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研究论文

马尾松种源在异质养分环境中的觅养行为差异

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摘要 选择广东信宜、福建武平、广西岑溪3个不同磷效率特性的马尾松种源，构建同质和异质两种养分环境开展盆栽实验，研究马尾松搜寻利用异质分布养分的获取机制及不同种源觅养行为差异。结果表明，与同质营养环境相比，异质营养环境中马尾松种源具有较高的苗高、地径生长量、较强光合速率和干物质生产能力。研究证实了根系形态可塑性和生理可塑性在马尾松获取异质分布养分中的重要性。马尾松可通过在富养斑块中须侧根的大量增生、对N、P、K等元素的有效吸收提高其觅养能力。马尾松在拓殖富养斑块的初期主要依靠新生侧根的增加和侧根的延长，在拓殖一段时期之后则主要靠新生侧根的生成和须根数量、须根密度的增加来搜寻异质分布养分。异质养分环境中的根系具有较高的养分吸收效率主要缘由在富养斑块中对N、P、K大量的吸收。综合比较分析认为，在3个参试种源中广西岑溪和福建武平种源在异质营养环境中拓殖富养斑块和觅养能力较强，广东信宜种源拓殖和觅养能力相对较弱。

关键词 马尾松；种源；异质养分环境；觅养行为；根系形态可塑性；根系生理可塑性

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Differences of foraging behavior between provenances of *Pinus massoniana* in heterogeneous nutrient environment

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Abstract Three provenances of Pinus massoniana with different phosphorus using efficiency including Xinyi of Guangdong,Wuping of Fujian and Cenxi of Guangxi were selected to investigate the foraging mechanism in heterogeneous nutrient environments and foraging behavior differences among the three provenances. In heterogeneous environment, larger seedling height, greater stem diameter, enhanced photosynthesis ability and higher dry matter accumulation were observed in comparison with homogeneous environment. These results suggested that root morphological plasticity and physiological plasticity of Pinus massoniana play an important role in acquiring nutrients in heterogeneous environment. It was root proliferation and effective absorption of N, P, K in rich nutrient patch that increase the foraging ability of Pinus massoniana in heterogeneous nutrient environment. Foraging nutrient of Pinus massoniana in heterogeneous environment mainly depended on the proliferation and elongation of lateral roots during initial stage of root colonization in riched-nutrient patch, and then depend on increase of new lateral roots and amount and density of fibrous root. Higher efficiency of nutrient acquisition of root in heterogeneous nutrient environment mainly attributed to large absorption of N, P, K in rich nutrient patch. Based on synthetical comparing analysis, Cenxi of Guangxi and Wuping of Fujian were superior to Xinyi of Guangdong with higher foraging ability and competitive advantage in heterogeneous environment.

Key words *Pinus massoniana* lamb _ provenance _ heterogeneous nutrient environment _ foraging behavior _ root morphological plasticity _ root physiological pla

sticity

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