

水稻与花生混作系统作物根系分泌氮的特性

王树起; 杨兴明; 黄启为; 沈其荣; 茆泽圣

南京农业大学资源与环境科学学院 江苏南京210095

Excretion of nitrogenous compounds by the root system of peanut intercropping with rice at different growth stages

WANG Shu-qi; YANG Xing-ming; HUANG Qi-wei; SHEN Qi-rong; MAO Ze-sheng*

College of Resour. and Environ. Sci.; Nanjing Agric. Univ.; Nanjing 210095; China

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摘要 采用砂培和溶液培养两种方法研究了水稻和花生混作系统根系氮化化合物的分泌。结果表明,在砂培和溶液培养条件下 NO_3^- 和 NH_4^+ 的分泌在不同时期和昼夜不同时间均出现有规律的变化。苗期两种培养条件下 NO_3^- 和 NH_4^+ 的分泌峰值均出现在早晨,水稻单作、间作和花生单作处理在砂培条件下 NO_3^- 和 NH_4^+ 的浓度分别为1.415、5.044、2.140.mg/L和0.0482、0.3320、.132.mg/L;而溶液培养条件下 NO_3^- 和 NH_4^+ 的浓度分别为0.0726、0.743、0.181mg/L和1.036、1.709、1.736.mg/L,下午和晚上两种形态氮处于耗竭状态。花期分泌高峰出现在下午,水稻单作、间作和花生单作处理在砂培条件下 NO_3^- 和 NH_4^+ 的浓度分别为17.338、25.294、5.369.mg/L和0.162、0.856、0.119mg/L,溶液培养条件下则分别为0.01960、.04130、.0226.mg/L和0.0683、0.0891、0.0656.mg/L。而鼓荚期 NO_3^- 和 NH_4^+ 的分泌高峰则出现在晚上,早晨和下午两种形态氮处于耗竭状态。砂培条件下 NO_3^- 的分泌量多于 NH_4^+ ,而溶液培养条件下则是 NH_4^+ 的分泌量多于 NO_3^- 。总氮的分泌规律,苗期最大分泌量出现在早晨,花期在下午,而鼓荚期则在晚上,表明在作物生长的不同时期,氮的分泌途径可能不同,释放的氮形态不同。在作物生长的不同时期,以花期的 NO_3^- 、 NH_4^+ 和总氮的分泌量最多,花期总氮的分泌浓度在砂培和溶液培养条件下分别为15.487、21.530、10.906mg/L和5.204、6.445、4.813.mg/L。两种培养条件下,不同形态氮的分泌量不同,砂培条件下氮的分泌远远高于溶液培养条件,表明培养介质的机械阻力刺激了氮的分泌,有利于作物更好地吸收利用释放的氮。

关键词: 水稻 花生 混作 氮分泌 生长时期 水稻 花生 混作 氮分泌 生长时期

Abstract: Recent success in cultivation of rice plants in aerobic soil makes rice plant intercropping with legumes possible. A previous study has shown an obvious yield advantage and nitrogen(N) transferring from antecedent peanut to rice in a peanut and rice intercropping system. Sand-culture and solution-culture experiments were carried out to study the (excretion) of nitrogenous compounds of peanut roots intercropped with rice at different growth stages (seedling, flowering and pod-filling stage of peanut). Considerable amounts of extraction of nitrogenous compounds were observed at the growth stages, with the highest amount recorded at flowering stage. The N (including NO_3^- , NH_4^+ and total nitrogen) (excretion) rate in the "morning" was the highest at seedling stage. The concentrations of NO_3^- and NH_4^+ of rice monocropping, (intercropping) and peanut monocropping treatments in sand-culture experiment were 1.415, 5.044, and 2.140 (mg/L) and 0.0482, 0.332, and 0.132 mg/L, respectively, while under water cultivation condition, for different cropping practices, they were 0.0726, 0.743, and 0.181 mg/L and 1.036, 1.709, 1.736 mg/L, respectively. However, the highest excretion of N was recorded during the "afternoon" at flowering stage, and it was in the "evening" at the pod-filling stage. At flowering stage, the total N concentrations of rice monocropping, intercropping and peanut monocropping treatments were 15.487, 21.530, and 10.906 mg/L in sand-culture experiment, respectively, but under water cultivation way, they were 4.204, 5.445, and 3.813 mg/L, respectively. Composition of the N forms examined as NO_3^- , NH_4^+ and total N, was found to be changeable during the growth stages, suggesting that the major pathways of excretion are possibly different at different plant ages. Our results also showed that extraction amounts of different N forms were variant under different cultivation conditions. The N excretion under sand-culture was far higher than that under solution-culture, indicating that the N excretion was stimulated by mechanical resistance of the culture medium, which in turn enhanced the plant N uptake.

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