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Special Issue: Sensing and transport of nutrients in plants

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Plants are rooted to the place where they germinate or are transplanted. As sessile organisms, plants are heavily relied on the soil where they are growing for getting nutrients and water. The nutrient concentration and buffering capacity of supply in soils with different texture and fertility are variable and affected by soil management. For example, both soluble nitrate (NO_3^-) and potassium ion (K^+) concentrations can vary by four orders of magnitude from the micro-molar to milli-molar range in soils. Thus, plants have developed complex sensing and regulatory systems for optimizing nutrient acquisition, distribution and assimilation in order to adapt to the fluctuating environments. In addition, the majority (probably about 80%) of terrestrial plant species are capable of interacting with arbuscular mycorrhizal (AM) fungi which have coevolved with their host roots for over 450 million years in nature. The major advantage of the AM symbiosis for plants in acquiring nutrients is the extended absorption area by AM fungi hyphae in soil.

In early 1960s Emanual Epestein and colleagues discovered a “biphasic pattern” of K^+ uptake by barley roots and proposed the two K^+ uptake mechanisms working simultaneously at the plasma membrane [1]. Since then, it has been characterized that there are both high affinity transport system (HATS) and low affinity transport system (LATS) not only for the major nutrients but also for some micro-nutrients in a number of plant species. During the past two decades, rapid progresses have been made in understanding the molecular mechanisms of sensing and transport of the major nutrients in plants. The transport proteins embedded within membranes are the key targets for improving the nutrient and water uptake and use efficiency [2]. Some plasma membrane transporters in plants like Arabidopsis NPF6.3 (NRT1.1) display dual functions as a nitrate transceptor, i.e., not only as nitrate transporter but also nitrate receptor for sensing the concentrations of nitrate in external environment [3].

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