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## 施氮和秸秆还田对小麦-玉米轮作农田硝态氮淋溶的影响

### Effects of application of nitrogen fertilizer and incorporation of straw on nitrate leaching in farmland under wheat-maize rotation system

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中文摘要:

连续4 a采用渗漏计测定法研究了陕西关中小麦-玉米轮作区施氮和秸秆还田对土壤剖面90 cm处NO<sub>3</sub><sup>-</sup>-N淋溶的影响。结果表明, NO<sub>3</sub><sup>-</sup>-N淋洗主要发生在7、8、9月份或灌溉后, 年际间变异较大。监测期内各处理渗滤液NO<sub>3</sub><sup>-</sup>-N浓度和淋失量的变幅为0~103.5 mg L<sup>-1</sup>和0~21.8 kg hm<sup>-2</sup>, 二者均随施氮量的增加呈增加趋势。小麦施氮150 kg hm<sup>-2</sup>、玉米施氮180 kg hm<sup>-2</sup>时, 连续4 a作物均能获得高产。施氮量继续增加, 产量不再增加, 0~100 cm土层NO<sub>3</sub><sup>-</sup>-N累积量和90 cm处NO<sub>3</sub><sup>-</sup>-N淋失量却相应增加。秸秆还田2 a后作物显著增产, 2010年和2011年分别增产15.1%和14.2%, 但对NO<sub>3</sub><sup>-</sup>-N累积和淋溶的影响不显著。回归分析显示, NO<sub>3</sub><sup>-</sup>-N年淋失量和0~100 cm土层累积量均随年施氮量的增加呈指数形式增加, 说明施氮量越高, NO<sub>3</sub><sup>-</sup>-N年淋失量和累积量越高, 二者占施氮量的比例也越高。

Abstract:

A four-year stationary field experiment, using the lysimeter method, was conducted to investigate effects of application of nitrogen fertilizer and incorporation of straws on nitrate leaching in the soil layer, 90 cm in depth, in a field under wheat and maize rotation in Guanzhong Plain of Shaanxi Province. Results show that nitrate leaching varied sharply in a year and occurred mainly in July, August, September, the rainy season of the year, and could be observed after flood irrigation, too. The nitrate concentration in the leachate and nitrate leaching loss in the whole monitored period was 0~103.5 mg L<sup>-1</sup> and 0~21.8 kg hm<sup>-2</sup>, respectively, and both displayed an increasing trend along with nitrogen application rate. The crops gained relatively high yields (14.4 t hm<sup>-2</sup> on average) in all the 4 year when 330 kg hm<sup>-2</sup> N (150 kg hm<sup>-2</sup> N for wheat and 180 kg hm<sup>-2</sup> N for corn) was applied for the wheat/maize rotation system. Any further increase in nitrogen application rate did not bring about increase in crop yield, but enhanced accordingly nitrate accumulation in the soil profile and nitrate leaching loss monitored at the depth of 90 cm of the profile. Straw incorporation showed some yield increase effect only two years later. Compared with Treatment N330, Treatment N330+S increased yield of the crops by 15.1% and 14.2% in 2010 and 2011, respectively. However, no significant effects were observed on nitrate accumulation and leaching. Regression analysis of the data exposed an positive exponential relationship of nitrate accumulation in the 0~100 cm soil layer and nitrate leaching loss with annual nitrogen application rate, which means that the higher the nitrogen application rate, the higher the nitrate accumulation, the



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higher the nitrate leaching loss, and the higher the proportions of the two to the total nitrate applied.