Quality-related constituents in tea (*Camellia sinensis* (L.) O. Kuntze) as affected by the form and concentration of nitrogen and the supply of chloride

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Free amino acids, polyphenols and caffeine are particularly important groups of compounds influencing the taste and quality of tea infusion. In this study, the influence of nutrient supply on the accumulation of these compounds in tea plants was investigated under controlled conditions.

Plants supplied with NO_3^- grew much slower than those receiving NH_4^+ or NH_4^++NO_3^-. The poor growth with NO_3^- was largely associated with inefficient absorption of this N source. Tea plants were well adapted to NH_4^+, which was attributed to the large capactiy to assimilate in NH_4^+ roots. Plant biomass production was the smallest at pH 6.0 but largest at pH 5.0 regardless of N forms. Decrease of plant growth caused by inappropriate external pH was due partly to the declining absorption of nitrogen.

The concentrations of free amino acids were substantially larger in NH_4^+- than in NO_3^--fed plants, which is firstly explained by the larger absorption rate of NH_4^+ over NO_3^-. Furthermore, the relative allocation of absorbed N to theanine was substantially increased by supplying plants with NH_4^+, suggesting that NH_4^+ was more readily to be assimilated into theanine than NO_3^-. Root-zone pH did not influence the concentrations of most free amino acids except theanine, which was larger at pH 4.0. This was considered as an accumulation effect as growth was reduced more than N absorption by low pH. The concentration of caffeine was larger in NH_4^+- and NH_4^++NO_3^-- than in NO_3^--plants whereas catechin concentrations were smaller in NH_4^++NO_3^- than in other plants.

High N concentration in the nutrient solution reduced the concentrations of most catechins, which was attributed to the decrease of substrate available for the biosynthesis of catechins as more carbon resources were allocated to N metabolism. Improving N supply increased the concentrations of free amino acids. However, with high external N supply relatively more absorbed N was allocated to the synthesis of arginine than to theanine. This is possibly caused by reduced carbohydrate concentrations and thus an imbalanced C : N status in the roots, which induced the synthesis of amino acids with low C : N ratios to improve carbon economy.

The concentrations of total free amino acid and theanine in the young shoots were decreased by the application of KCl compared to K_2SO_4 to the soil, which was more likely due to Cl accumulation in the plants. In the second experiment of which plants were supplied with different amounts of Cl, N uptake (measured with ^{15}N) of plants was reduced by Cl addition while NO_3^- accumulated in the plant tissues possibly due to depressed reduction. A third experiment was conducted to verify whether the decrease of free amino acids is simply a result of inhibition on NO_3^- assimilation. The plants were cultivated with sole NH_4^+ nutrition with Cl or without. Similarly, the concentrations of theanine and total free amino acid in the young shoots were reduced by Cl, indicating that Cl likely has inhibitory effect in addition to that on NO_3^- reduction. However, total N contents, the absorption rate of NH_4^+ and the activity of glutamine synthetase were all not influenced by Cl. The concentration of theanine in the roots, where it is synthesized, was unaffected as well. Based on the overall data, it is suggested that the translocation of theanine from root to shoot and its further catabolism in the young shoots might be influenced by Cl.