

研究论文

水稻籽粒中乙烯和ACC对土壤水分的反应及其与籽粒灌浆的关系

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摘要 以武运粳8号(粳稻)和扬稻6号(籼稻)为材, 自抽穗后9 d至成熟期进行保持浅水层(WW)、土壤轻度落干(MD)和土壤水分严重亏缺(SD)3种处理。观察在不同土壤水分条件下灌浆期籽粒中乙烯和1-氨基环丙烷1-羧酸(ACC)浓度的变化及其与籽粒灌浆的关系, 并使用化学调控物质进行验证。结果表明, MD显著提高籽粒灌浆速率和粒重, SD明显降低籽粒灌浆速率和粒重。籽粒中乙烯释放速率和ACC浓度在MD中降低, 在SD中增加。籽粒乙烯释放速率及根系伤流液中ACC浓度与籽粒中ACC浓度呈极显著的正相关。籽粒灌浆速率与乙烯释放速率呈极显著负相关。在花后9~13 d喷施乙烯合成的抑制物质氨基-乙氧基乙烯基甘氨酸(AVG), 明显降低籽粒中ACC的浓度和乙烯的释放速率, 显著提高了籽粒灌浆速率和粒重以及籽粒中的蔗糖合成酶(SuSase)、ADP葡萄糖焦磷酸化酶(AGPase)和可溶性淀粉合成酶(SSSase)活性; 喷施乙烯释放的促进物质乙烯利, 结果则相反。表明结实期土壤轻度落干或适度干旱处理可以抑制水稻体内乙烯的产生, 促进籽粒灌浆。

关键词 水稻 1-氨基环丙烷1-羧酸(ACC) 乙烯 籽粒灌浆 根系伤流液 土壤水分

分类号

Responses of Ethylene and ACC in Rice Grains to Soil Moisture and Their Relation to Grain Filling

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Abstract The objectives of this study were to measure the contents of ethylene and 1-aminocyclopropane -1-carboxylic acid (ACC) in rice grains and root bleeding sap during the grain filling period and the grain filling rate. Using two high lodging-resistant rice (*Oryza sativa* L.) cultivars grown by pot or tank with these treatments, well watered (WW), moderate soil-drying (MD), and severe water-deficit (SD) from 9 d post-anthesis until maturity. The effects of chemical regulators on the concentrations of ethylene and ACC in the grains were also studied. The results indicated that MD significantly increased, whereas SD significantly reduced, grain-filling rate and grain weight. Concentrations of ethylene and ACC in the grains were very high at early grain filling stage and sharply decreased during the linear period of grain growth. MD reduced, whereas SD remarkably increased, ACC concentrations and ethylene evolution rate. Both the ethylene evolution rate in rice grains and ACC concentrations in root-bleeding sap were significantly and positively correlated with ACC concentrations in rice grains. The ethylene evolution rate was significantly and inversely correlated with grain-filling rate. Application of amino-ethoxyvinylglycine (AVG), an inhibitor of ethylene synthesis, at 9 - 13 d post-anthesis significantly reduced ACC concentrations and ethylene evolution rate of the grains, whereas significantly enhanced the activities of sucrose synthase, ADP glucose pyrophosphorylase and soluble starch synthase, and the results were reversed when ethephon (ethylene-releasing agent) was applied. The results suggested that a moderate water stress during the grain-filling period of rice could inhibit the production of ethylene and ACC and therefore accelerate grain filling and increase grain weight.

Key words Rice 1-Aminocyclopropane-1-carboxylic acid (ACC) Ethylene Grain filling Root-bleeding sap Soil moisture

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