

混种对杉木和火力楠幼苗生长和非结构性碳的影响

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摘要:【目的】非结构性碳水化合物(Non-Structural Carbohydrates, NSC)为植物生长代谢提供能量, 可体现植物对于环境变化的生理响应方式。树种混交被认为是提高林分生产力的有效措施之一, 而混交模式下根系互作对苗木 NSC 的影响尚不清楚。通过设置不同的混交模式, 从根系互作的角度分析杉木和火力楠幼苗生物量和不同器官 NSC 分配格局。【方法】以杉木(*Cunninghamia lanceolata*)和火力楠(*Michelia macclurei* Dandy)幼苗为研究对象, 以杉木单种(MC)和火力楠单种(MM)为对照, 设置根系不分隔混种杉木火力楠(NB)、尼龙筛网分隔混种杉木和火力楠(MB)、塑料膜分隔混种杉木和火力楠(PB), 分析土壤理化性质与杉木火力楠生物量和各部位 NSC 含量的关系。【结果】混种显著促进了杉木和火力楠幼苗生物量的积累, 提高根冠比, 对杉木的促进效果最显著($P<0.05$)。混种显著促进杉木和火力楠幼苗 NSC 的合成, 提高各部位 NSC 含量。杉木和火力楠幼苗叶片可溶性糖比例占 60%以上, 这主要因为叶片是光合作用的主要场所。与对照相比, NB 处理下, 杉木叶片淀粉含量增长 60.20%, 而火力楠叶片淀粉含量显著增长了 259.88%; 火力楠根系淀粉含量显著提高了 93.52%($P<0.05$), 杉木仅增长 2.7%。PB 处理促进杉木 NSC 含量提高了 2.87%, 火力楠 NSC 含量显著提高了 37.43%($P<0.05$)。杉木叶片可溶性糖含量与速效磷含量呈负相关, 而火力楠 NSC 与碱解氮含量呈正相关关系($P<0.05$)。火力楠根系淀粉含量与 TOC 显著负相关($P<0.01$)。【结论】杉木和火力楠混交能发挥生态位互补优势, 同时调整自身碳资源的分配来响应环境变化。

关键词: 生物量分配; 淀粉; 可溶性糖; 火力楠; 杉木; 根系分隔

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Effects of intercropping on seedlings growth and non-structural carbohydrates in *Cunninghamia lanceolata* and *Michelia macclurei* Dandy

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Abstract: 【Objective】 Non-structural carbohydrates (NSC) can provide energy for plants growth and metabolism, reflecting plants physiological response modes to environmental changes. Tree species intercropping is considered to be one of the effective way to improve forest productivity, but the effect of root interactions under intercropping on seedling NSC is uncertain. The aim of this study is to investigate the distribution patterns of seedling biomass and NSC in *C. lanceolata* and *M. macclurei*. 【Method】 The study selected *Cunninghamia lanceolata* and *Michelia macclurei* Dandy as objects, set monoculture *C. lanceolata* (MC) and monoculture *M. macclurei* (MM) as controls, and set up three different co-planting modes: no barrier (NB), mesh barrier (MB) and plastic film barrier (PB). The relationships between soil physicochemical properties, biomass and NSC content of various parts in *C. lanceolata* and *M. macclurei* were analyzed in the present study. 【Result】 The results showed NB increased the accumulation of biomass and improved root-shoot ratio in *C. lanceolata* and *M. macclurei* ($P<0.05$). Mixed patterns significantly promoted the synthesis and concentration of NSC in *C. lanceolata* and *M. macclurei*. The proportion of leaf SS in *C. lanceolata* and *M. macclurei* accounted for more than 60%, because photosynthetic products mainly originate from leaf. Compared with control, the leaf ST content in *C. lanceolata* increased by 60.20%, but the leaf ST content in *M. macclurei* significantly increased by 259.88% with NB. Besides,

the root ST content in *M. macclurei* significantly increased by 93.52% ($P<0.05$) with NB, while the root ST in the *C. lanceolata* only increased by 2.7%. In the PB treatment, NSC content in *C. lanceolata* just increased by 2.87% while *M. macclurei* increased by 37.43% ($P<0.05$). Leaf SS content was significantly and negatively correlated with soil AP while NSC content in *M. macclurei* was positively correlated with soil AN ($P<0.05$). Root ST content in *M. macclurei* had a significant negative correlation with soil TOC ($P<0.01$). **【Conclusion】** Our results demonstrated that *C. lanceolata* and *M. macclurei* can take advantages of complementary ecological niches and adjust the distribution of their own carbon resources in response to environmental changes.

Key words: biomass distribution; starch; soluble sugar; *Michelia macclurei*; *Cunninghamia lanceolata*; root separation