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分根区交替灌溉对玉米水分利用和土壤微生物量碳的影响

Effects of alternate partial root-zone irrigation on maize water use and soil microbial biomass carbon

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中文关键词：分根区交替灌溉,水分利用效率,土壤微生物量碳,玉米

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作者	单位
刘 水	广西大学农学院，南宁 530005
李伏生	广西大学农学院，南宁 530005
韦翔华	广西大学农学院，南宁 530005
农梦玲	广西大学农学院，南宁 530005

中文摘要:

分根区交替灌溉由于创造了一个土壤水分分布不均匀的环境，从而影响土壤中微生物活性，作物水分和养分利用。为探明这种影响，该文通过盆栽试验，研究了在2种灌水水平（正常灌水W1，70%～80%田间持水率；轻度缺水W2，60%～70%田间持水率）和2种有机无机氮比例（100%无机氮，70%无机氮+30%有机氮）条件下，常规灌溉和不同生育期分根区交替灌溉（分别在苗期～灌浆初期、苗期～拔节期以及拔节期～抽雄期进行分根区交替灌溉（AI），即AI1、AI2和AI3）对玉米干物质积累、水分利用以及拔节期、抽雄期和灌浆初期土壤微生物量碳（MBC），可溶性碳（DOC）含量以及基础呼吸和诱导呼吸CO2释放量等的影响。结果表明，与常规灌溉相比，轻度缺水时，拔节期～抽雄期分根区交替灌溉总干物质质量增加23.2%～27.4%，水分利用效率提高23.3%～26.7%；相同施肥和灌水水平条件下，抽雄期时拔节期～抽雄期分根区交替灌溉土壤MBC增加，但是土壤诱导呼吸CO2释放量降低。与单施无机氮相比，有机、无机氮配施增加玉米干物质质量，在某些水分条件下（W1CI、W1AI1和W1AI2）还提高灌浆初期基础呼吸和诱导呼吸CO2释放量。因此，轻度缺水时拔节期～抽雄期进行分根区交替灌溉可以提高玉米总干物质质量、水分利用效率和微生物量碳。

英文摘要:

Alternate partial root-zone irrigation creates a heterogeneous soil moisture distribution that may affect soil microbiological activity and crop water and nutrient use. In order to understand such effect, this study investigated dry mass accumulation and water use, microbial biomass carbon (MBC), dissolved organic carbon (DOC) and CO2 release quantity of basic and induced respiration in soils from jointing to early grain filling stages of maize subjected to conventional irrigation and alternate partial root-zone irrigation (AI) (respectively carried out at seedling-early grain filling, seedling-jointing and jointing-tasselling stages, i.e. AI1, AI2 and AI3) using a pot experiment under two irrigation levels, i.e. normal irrigation (F1, 70%-80% field capacity) and mild water deficit (F2, 60%-70% field capacity), and two ratios of inorganic to organic N, i.e. 100% inorganic N and 70% inorganic N + 30% organic N. Results show that at mild water deficit condition, alternate partial root-zone irrigation at jointing-tasselling stages increased total dry mass and water use efficiency of maize by 23.2%-27.4% and 23.3%-26.7% when compared to conventional irrigation. Under the same fertilization and irrigation levels, alternate partial root-zone irrigation at jointing-tasselling stages increased soil MBC, but reduced CO2 release quantity of induced respiration at the tasselling stage. Compared to only inorganic N, combined application of organic and inorganic N increased total dry mass of maize, and increased CO2 release quantity of basic and induced respiration in soil at the early grain filling stage under certain soil moisture conditions (W1CI, W1AI1 and W1AI2). Therefore, alternate partial root-zone irrigation at the jointing-tasselling stage could increase total dry mass and water use efficiency of maize and soil microbial biomass carbon under mild water deficit condition.

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