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Phenotypic plasticity of shoot and root traits of tomato in response to different rates of K, Mg and N supply

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Abstract: The aim was to assess the physiological and morphological plasticity of shoot traits and morphological root traits in response to the intensity of nutrient deficiency and comparing plastic responses to K, Mg and N at vegetative growth phase. Tomato plants were cultured in nutrient solution at three different rates of nutrient supply (optimal, or growth reduction to 80 % and 60 % induced either by K, Mg or N deficiency).

Physiological and morphological shoot responses to nutrient deficiency were nutrient-specific. Net assimilation rate (NAR) of N-deficient plants was not affected, while NAR of K-deficient plants was slightly reduced, and NAR of Mg-deficient plants was severely reduced. Maintenance of high NAR in N-deficient plants was associated with severe reduction of leaf area (LA) and leaf area ratio (LAR. Leaf area per total plant biomass). Leaf area of K and Mg-deficient plants less affected and LAR was enhanced in comparison to control plants. Thus, in N-deficient plants the reduction of growth was mainly due to lower LAR, whereas, in K- and particularly Mg-deficient plants growth reduction was mainly due to lower NAR.

The morphological response of roots to nutrient deficiency also was nutrient-specific.N deficiency slightly reduced specific root length (SRL), but increased root mass ratio (RMR). Therefore, root length ratio (RLR, root length per total dry mass of plant) was not influenced by N deficiency. In contrast, Mg deficiency resulted in increased SRL, but decreased RMR. Thus, RLR was also not influenced by Mg deficiency. K deficiency was associated with higher RLR because both, RMR and SRL were increased.

Keywords: Phenotypic plasticity, shoot and root traits, tomato.

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