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氮素形态对茶树根系释放质子的影响

Effect of forms of nitrogen on proton release from tea plant roots under hydroponic condition

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中文关键词:茶树 铵态氮 硝态氮 质子释放 酸化

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中文摘要:

为探讨茶树根系酸化土壤的机制，利用水培实验和自动电位滴定方法研究了恒定pH条件下铵态氮、硝态氮及其混合液对茶树根系释放质子的影响。结果表明，在氮供应量相同情况下，纯铵态氮处理茶树根系释放质子的量最多，其次为铵/硝比为1:1处理，在纯硝态氮处理中，茶树根系释放羟基。随着铵初始浓度的增加，茶树根系释放质子数量增加，且茶树根系的质子释放量与其对铵态氮的吸收量呈显著正相关。在pH4.5至5.5范围内，茶树根系在初始pH5.0时质子释放量最大，其次是初始pH5.5的处理，在pH4.5时茶树根系的质子释放量最少。用硝酸铵培养验证了茶树的喜铵特性，发现随着培养时间的延长，茶树对铵态氮和硝态氮的吸收量均增加，且质子释放量也有相同趋势，但在整个培养期内茶树对铵态氮的吸收量均高于对硝态氮的吸收量。因此，茶树对铵态氮的偏好吸收导致其根系释放质子，从而引起根际土壤酸化。

英文摘要:

In order to explore mechanisms of tea plant roots acidifying soils, a hydroponic experiment was carried out using the method of automatic potentiometric titration to investigate effects of different forms of nitrogen, i.e. NH_4^+-N, NO_3^--N and ammonium nitrate, on proton release from tea plant roots in the solution of constant pH. Results show that tea plant roots released protons in the presence of ammonium at a higher rate than they did in the solution containing ammonium and nitrate with mole ratio of NH_4^+/ NO_3^-=1:1; but they released hydroxyl in the presence of nitrate. The release of proton release was positively related the initial concentration of ammonium in the solution and with the uptake of ammonium by tea plant roots, too. Within the range of pH from 4.5 to 5.5, the maximum proton occurred in the treatment with initial pH being 5.0, and then in the treatment with initial pH being 5.5, and the least in the treatment with initial pH being 4.5. To culture tea plants with ammonium nitrate solution validated the plant’s ammoniaphilic feature. It was found that longer duration of incubation in ammonium nitrate solution increased the plant’s uptake of both ammonium and nitrate and its release of proton as well. However, at the end of the incubation, the plants were found to have absorbed more ammonium than nitrate. The findings suggest that tea plants preferred to absorb ammonium, which leads to release of more protons from their roots, thus causing acidification of the soil in tea gardens.

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