

研究论文

土壤水分与氮素对水稻地上器官脱落酸和细胞分裂素含量的影响

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摘要 在盆栽和土培池条件下, 研究了结实期轻度土壤水分胁迫与氮素营养对水稻地上部脱落酸和细胞分裂素含量及籽粒灌浆的影响。轻度土壤水分胁迫提高了籽粒的灌浆速率, 缩短了灌浆期。在高氮(HN)水平下, 轻度土壤水分胁迫处理使结实率、粒重和产量较正常灌溉条件下提高。土壤水分胁迫降低了稻株中的玉米素(Z) + 玉米素核苷(ZR)含量, 显著增加了稻株中特别是籽粒中脱落酸(ABA)含量。籽粒灌浆速率与籽粒ABA含量极显著正相关, 而与籽粒中Z+ZR含量的相关不显著。灌浆前期(花后9~13 d)对在HN和正常灌水下生长的稻株喷施ABA, 显著提高了籽粒中蔗糖合成酶、淀粉合成酶、淀粉分枝酶、可溶性酸性转化酶和腺苷二磷酸葡萄糖焦磷酸化酶的活性, 增加了粒重。喷施氟草酮(ABA合成抑制剂)的结果与喷施ABA相反。表明轻度土壤水分胁迫促进籽粒灌浆, ABA起重要的调控作用。

关键词 [水稻](#) [土壤水分](#) [氮素](#) [脱落酸](#) [细胞分裂素](#) [籽粒灌浆](#)

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Effects of Soil Moisture and Nitrogen on Abscissic Acid and Cytokinin Contents in the Aboveground Plant Parts of Rice

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Abstract Improvement of grain filling is very important in rice production. Two rice cultivars with high lodging resistance grown in pots and tanks were used to investigate the possibility that a moderate water stress imposed during the grain-filling period of rice might accelerate grain-filling rate, and hormones might mediate this process. Two levels of nitrogen, normal amount (NN) or high amount (HN), were applied at heading. Well-watered (WW) and water-stressed (WS) treatments were imposed from 9 d after anthesis till maturity. Leaf water potentials, grain filling rate, and cytokinins and abscissic acid (ABA) contents in the leaves, stems and grains were determined. The results showed that leaf water potentials of both cultivars were markedly decreased at midday in WS treatments but completely recovered by early morning. In WW treatments, grain-filling rate was decreased by HN, while the grain-filling rate was increased and the grain filling period shortened under both HN and NN by WS treatments. At the HN level, filled grain percentage, grain weight and yield were significantly higher than those under WW, implying that the effect of accelerated grain filling rate outweighed the possible loss of photosynthesis due to the shortened grain filling period when subjected to water stress during grain filling. Zeatin (Z) + zeatin riboside (ZR) contents in the stems and grains were transiently increased at early grain filling stage, reached a maximum at 9–12 d after anthesis, and decreased thereafter. Apposite to the performance of Z + ZR, ABA content in the stems and grains was low and slowly increased at early grain filling stage, then reached the peak value simultaneously with the grain-filling rate. The Z + ZR content was decreased, but ABA content significantly increased in plants, especially in the grains by WS. ABA content in grains was positively and significantly correlated, whereas Z + ZR content in grains was not correlated, with grain filling rate. The activities of sucrose synthase, adenosine diphosphoglucose pyrophosphorylase, starch synthase and starch-branching enzyme were significantly enhanced, and at last grain weight was increased by spraying ABA at low concentration on HN-WW plants at early grain filling stage (9–13 d after anthesis). The results were reversed when fluridone (an inhibitor of ABA synthesis) was applied. In conclusions, grain-filling rate is accelerated by a moderate water stress during the grain-filling period of rice and ABA plays an important regulatory role in the process.

Key words [Rice \(*Oryza sativa*\)](#) [Soil moisture](#) [Nitrogen nutrient](#) [Abscissic acid](#) [Cytokinin](#) [Grain filling](#)

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