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限水灌溉下施氮量对冬小麦产量、氮素利用及氮平衡的影响

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Effects of nitrogen application on grain yield, nitrogen utilization and balance of winter wheat under limited irrigation condition

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摘要 2008-2009年通过大田试验，研究了限水灌溉条件下，不同施氮量对冬小麦产量、氮素利用、土壤硝态氮动态变化及氮素平衡的影响。结果表明，施用氮肥显著增加小麦穗数和穗粒数，对千粒重无显著影响。作物产量、吸氮量与施氮量均呈抛物线关系，施氮量超过N 240 kg/hm^2，产量和吸氮量随施氮量增加略有降低。小麦起身期后，0—100 cm土层都有硝态氮分布，且随土层深度增加而减少；相同土层则随施氮量的增加而增加。土壤硝态氮积累量随生育期推进而降低，N_0和N_{120}处理分别在拔节期和开花期后表现出氮素亏缺；成熟期，土壤表观盈余以残留为主，表观损失量占小部分。氮肥表观利用率、农学利用率随施氮量增加呈降低趋势，而氮素残留率随施氮量增加呈增加趋势。在本试验条件下，施氮量在N 180220 kg/hm^{2}水平可以达到产量、氮素表观利用率、氮素残留率的较好结合，是限水灌溉下兼顾经济效益与环境效益的适宜施氮量。

关键词： 限水灌溉 冬小麦 产量 氮素利用 氮平衡

Abstract： Effects of different N application rates on grain yield and N utilization of winter wheat and soil N balance were studied using field experiment under water-limited irrigation during 2008-2009. The results show that spike numbers and per spike grains of winter wheat are significantly increased under N applications, while the 1000-grain weight is not significant increased. The relationships between grain yield, N uptake and the N application rates are parabolic, and grain yield and N uptake are reduced when N application rates exceed N 240 kg/ha. Soil NO^-_3-N is found at 0-20, 20-40, 40-60, 60-80 and 80-100 cm soil layers after the erecting stage of winter wheat. Soil NO^-_3-N contents are decreased with increase of soil layer depth under the same treatment, and are increased with increase of N application rates at the same layer. Soil NO^-_3-N accumulations decrease with winter wheat growth and development. Under the N_0 and N_{120} treatments, there are NO^-_3-N deficiencies after the jointing stage and anthesis stage. In the harvest stage, soil residual N in 100 cm soil layer is the main part of surplus N, and soil lost N accounts for little percentage. With increase of N application rates, N utilization efficiency and N agronomy efficiency appear downtrend, while the N residual efficiency appears uptrend. Under this experiment condition, N application rates from N 180 to 220 kg/ha has good combinations of grain yield, N utilization efficiency and N residual efficiency. Therefore, the N 180-220 kg/ha are ideal N rates considering both economic benefit and environmental benefit under water-limited irrigation.

Keywords： limited irrigation winter wheat grain yield N utilization N balance

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