

供氮形态和水分胁迫对苗期—分蘖期水稻光合与水分利用效率的影响

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Effects of nitrogen forms and water stress on photosynthesis and water use efficiency of rice at seeding-tillering stage

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摘要 采用室内营养液培养及聚乙二醇(PEG6000)模拟水分胁迫处理的方法,在3种供氮形态($\text{NH}_4^+/\text{NO}_3^-$ 比为100/0,50/50和0/100)和2种水分条件(非水分胁迫及水分胁迫)下,研究了水稻苗期—分蘖期的生长及其水分利用效率。结果表明,苗期—分蘖期水稻在非水分胁迫条件下, $\text{NH}_4^+/\text{NO}_3^-$ 比为50/50处理(NH_4^+ 、 NO_3^- 混合处理)的生物量最大,比单一供 NH_4^+ -N和单一供 NO_3^- -N的处理分别高49.63%和63.25%。而在水分胁迫条件下,单一供 NH_4^+ -N的处理生物量最大,比 NH_4^+ 、 NO_3^- 混合处理和单一供 NO_3^- -N的处理分别高5.76%和484.0%;单一供 NH_4^+ -N其水分利用效率也最高,比 NH_4^+ 、 NO_3^- 混合处理和单一供 NO_3^- -N的处理分别高11.36%和81.63%,而非水分胁迫条件下的相应处理高12.39%。此外,单一供 NH_4^+ -N较单一供 NO_3^- -N的处理水稻有较强的抗旱性,主要与其能保持相对较高的叶绿素含量、叶面积、分蘖数和净光合速率有关。

关键词: 水稻 供氮形态 水分胁迫 水分利用效率 水稻 供氮形态 水分胁迫 水分利用效率

Abstract: By using nutrient solution culture and simulated water stress by PEG(6000), the effects of different nitrogen forms(NO_3^- -N, NH_4^+ -N and the mixture of NO_3^- -N and NH_4^+ -N) and water statuses(non-water stress and water stress) on water use efficiency(WUE) and the biological characteristics of rice plants at seedling-tillering stage were studied. The results showed that, under non-water stress, the biomass of rice plants were about 49.63% and 63.25% higher under the supply of mixture of NO_3^- -N and NH_4^+ -N than either sole supply of NO_3^- -N or NH_4^+ -N, respectively. However, under water stress, the biomass of rice plants were about 5.76% and 484.01% higher under sole ammonium supply than the other two treatments, WUE of rice plants were also 11.36% and 81.63% higher than the two treatments, while 12.39% higher than the same nitrogen form supply under non-water stress. Furthermore, rice plants grown with ammonium nutrition showed a stronger tolerance to water stress, due to their higher chlorophyll content, leaves area, tillers, and net photosynthetic rate et al. compared with those grown with nitrate nutrition.

Keywords:

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