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Influence of flowering on the anatomical structure, chemical components and carbohydrate metabolism of Bambusa tuldoides culms at different ages

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Bamboo forests, which have come to occupy large areas in recent years, naturally undergo the process of blooming. However, bamboo culms and rhizomes degenerate after the plants bloom, resulting in widespread loss of raw materials. Systematic research on the properties and physiology of bamboo culms after flowering is lacking, and whether flowering bamboo culms could be used as raw materials in industry is unclear. In this paper, we compared and measured the fiber morphology, chemical components, and sugar metabolism indexes of non-flowering and flowering Bambusa tuldoides culms at different ages. The results showed that the fibers in the middle internodes of both non-flowering and flowering B. tuldoides culms had the longest length. The fibers completed their elongation within 1 year, but the fiber walls were continually deposited with age. The levels of the chemical components in the nonflowering culms also continually increased with age. The nonstructural carbohydrate (NSC) content and sugar metabolism indexes showed the highest levels in the 2-year culms and then declined in the 3-year culms. Compared to young culms that had not yet flowered, the 3-month-old and 1-year-old flowering culms had a significant decrease in the fiber length and tangential diameter, and their holocellulose and lignin levels also decreased, while the levels of ash, SiO_2, 1% NaOH extractives, and benzene-ethanol extractives increased. A correlation analysis showed that sugar catabolism was accelerated in the flowering cluster, which could lead to “starvation death” in bamboo and which had a significant negative impact on the anatomical and chemical properties of the bamboo culms. Generally, the flowering bamboo culms had shorter fibers, higher levels of extractives and ash, and lower holocellulose content, which indicated that bamboo flowering has an adverse effect on the application of such