

长期氮添加对四川盆地西缘常绿阔叶林优势树种凋落叶产量及碳氮磷归还的影响*

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摘 要:【目的】明确长期氮添加对亚热带常绿阔叶林凋落叶产量及碳、氮、磷归还的影响。【方法】以四川盆地西缘峨眉含笑(*Michelia wilsonii* Finet et Gagn.)次生林为研究对象, 设置对照($0 \text{ kg} \cdot \text{N} \cdot \text{hm}^{-2} \cdot \text{a}^{-1}$)、低氮添加($20 \text{ kg} \cdot \text{N} \cdot \text{hm}^{-2} \cdot \text{a}^{-1}$)和高氮添加($40 \text{ kg} \cdot \text{N} \cdot \text{hm}^{-2} \cdot \text{a}^{-1}$)3种氮添加水平, 探究含笑凋落叶产量、凋落叶碳、氮、磷含量与归还量的年际变化(2016 - 2022 年)及其对氮添加的长期响应。【结论】(1)含笑凋落叶年产量、凋落叶碳、氮、磷年均含量和年均归还量均存在显著的年际变化, 且氮添加处理未改变凋落叶年际动态特征。(2)相较于对照, 高氮添加处理显著增加了含笑凋落叶年均产量(24.9%), 氮添加处理对凋落叶产量的影响随时间增加显著降低。(3)相较于对照, 高氮添加处理显著增加了凋落叶碳年均含量(3.4%); 高氮添加处理对凋落叶氮、磷含量的影响在 2019-2020 年间出现拐点: 在 2016 - 2019 年间总体抑制凋落叶氮年均含量, 而在 2019 年后总体增加凋落叶氮年均含量; 在 2018、2019 年显著抑制凋落叶磷年均含量, 在 2020 年显著增加凋落叶磷年均含量。(4)氮添加处理显著增加了凋落叶碳、氮、磷年均归还量, 且氮添加水平越高, 促进效果越强; 凋落叶磷年归还量的氮添加效应随时间呈显著的线性下降趋势。该研究表明高氮添加显著提高了含笑林生产力, 并增加了其生态系统碳和养分输入, 而短期与长期氮输入会对含笑林生态系统氮循环进程产生不同的影响。

关键词: 长期氮添加; 凋落叶产量; 凋落叶碳、氮、磷含量; 元素归还; 年际动态

Effects of long-term nitrogen addition on leaf litter production and carbon, nitrogen and phosphorus return of the dominant tree species in broad-leaved evergreen forests on the western margin of Sichuan basin^{Author¹ Author²}

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Abstract: 【Objective】The aim of this study was to investigate the leaf litter yield, leaf litter carbon (C), nitrogen (N) and phosphorus (P) content and return amount (2016-2022) of the dominant evergreen broad-leaved forest species *Michelia wilsonii* in the western margin of Sichuan Basin, and their long-term response to nitrogen addition. 【Result】(1) There were significant inter-annual variations in the annual yield, mean annual C, N and P content and mean annual restitution of the *Michelia wilsonii* litter, and the N addition treatment did not change the inter-annual dynamic characteristics of them. (2) The HN treatment significantly increased the average annual yield of *Michelia wilsonii* litter by 24.9%, and the effect of N addition treatment on the yield of litter decreased with time significantly. (3) The HN treatment significantly increased the mean annual content of litter C by 3.4%; The effects of HN treatment on leaf litter N and P contents showed an inflection point during 2019-2020: the annual average N content of leaf litter was generally inhibited during 2016-2019, while generally increased after 2019; the annual average P content in leaf

litter was significantly inhibited in 2018 and 2019, but significantly increased in 2020. (4)N addition treatments significantly increased the annual return of C, N and P from leaf litter, and the more nitrogen added, the stronger the promotion effect; The N addition effect of annual P return showed a significant linear decline trend with time.

【Conclusion】 Our results demonstrated that high N additions significantly improved the productivity of the forest and increased the C and nutrient inputs, and that short-term versus long-term N inputs had different impacts on ecosystem N cycling processes in the forest.

Key words: Long-term nitrogen addition; Leaf litter yield; Content of carbon, nitrogen and phosphorus in leaf litter; Element return; Inter-annual dynamics