干旱及复水对油茶土壤养分及微生物的影响

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摘要：【目的】为探究土壤不同干旱程度对根际土壤养分与微生物的影响，指导油茶科学灌水。【方法】采用棚内盆栽试验，对 3 年生‘华金’进行不同土壤体积含水量处理（5%~10、10%~15%、15%~20%、20%~25%），处理 30 天后均复水到体积含水量 20%~25%，测定油茶生长量、土壤养分含量和土壤微生物多样性。【结果】1）试验表明当土壤体积含水量降至较低水平（5%~15%）时，会导致油茶植株生长变缓。2）不同处理下根际土壤土壤水分含量（SM）与 pH、速效钾（AK）存在显著正相关关系，与全氮（TN）、硝态氮（NO_3^--N）、有效磷（AP）和全钾（TK）存在极显著负相关关系；复水处理后各处理全磷（TP）、全钾（TK）及速效养分有所下降，pH 提高。3）高通量测序表明干旱复水能够改善油茶根际环境，提高微生物群落的丰富度和多样性；但复水降低了细菌酸杆菌纲（*Acidobacteria*）、嗜热油菌纲（*Thermoleophilia*）的相对丰度，提高了纤线杆菌纲（*Ktedonobacteria*）、*Saccharimonadia* 和芽孢杆菌（*Bacilli*）的相对丰度。4）冗余分析表明，油茶根际土壤理化因子 SM、NO_3^--N、TP 对微生物群落结构存在显著影响。综合田间和盆栽试验结果，土壤含水量变化显著影响的细菌种类有 *Patescibacteria*、*Cyanobacteria*、拟杆菌属（*Bacteroidetes*），真菌种类有圆环菌纲（*Orbiliomycetes*）、*Leotioycetes*、绿藻纲（*Chlorophyceae*）、根囊壶菌纲（*Rhizophydiomycetes*）和散囊菌纲（*Eurotiomycetes*）。【结论】控制土壤体积含水量在 20%~25%时对土壤微生物群落多样性和丰富度最有利。

关键词：干旱；复水；土壤养分；土壤微生物

Effects of drought and re-water on nutrients and microorganisms in *Camellia oleifera* soil

Abstract: 【Objective】To investigate the effects of different levels of soil drought on the growth of Camellia oleifera and the nutrient content and microbial community in the rhizosphere soil, provide guidance for scientific irrigation practices for Camellia oleifera. 【Methods】 A greenhouse pot experiment was conducted on 3-year-old 'Huajin' plants, subjected to different soil volumetric water content treatments (5%–10%, 10%–15%, 15%–20%, 20%–25%). After 30 days of treatment, all plants were rehydrated to a soil volumetric water content of 20%–25%. The growth parameters of Camellia oleifera, soil nutrient content, and soil microbial diversity were measured. 【Results】 1) The experiment showed that when the soil volumetric water content decreased to lower levels (5%–15%), the growth of Camellia oleifera plants slowed down. 2) Under different treatments, the soil moisture content (SM) in the rhizosphere showed a significant positive correlation with pH and available potassium (AK), and a highly significant negative correlation with total nitrogen (TN), nitrate nitrogen (NO3-N), available phosphorus (AP), and total potassium (TK). After rehydration, the total phosphorus (TP), total potassium (TK), and available nutrients decreased, while the pH increased. 3) High-throughput sequencing revealed that drought rehydration improved the rhizosphere environment of Camellia oleifera, enhancing the abundance and diversity of microbial communities. However, rehydration decreased the relative abundance of *Acidobacteria* and *Thermoleophilia*, while increasing the relative abundance of *Ktedonobacteria*, *Saccharimonadia*, and *Bacilli*. 4) Redundancy analysis indicated that soil physicochemical factors such as SM, NO3-N, and TP had a significant impact on the microbial community structure. Based on the results of field and pot experiments, bacteria species such as *Patescibacteria*, *Cyanobacteria*, and *Bacteroidetes*, as well as fungal species such as *Orbiliomycetes*, *Leotioycetes*, *Chlorophyceae*, *Rhizophydiomycetes*， and *Eurotiomycetes*, were significantly influenced by soil moisture changes. 【Conclusion】 Maintaining a soil volumetric water content of 20%–25% is most favorable for the diversity and abundance of the soil microbial community.

Key words: Drought stress; Rewater; Soil nutrients; Soil microbial