基于最小数据集的不同白及复合模式的土壤质量评价

曹小青 王斐 张志丽 戴慧衍 张爱婷 徐小牛[*]

（安徽农业大学林学与园林学院 合肥 230036）

摘要：【目的】评价不同白及（*Bletilla striata*）复合经营模式的土壤质量指数，为筛选合适的白及复合模式和促进林下仿生栽培提供理论依据。【方法】在安徽省广德市建立了不同复合模式的试验林，选择了毛竹（*Phyllostachys edulis*）-白及（BM），悬铃木（*Platanus acerifolia*）-白及（BX），山核桃（*Carya cathayensis*）-白及（BS）3 种复合模式为研究对象，以白及单作模式（CK）为对照，对土壤质量进行了评估。在 0-20 cm 土层共测定了土壤含水量、有机碳、全氮等 16 个指标作为土壤质量评价的总数据集（TDS），并基于主成分分析和 Norm 值建立土壤质量评价指标最小数据集（MDS）。【结果】1）与对照相比，复合模式 BS 的土壤含水量、电导率、铵态氮、可溶性有机碳、全氮、全磷、土壤有机碳、镁、微生物生物量碳和氮含量均显著提高（$p < 0.05$）。复合模式（BM 和 BX）的可溶性有机碳和氮含量、稳定氮同位素均显著降低（$p < 0.05$）。2）MDS 土壤质量选取指标为 pH、土壤有机碳、可溶性有机碳、全磷和全钾 5 项指标。3）土壤质量指数（SQI）介于 0.220～0.731，复合模式 BS 的 SQI 显著高于对照（$p < 0.01$），复合模式 BX 的 SQI 显著低于对照（$p < 0.01$）。通过分析 TDS 和 MDS 的 SQI 线性关系（$r = 0.824$，$p < 0.01$），说明基于 MDS 的土壤质量评价方法具有较好的适用性，可以较为准确地对白及复合经营模式的土壤质量进行评价。【结论】不同复合模式效应存在显著差异，其中复合模式 BS 在改善土壤质量方面显著高于其它模式和对照，在白及仿生栽培的生产实践中具有一定的指导意义。

关键词：白及；复合经营；最小数据集；主成分分析；土壤质量指数

Soil quality evaluation of different stands intercropping with *Bletilla striata* based on the minimum data set

Cao Xiaoqing   Wang Fei   Zhang Zhili   Dai Huiyan   Zhang Aiting   Xu Xiaoniu[*]

School of Forestry & Landscape Architecture   Anhui Agricultural University   Hefei 230036

Abstract: 【Objective】The soil quality index (SQI) of different intercropping models for *Bletilla striata* was evaluated to provide the theoretical basis for selecting suitable intercropping models and promoting understory bionomic cultivation. 【Method】The experimental forests with different intercropping models were established in Guangde City, Anhui Province, China. three intercropping models of *Phyllostachys edulis - Bletilla striata* (BM), *Platanus acerifolia - Bletilla striata* (BX), and *Carya cathayensis - Bletilla striata* (BS) were selected, and the monoculture model of *Bletilla striata* (CK) was used as a control to assess the soil quality. A total of 16 soil indicators such as soil water content, organic carbon, and total nitrogen were measured in the 0-20 cm soil layer as the total data set (TDS) for soil quality evaluation, and the minimum data set (MDS) for soil quality evaluation indicators was established based on principal component analysis and Norm values. 【Result】1) Soil water content, electrical conductivity, ammonium nitrogen, dissolved organic carbon, total nitrogen, total phosphorus, soil organic carbon, magnesium, microbial biomass carbon, and nitrogen content were significantly higher in BS than in CK ($p < 0.05$). The dissolved organic carbon and nitrogen content and stable nitrogen isotopes were significantly lower in the intercropping models (BM and BX) ($p < 0.05$). 2) The indicators selected for MDS soil quality were pH, soil organic carbon, dissolved organic carbon, total phosphorus, and total potassium. 3) The SQI ranged from 0.220 ～

0.731, with the SQI of the intercropping model (BS) significantly higher than CK ($p < 0.01$) and the SQI of BX significantly lower than CK ($p < 0.01$). The linear relationship between the SQI of TDS and MDS (r = 0.824, $p < 0.01$) was analyzed, indicating that the soil quality evaluation method of MDS has good applicability to evaluate the soil quality of intercropping model for *Bletilla striata*. 【Conclusion】 There were significant differences in the effects of different intercropping models, among which the intercropping model (BS) was significantly higher than the other models and CK in improving soil quality. Intercropping model (BS) has the meaning of guidance in the production practice of *Bletilla striata* and bionic cultivation.

Keywords: *Bletilla striata*; intercropping; minimum data set; Principal component analysis; soil quality index