

基于密度效应的杉木闽楠复层林邻株根系养分与 AMF 多样性的关系分析²

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摘要: 复层林改造能够调节林分结构, 改善立地质量, 对于维持森林的可持续经营具有重要作用。但复层林中树种的密度效应仍然是林分生产力的主要限制因素。为研究复层林内树种密度效应对林木根系生长及共生 AMF 群落组成的影响。本文选择杉木 (19 a 生) 林下套种闽楠形成的杉楠异龄复层林为研究对象, 共设置 4 个不同闽楠保留密度 (300 株·hm⁻²、600 株·hm⁻²、900 株·hm⁻²、1200 株·hm⁻²)。采用根系原位挖掘法, 在测定分析杉木-闽楠邻间公共区域杉木及闽楠根系养分特性的基础上, 结合根系组织内丛枝菌根真菌 (Arbuscular mycorrhizal fungi, AMF) 多样性及群落组成的变化特征, 分析根系养分含量和 AMF 群落组成的内在关系, 及其对竞争强度变化的响应规律。研究表明: 闽楠根系总氮、总磷及总钾含量随着竞争强度的增大均显著增加 ($p < 0.05$), 对于邻株杉木而言, 其根系养分含量未受竞争强度的显著影响 ($p > 0.05$), 在不同竞争强度处理中, 闽楠根系总氮、总碳、总磷及总钾含量均高于杉木; 杉木根系中分离出的 AMF 为 4 目 4 科 7 属 48 个种, 闽楠根系中分离出的 AMF 则为 3 目 4 科 8 属 52 个种, 闽楠根系中检测到的 AMF 物种数量要大于杉木根系, AMF 在 Top5 水平上的物种基本上均划归于球囊霉属, 球囊霉属均为主要优势属。林木可能通过促进根系内 AMF 多样性来帮助自身获取养分, 调节种间关系, 以应对竞争胁迫。

关键词: 杉木; 闽楠; AMF; 根系分布; 养分

Effects of competition intensity between *Phoebe bournei* and Chinese fir on root growth and AMF community composition

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Abstract: The transformation of multi-layer forest can adjust the stand structure and improve the site quality, which plays an important role in maintaining the sustainable management of forest. However, the density effect of

²基金项目: 国家重点研发计划项目课题“杉木人工林近自然改造技术”(编号 2021YFD2201304)。

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tree species in multi-layer forest is still the main limiting factor of stand productivity. In order to study the effect of tree species density on root growth and symbiotic AMF community composition in multi-layer forest, this paper

selected the different-age multi-layer forest of *Phoebe bournei* formed by intercropping *Phoebe bournei* under Chinese fir (19a) forest as the research object, and set four different retention densities of *Phoebe bournei* (300 trees·hm⁻², 600 trees·hm⁻², 900 trees·hm⁻², 1200 trees·hm⁻²). Based on the nutrient characteristics of roots of Chinese fir and *Phoebe bournei*, combined with the variation characteristics of AMF diversity and community composition in root tissues, the internal relationship between root nutrient content and AMF community composition and its response to changes in competition intensity were analyzed. Research shows that: the contents of total nitrogen, total phosphorus and total potassium in roots increased significantly with the increase of competition intensity ($p<0.05$). For Chinese fir, the root nutrient content was not significantly affected by competition intensity ($p>0.05$). In different competition intensity treatments, the contents of total nitrogen, total carbon, total phosphorus and total potassium in roots of *Phoebe bournei* were higher than those of Chinese fir. The AMF isolated from the roots of Chinese fir were 4 orders, 4 families, 7 genera and 48 species, and the AMF isolated from the roots of *Phoebe bournei* were 3 orders, 4 families, 8 genera and 52 species. The number of AMF species detected in the roots of *Phoebe bournei* was greater than that of Chinese fir. The species of AMF at the Top5 level were basically classified into *Glomus*, and *Glomus* was the main dominant genus. Trees may help themselves to obtain nutrients and regulate interspecific relationships by promoting AMF diversity in roots to cope with competitive stress.

Key words: Chinese fir; *Phoebe bournei*, Arbuscular mycorrhizal fungi; Root distribution; Nutrien