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研究论文

施氮对杂交小麦不同器官氮素积累与转运及其杂种优势的影响

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摘要 氮肥对小麦不同器官的氮素代谢及生长发育影响显著。在施氮（200 kg hm^{-2}）和不施氮条件下，以6个杂交小麦及其7个亲本为材料，研究了叶片、茎鞘、穗轴及颖壳和籽粒中的氮素积累量、氮素含量和转运及其杂种优势。结果表明，施氮显著提高各器官的氮素积累量和含量，但不影响其变化趋势。花期前叶片是贮存氮素的主要器官，花期后籽粒成为贮存氮素的最主要部位，其次为茎鞘。施氮对氮素积累量的杂种优势没有显著的影响，但对氮素含量的杂种优势有显著的抑制效应。施氮极显著促进叶片中的氮素转运，而对茎鞘、穗轴及颖壳无显著影响。总麦草90%以上的氮素转运自叶片。施氮与不施氮处理的氮素转运率和贡献率均以叶片最大，穗轴及颖壳次之，且同一器官中处理间并无显著差异。不施氮的各器官氮素的转运量、转运率和贡献率多表现正的杂种优势，施氮的多呈负优势，表明施氮对氮素转运的杂种优势有抑制作用。

关键词 杂交小麦 氮素积累量 氮素含量 氮素转运 杂种优势

分类号

Effects of Nitrogen Application on Nitrogen Accumulation and Translocation as well as Their Heterosis in Different Organs of Hybrid Wheat

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Abstract Nitrogen fertilizer is one of the most important factors to influence the nitrogen metabolism in different organs as well as the growth and development of wheat. In this study, six hybrids of wheat (*Triticum aestivum* L.) and their seven parents were employed to compare the nitrogen accumulation and translocation in different organs at various growth stages and further to study the heterosis of nitrogen utilization. The experiment was set by a split plot design with two replications under two levels of nitrogen applications 0 and 200 kg ha^{-1}. Above-ground plant parts were harvested at 75, 90, 105, 120, 140 and 160 d after sowing, corresponding with stages of stem elongation, flag leave emergence, heading, flowering, milk-ripe and maturity, respectively. The samples were partitioned into leaf, stem and sheath, stalk and chaff of spike, and grain, then microwaved for 4 min, and dried in an oven at 60℃. Nitrogen content of the hammermill-ground sample and grain nitrogen content were determined by near infrared reflectance spectrometry. The results showed that the nitrogen application significantly increased the amount of nitrogen accumulation and content of various organs, but didn’t affect their change patterns. Leaves were the main nitrogen storage organ prior to anthesis while grains stored the largest amount of nitrogen post anthesis, followed by stem and sheath. Nitrogen application had no significant effects on the heterosis of nitrogen accumulation, but had a significant inhibitory effect on the heterosis of nitrogen content. With nitrogen application nitrogen translocation was greatly accelerated in leaves, but not in stems and sheaths, stalk and chaff of spikes. More than 90% of nitrogen translocation of total straw came from leaves. The contributions to nitrogen translocation efficiency and contribution ratio in all organs were the largest in leaves, the next in stalk and chaff of spikes, and there was no significant difference in the same organ whether nitrogen was applied or not. There was a positive heterosis in nitrogen translocation, translocation efficiency and contribution ratio of various organs when no nitrogen was applied, but a negative heterosis when nitrogen was applied, which indicates an inhibitory effect of nitrogen application on the heterosis of nitrogen translocation.

Key words Hybrid wheat Nitrogen accumulation Nitrogen content Nitrogen translocation Heterosis

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