

Effect of N source on accumulation of amino acids in sugar beet

Gisela Mäck

Institute of Sugar Beet Research (IfZ), Holtenser Landstr. 77, D-37079 Göttingen, Germany
email maeck@ifz-goettingen.de

Introduction

Amino-N compounds constitute 30-40% of the so-called harmful nitrogen which considerably lowers the technical quality of the beet. A major aim in breeding is thus to minimize the concentration of N compounds in the beet. N is taken up by the plant from the soil as nitrate and ammonium and reduced in the plant's organs to produce amino acids and amides. Since nitrate has become a serious environmental pollutant, ammonium as N fertilizer receives increasing interest. In the present investigation the effect of the plant's N source on content and pattern of amino acids in the beet was studied with two sugar beet genotypes which differed in the accumulation of amino-N in the beet.

Material and Methods

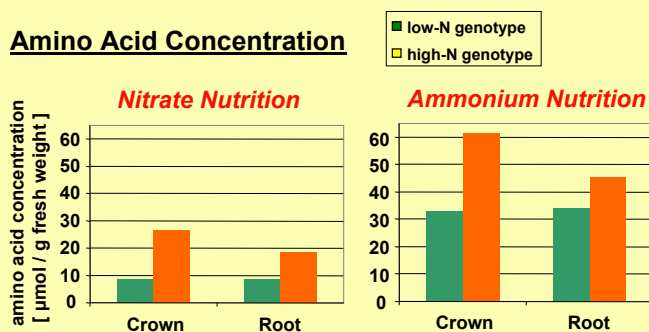
Two genotypes were selected from field trials; they were characterized by a different amino-N content of the beet (low- and high-N type). Seeds were germinated and the plants were grown hydroponically for 40 days in a growth chamber with either 5 mM nitrate or ammonium as N source. The beet was dissected into two morphologically different parts: shoot plus hypocotyl (crown, without leaf stems) and storage root. Amino acids in methanol-chloroform extracts were analysed by HPLC.

Results

and

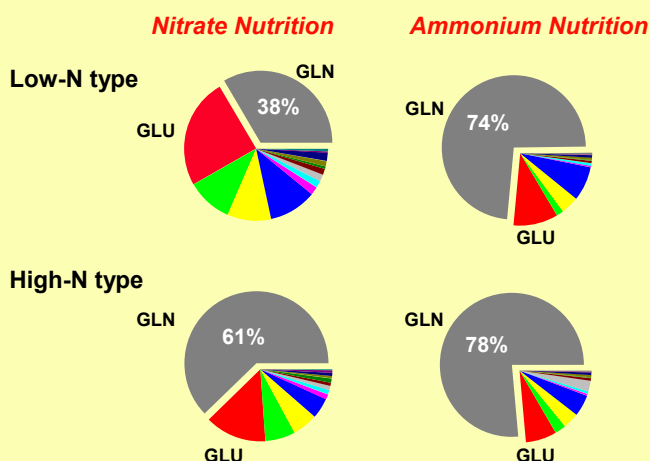
Conclusions

Amino Acid Concentration



- NH_4^+ elevates the amino acid level by factor 4 in the low-N genotype, by factor 2 in the high-N genotype.
- The difference between the genotypes remains, but it becomes smaller after NH_4^+ nutrition.
- More amino acids are stored in crown than root of the high-N, but not of the low-N genotype.

Amino Acid Pattern in the Root



- Gln is the predominant amino acid in the root and also in the crown (not shown).
- Its relative proportion differs by a factor of 2 in the two genotypes after NO_3^- nutrition, but it reaches a similar maximum in both genotypes after NH_4^+ nutrition.

Take-home message:

- Concentration and pattern of amino acids depend on the plant's N source.
- Phenotypic differences between genotypes are reduced by NH_4^+ as N source.
- NH_4^+ as N source elevates the concentration of amino acids and thus lowers the technical quality of the beet.