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Effects of nitrogen source, nitrate concentration and salt stress on element and ion concentrations in transport fluids and on C and N flows in *Ricinus communis* L.

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Abstract

Ricinus communis L. was supplied with 0.2, 1.0, 4.0 m*M* nitrate or 1.0 m*M* ammonium and treated with a mild salt stress 40 m*M* NaCl (1.0 m*M* nitrate or ammonium). Between 41 and 51 days after sowing, element and ion concentrations in xylem and phloem sap were determined, and flows of C and N were modelled. Nutritional conditions particularly affected anion concentrations in the root-pressure xylem sap. Nitrate was the major N-compound in xylem sap of nitrate-fed, and amino acids in that of ammonium-fed plants. Lower nitrate was compensated mainly by chloride as an anion and by amino acids as a N-solute. Under salt treatment, Na^+ and Cl^- levels increased, but a high selectivity of ion uptake into the xylem was observed. The phloem sap was less affected by nutritional conditions; only under stress conditions higher ion concentrations in the xylem, i.e. mainly of Na^+ and Cl^-, reflected in the phloem sap. Most of the N taken up was first transported to the shoot. In plants provided with adequate N, 70 – 77% of the N was incorporated into the shoot. This partitioning was shifted in favour of the shoot in salt-stressed, and in favour of the root, in N-limited plants, in which a net export of N from the shoot occurred. Salt stress and N-limitation decreased the photosynthetic and respiratory rates in *Ricinus* shoots, root respiration was stimulated by ammonium assimilation. Higher N assimilation in the root increased the proportion of C transported to the root, which was used there for respiration. Concomitantly more amino acids were translocated and led to higher recycling of carbon to the shoot via the xylem.

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VI. Nitrate or Ammonium Uptake and Transport, and Rapid Regulation of Nitrate Reduction in Higher Plants

By Andreas D. Peuke and Werner M. Kaiser

1. General Introduction

Higher plants acquire nitrogen from the soil mainly in the form of nitrate and/or ammonium. The two N sources are taken up by the roots, where part of the nitorgen can be utilized directly or stored (mainly as nitrate). If nitrate or ammonium uptake exceed storage and utilization by roots, part of the inorganic nitrogen will be transported to the shoot, where it can be reduced and metabolized or stored as before. The first two sections of this chapter review physiological aspects of nitrate and ammonium uptake by the roots and their transport to the shoot. The third section focuses on the aspect of a rapid regulation of nitrate reduction in roots and shoots by environmental factors such as light, CO_2, or oxygen availability.

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