

中国木本植物叶片和根部非结构性碳水化合物对氮添加的不同反应：季节变化与生态影响

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摘要:【目的】植物非结构碳水化合物(NSC)主要由淀粉和可溶性糖组成, 是支持植物生长和生理功能的重要能量储备。众所周知, 全球氮沉降的加剧会影响植物的 NSCs 浓度, 但在更大的空间尺度上, 仍缺乏木本物种叶片和根部 NSCs 对氮添加量的季节性响应和驱动因素的量化研究。【方法】因此, 我们系统分析了分布在中国各地的 53 个田间试验的数据(包括 1202 个观测值), 以检验氮添加量在不同生长季节和非生长季节内对木本植物叶片和根系 NSC 的影响。【结果】我们发现: (1) 在叶片的生长季节和非生长季节, 添加氮对叶片和根的 NSC、可溶性糖或淀粉浓度没有总体影响, 而在非生长季节, 添加氮对根的 NSC 和淀粉浓度分别降低了 13.8% 和 39.0%, 对可溶性糖的浓度提高了 15.0%。(2) 在添加氮的情况下, 叶片 NSC 浓度的变化在两个季节都是由可溶性糖的反应驱动的, 而根系 NSC 的变化在非生长季节是由可溶性糖驱动的, 在生长季节则是由淀粉和可溶性糖驱动的。(3) 氮、碳和磷的化学计量与叶片和根部营养繁殖之间的关系表明, 氮的添加通过影响植物的光合作用、呼吸作用和生长, 对木本植物营养繁殖的分配产生了影响。(4) 氮添加量对叶片和根部 NSC 的影响因植物功能类型而异, 在非生长季节, 对根部的影响比对叶片的影响更明显。【结论】总之, 我们的研究结果揭示了木本植物叶片和根部营养繁殖细胞在非生长季节对氮添加的不同反应, 并强调了生态化学计量和植物功能类型在木本植物营养繁殖细胞分配模式中的作用, 以应对全球变化下持续的氮沉积。

Divergent responses of woody plant leaf and root non-structural carbohydrates to nitrogen addition in China: Seasonal variations and ecological implications

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Abstract: 【Objective】Plant non-structural carbohydrates (NSCs), which largely comprise starch and soluble sugars, are essential energy reserves to support plant growth and physiological functions. While

it is known that increasing global deposition of nitrogen (N) affects plant concentration of NSCs, quantification of seasonal responses and drivers of woody species leaf and root NSCs to N addition at larger spatial scales remains lacking. **【Method】** Here, we systematically analyzed data from 53 field experiments distributed across China, comprising 1202 observations, to test for effects of N addition on woody plant leaf and root NSCs across and within growing and non-growing seasons. **【Result】** We found (1) no overall effects of N addition on the concentrations of leaf and root NSCs, soluble sugars or starch during the growing season or the non-growing season for leaves, while for roots in the non-growing season, N addition decreased NSC and starch concentrations by 13.8% and 39.0%, respectively, and increased concentration of soluble sugars by 15.0%; (2) shifts in leaf NSC concentration under N addition were driven by responses by soluble sugars in both seasons, while shifts in root NSC were driven by soluble sugars in the non-growing season and starch and soluble sugars in the growing season; (3) relationships between N, carbon, and phosphorus stoichiometry with leaf and root NSCs indicated effects of N addition on woody plant NSCs allocation through impacts on plant photosynthesis, respiration, and growth; and (4) effects of N addition on leaf and root NSCs varied with plant functional types, where effects were more pronounced in roots than in leaves during the non-growing season. **【Conclusion】** Overall, our results reveal divergent responses of woody plant leaf and root NSCs to N addition within non-growing season and highlight the role of ecological stoichiometry and plant functional types in woody plant allocation patterns of NSCs in response to ongoing N deposition under global change.