

## 外源酚酸对欧美杨‘I-107’水培幼苗硝态氮吸收利用的影响

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**摘要** 连作杨树人工林地力衰退可能与土壤中累积的酚酸存在密切的关系。土壤氮素供应是决定杨树生长发育的重要因素, 而硝态氮是土壤无机氮化合物的主要形式之一。研究酚酸作用下杨树对硝态氮的吸收利用对于揭示酚酸化感机理、明确林地改良的途径和方法具有重要意义。以欧美杨‘I-107’ (*Populus × euramericana* ‘Neva’) 水培苗为试验材料, 采用改良Hoagland营养液培养, 以二代杨树连作人工林土壤酚酸的实际含量为参照浓度(X), 设置5个酚酸浓度水平(0, 0.5X, 1.0X, 1.5X, 2.0X), 分析不同浓度酚酸混合物对杨树硝态氮吸收利用的影响。分别在酚酸处理后第1、5、10、20、30和40天测定分析与硝态氮吸收利用密切相关的生理特性。试验结果表明: 酚酸处理导致根系伤害度明显提高, 根系活力受到酚酸物质的明显抑制, 处理后第40天各处理间表现出显著差异( $p < 0.05$ ); 48 h动态测定发现酚酸物质对硝态氮的吸收存在显著的抑制作用( $p < 0.05$ ); 处理后第40天, 低浓度酚酸(0.5X, 1.0X)导致硝态氮在植株体内发生积累, 而高浓度酚酸(1.5X, 2.0X)导致植株硝态氮含量下降; 酚酸物质明显抑制植株硝酸还原酶活性, 处理后第40天各处理间表现出显著差异( $p < 0.05$ ), 酚酸物质处理后后期则引起亚硝态氮含量的升高。酚酸浓度与处理时间对杨树水培苗硝态氮的生理效应关系可以用多元线性模型描述。

**关键词:** 吸收 化感 硝态氮 酚酸 杨树

**Abstract:** Aims Degradation of forestland productivity by continuously cropped poplar plantations is closely related to phenolic acid accumulation in the soil. Soil nitrogen is an essential factor affecting the growth and development of poplars. Nitrate was one of the main forms of nitrogen in soil, and the impact of phenolic acids on absorption and utilization of nitrate is vital to revealing the allelopathic mechanism of phenolic acids and proposing measures for improving forestland productivity. Methods We cultured hydroponic cuttings of black poplar cultivar ‘I-107’ (*Populus × euramericana* ‘Neva’) in improved Hoagland nutrient solution to which we added gradations of phenolic acids (0, 0.5X, 1.0X, 1.5X, 2.0X) according to actual content (1.0X) in the soil of a second-generation poplar plantation. We observed the effects of phenolic acids on nitrate absorption and utilization by the hydroponic cuttings. We tested several physiological characteristics closely related to nitrate absorption and utilization at 1, 5, 10, 20, 30 and 40 days after treatment with phenolic acids. Important findings Degree of root injury was aggravated by phenolic acids, root activity was inhibited by phenolic acids and both indexes of phenolic acid treatments were significantly different from the control at 40th day ( $p < 0.05$ ). Absorption of nitrate by poplar hydroponic cuttings was significantly diminished by phenolic acids at 48 h ( $p < 0.05$ ). Low levels of phenolic acids (0.5X and 1.0X) led to accumulation of nitrate in cuttings, but high levels (1.5X and 2.0X) led to decline in nitrate content. Nitrate activity of poplar hydroponic cuttings was inhibited by phenolic acids, and treatment values were significantly different from the control at 40th day ( $p < 0.05$ ). Nitrate content increased in later periods with phenolic acids treatments. Relationship of effects of phenolic acids concentration and duration time on nitrate metabolism could be described by multiple linear regression.

**Keywords:** absorption, allelopathy, nitrate nitrogen, phenolic acids, poplar

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