

15N示踪法研究不同灌水处理对小麦氮素吸收分配及利用效率的影响

孟维伟^{1,2}, 王东^{1*}, 于振文¹, 石玉¹

1山东农业大学农业部作物生理生态与栽培重点开放实验室, 山东泰安 271018; 2山东省无棣县农业局, 山东无棣 251900

Effects of irrigation on nitrogen uptake and distribution of wheat using the 15N tracer technique

MENG Wei-wei^{1,2}, WANG Dong^{1*}, YU Zhen-wen¹, SHI Yu^{1*}

1 Key Laboratory of Crop Ecophysiology and Cultivation, Ministry of Agriculture, Shandong Agricultural University, Taian, Shandong 271018, China; 2Agricultural Bureau of Wudi County, Wudi, Shandong 251900, China

摘要

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摘要 通过田间试验, 采用15N示踪法, 设置全生育期不灌水(W0)、冬水+拔节水(W1)、冬水+拔节水+开花水(W2) 3个灌水处理, 每次灌水60 mm, 每个灌水处理下, 设置15N尿素作底肥+普通尿素作追肥、普通尿素作底肥+15N尿素作追肥2个15N示踪处理的微区, 研究不同灌水处理对小麦氮素吸收分配及利用效率的影响。结果表明, 成熟期地上部植株氮素积累量及来源于土壤的氮素的积累量均为: W2>W1>W0; 肥料氮的积累量为W0、W1>W2。W1处理基肥氮积累量及比例均显著低于W0处理, 追肥氮的积累量及比例均显著高于W0处理; W2处理基肥氮和追肥氮的积累量均显著低于W0处理。成熟期肥料氮在植株各器官的分配量为: 子粒>茎秆+叶鞘>叶>穗轴+颖壳; 各处理营养器官中基肥氮的比例高于追肥氮, 子粒中追肥氮的积累量及比例高于基肥氮。子粒中分配的肥料氮量为W0、W1>W2。W1处理子粒产量最高, 植株中肥料氮的积累量及利用率均高于W2处理。说明灌溉冬水+拔节水促进了小麦对追肥氮和土壤氮素的吸收积累, 提高了肥料氮的积累量和利用率; 在此基础上增灌开花水, 地上部积累的追肥氮量及其向子粒中的分配比例均显著降低, 这是花后供水多导致产量和氮肥利用效率显著降低的生理原因。

关键词: 小麦 15N示踪 灌水量和时期 氮素吸收分配 肥料氮利用率

Abstract: Field experiments were conducted to determine the effects of irrigation amounts on nitrogen uptake and distribution in wheat by using 15N tracer technique in Wanghai village, Yanzhou, Shandong, China. Jimai 20 was selected as the cultivar. Three irrigation regimes were designed with no irrigation during the whole growth season (W0); irrigated 2 times, before wintering and at the jointing stage (W1); irrigated 3 times, before wintering, at jointing and anthesis stages (W2), and the irrigation amount is 60 mm every time. The results show that the total amount of nitrogen accumulation in wheat at maturity and the amount of nitrogen derived from soil are both ranked as W2>W1>W0, while the amount of nitrogen derived from fertilizer in wheat at maturity is ranked as W0 and W1>W2. The amounts and proportion of nitrogen derived from basal fertilizer in wheat of W1 are lower than those of W0, the amount and proportion of nitrogen derived from top dressing fertilizer in wheat of W1 are higher than those of W0. The amounts of nitrogen derived from basal and top dressing fertilizer in wheat of W2 are lower than those of W0. At the maturity stage, the amounts of nitrogen distribution derived from fertilizer are ranked as Kernel > Stem + Sheath > Leaf > Spike axis + glume. The percentages of nitrogen derived from basal fertilizer in vegetative organs are higher than those derived from topdressing fertilizer, but, opposite phenomenon occurs in grains. The amounts of nitrogen derived from fertilizer in grains are ranked as W0 and W1 > W2. W1 treatment gains the highest grain yield. The amount of nitrogen derived from fertilizer and the recovery of fertilizer nitrogen in plant of W1 are higher than those of W2. These is indicate that irrigation before wintering and at the jointing stage can improve the absorption and accumulation of top dressing nitrogen and soil nitrogen, and increase the fertilizer nitrogen accumulation amount and use efficiency. Adding irrigation at the anthesis stage based on W1 treatment, the amount of top dressing nitrogen accumulation in shoot and the proportion of that distribution to grain are decreased significantly. This is the physiological reason why the yield and nitrogen use efficiency are decreased as more water applied after anthesis.

Keywords: wheat 15N tracer irrigation amount and stage nitrogen uptake and distribution fertilizer nitrogen use efficiency.

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