative as well as qualitative parameters of sugar beet during harvest varied from year to year. This was apparently due to climatic and environmental conditions during the individual years. More balanced results were found in Mitscherlich vegetation vessels and small-plot field experiments, as compared with general field experiments. The sugar content was generelly affected very little, ranging from 17.8 to 18.3 %. A more pronounced effect of cytokinins was observed in the yield of root mass, being highest (6 %) during pre-harvest application (variant C) and 5.1 % (variant B).

No fungicidal, fungistatic or bacteriostatic effect of foliar application of both cytokinins on the state of health of growing as well as stored sugar beet was observed. Analogously, no retarding effect of the cytokinins on sprouting was found.

The contens of technologically noxious nonsugar substances (amides, amono acids, potassium and sodium ash) and invert sugar was comparable in all the variants.

The highest reactivity to the application of cytokinins was found with the Helma variety, both with regard to yield, sugar content and better storage properties.

The content of betaine was pronouncedly (10–15 %) lower on the cytokinin-treated planst.

The number of vascular bundles was not affected by the cytokinins.

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