

## 不同灌溉模式下水分养分的运移及其利用

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## Movement and utilization of water and nutrient under different irrigation patterns

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摘要

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**摘要** 以玉米为试验材料通过人工控制水分的微区试验,比较了水肥异区交替灌溉与传统均匀灌溉条件下,水分与养分在200cm剖面上的动态迁移规律,并分析了不同灌水模式下的灌溉效率和肥料利用效率。结果表明,在低灌水量( $450\text{m}^3/\text{hm}^2$ )水平下水肥异区交替灌溉,施肥区和灌水区之间存在水势梯度差异, $\text{NO}_3^-$ -N含量也有差异;灌溉效率和肥料利用效率均高于均匀灌溉。在高灌水量( $900\text{m}^3/\text{hm}^2$ )水平下,水肥异区交替灌水与常规均匀灌水差异不显著,但养分离子发生了强烈的淋洗。收获后,交替灌溉的 $\text{NO}_3^-$ -N残留量比传统灌溉要高,而水分残留量则相反。研究结果发现,交替灌溉在 $450\text{m}^3/\text{hm}^2$ 时的产量与均匀灌溉在 $900\text{m}^3/\text{hm}^2$ 时的产量相差并不大,即交替灌溉可节水一半。秸秆覆盖能影响0—60cm土壤水分运动,可减少土壤水分蒸发,但对玉米产量影响不大。

**关键词:** 灌溉模式 水分养分运移 灌溉效率 肥料利用效率 灌溉模式 水分养分运移 灌溉效率 肥料利用效率

**Abstract:** We conducted an experiment to determine the effect of different patterns of irrigation and fertilization on: (i) the distribution of nitrate and water in the soil profile and (ii) irrigation efficiency and the recovery of applied fertilizer. Micro-field trials were conducted using rain shelters to control water input. Maize *Zea Mays* L. cultivar: Hudan 4) was used as a test crop. The experiment consisted of two irrigation methods. One is alternate furrow irrigation method in which irrigation water was applied to one row and fertilizer was applied to the adjoining row at the same time. The other one is traditional method. In this method, water and fertilizer were both applied to the same row. Two water rates ( $450\text{ m}^3/\text{ha}$  and  $900\text{ m}^3/\text{ha}$ ) were set up and soil water and nitrate contents from 0-200 cm in the soil profile were determined in this experiment. Results indicated that there was a water potential difference between rows in the alternate (furrow) irrigation method when the rate of irrigation water was  $450\text{ m}^3/\text{ha}$ . So do the nitrate content. However, there was no significant difference on the water potential between rows when  $900\text{ m}^3/\text{ha}$  water was used. The low concentration of (nitrate) from 0-180 cm in the  $900\text{ m}^3/\text{ha}$  treatment indicated that nitrate was leached out. After maize harvest, the amount of available nitrate in the soil in the alternate furrow irrigation treatment was higher than that in the traditional (irrigation) treatment. However, the soil water content was less in the alternate furrow irrigation treatment compared to the traditional treatment. Grain yield in the alternate furrow irrigation treatment with  $450\text{ m}^3/\text{ha}$  of irrigation water was nearly equal to that of the traditional irrigation method under  $900\text{ m}^3/\text{ha}$ . This indicates that half irrigation water could be saved when the alternate furrow irrigation treatment was used without any yield reduction. Irrigation efficiency and the (recovery) of (fertilizer) in the alternate furrow irrigation method were higher than that of traditional model when the amount of irrigation water was  $450\text{ m}^3/\text{ha}$ . Evaporation was significantly decreased when the soil was mulched with wheat straw, moreover, the use of straw mulch is also beneficial to nutrient uptake. Nevertheless maize yield was not affected significantly by the mulch treatment. In conclusion, the alternate furrow irrigation method combined with the application of irrigation water at the rate of  $450\text{ m}^3/\text{ha}$  is appropriate for semi-humid areas. Straw mulch is of great advantage of water saving.

**Keywords:**

## 引用本文:

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