

氮硫肥配施对小麦籽粒谷蛋白大聚合物含量及粒度分布的影响

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Combined Effects of Nitrogen and Sulphur Fertilization on Content and Size Distribution of Glutenin Macropolymer in Wheat Grain

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摘要

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摘要 以优质小麦品种山农15为材料, 研究了氮硫肥配施对小麦籽粒谷蛋白大聚合物(GMP)含量、高分子量谷蛋白亚基(HMW-GS)含量、低分子量谷蛋白亚基(LMW-GS)含量和谷蛋白大聚合物(GMP)粒度分布的调控效应。结果表明, 在一定范围内, 增施氮肥可提高籽粒GMP含量、高分子量谷蛋白亚基(HMW-GS)含量和低分子量谷蛋白亚基(LMW-GS)含量。增施硫肥对籽粒GMP含量无显著影响, 但降低了HMW-GS含量和D区LMW-GS含量, 提高了B区和C区LMW-GS含量。增施氮肥和硫肥均降低小粒径($d < 12 \mu\text{m}$)GMP颗粒体积和表面积百分比, 提高大粒径($d \geq 12 \mu\text{m}$) GMP颗粒体积百分比和表面积百分比, 但对GMP颗粒数目百分比无显著影响。相关性分析显示, C区LMW-GS含量与小粒径GMP颗粒体积百分比和表面积百分比均呈显著负相关。说明增施氮肥能改变籽粒GMP的绝对含量, 增施硫肥却改变籽粒GMP亚基的相对含量。增施氮肥和硫肥对大粒径GMP颗粒的体积及表面积分布均有正向效应; LMW-GS, 特别是C区LMW-GS在大粒径GMP颗粒形成中起重要作用。

关键词: 小麦 氮肥 硫肥 HMW-GS LMW-GS 谷蛋白大聚合物(GMP)粒度分布

Abstract: The content and size distribution of glutenin macropolymer (GMP) play key roles in grain quality of wheat (*Triticum aestivum* L.). The aims of this study were to analyse the relationship between the content and size distribution of GMP and evaluate combined effects of nitrogen and sulphur fertilization on the content and size distribution of GMP in wheat grain. In the study, Shannong 15 was used in a field experiment with three nitrogen (N) application levels (120, 240, and 360 kg ha⁻¹) and three sulphur (S) application levels (0, 60, and 90 kg ha⁻¹). HMW-GS and LMW-GS were firstly separated using the sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE), and each of the subunits was then extracted before quantitative measurement by colorimetric analysis. The result showed that, in certain ranges, contents of GMP, HMW-GS, and LMW-GS were significantly increased with more application of nitrogen fertilizers. The increasing application of sulphur showed no significant effect on GMP content, but reduced contents of HMW-GS and D-LMW-GS and promoted contents of B-LMW-GS and C-LMW-GS. The content of small GMP particle (diameter less than 12 μm) was significantly reduced with the increase of nitrogen and sulphur fertilization, and the content of large GMP particle (diameter no less than 12 μm), tended to increase with the increase of nitrogen application and sulphur application. However, the distribution of GMP particle number was not affected by the nitrogen and sulphur treatments. According to correlation analysis, C-LMW-GS content was negatively correlated with the content of small GMP particle. These results suggested that increasing nitrogen application had the effect on the absolute content of GMP, while increasing sulphur application affected relative content of GMP. Nitrogen and sulphur fertilization have positive modulation on the content of large GMP particle, and C-LMW-GS plays an important role in the development of large GMP particle.

Keywords: Wheat Nitrogen fertilizer Sulphur fertilizer HMW-GS LMW-GS Glutenin macropolymer size distribution

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