

基于高速摄像技术倒伞型收集装置油茶果收集机理研究

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摘要: 目前, 油茶果机械化采收中的收集部分大多采用倒伞型收集装置, 有人机结合、自动化、智能化等多种形式, 但未对其中收集机理进行研究。【目的】本文通过对收集机理中的油茶果与伞布碰撞恢复系数测定进行试验, 为油茶果倒伞型收集装置的优化设计提供理论依据。【方法】利用设计研发的伞面碰撞恢复系数测定装置模拟油茶果机械化采收过程中果实掉落及收集部分, 结合两台高速摄像机对试验过程记录与分析, 通过单因素初选试验和多因素正交试验探究果实掉落高度、伞布材料、伞布所受张紧力大小、伞布与水平面角度对油茶果与伞布碰撞恢复系数的影响, 确定各因素对油茶果与伞布碰撞恢复系数的影响主次顺序及各因素的显著性水平。【结果】1) 分析得出四种因素对碰撞恢复系数的影响主次顺序为: 伞布与水平面角度、伞布材料、伞布所受张紧力大小、果实掉落高度; 2) 选出较优的参数组合为伞布与水平面角度 25°, 伞布材料帆布, 伞布所受张紧力大小 20N。【结论】本研究揭示了油茶果与伞布碰撞时其恢复系数的主要影响因素, 并给出了较优的参数组合, 为倒伞型油茶果收集装置的优化设计提供参考, 并为提高油茶果收集装置的果实收集率和集中率提供理论依据。

关键词: 油茶果; 碰撞恢复系数; 倒伞型收集装置; 多因素正交试验; 高速摄像机

Research on the Collection Mechanism of *Camellia oleifera* Fruits by Inverted Umbrella - type Collection Device Based on High - speed Photography Technology

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Abstract: At present, most of the collection parts in the mechanized harvesting of *Camellia oleifera* fruits adopt inverted umbrella - type collection devices, with various forms such as human - machine combination, automation, and intelligence, but the collection mechanism has not been studied. [Objective] This paper conducts experiments on the determination of the collision restitution coefficient between *Camellia oleifera* fruits and umbrella cloth in the collection mechanism, providing a theoretical basis for the optimal design of the inverted umbrella - type collection device for *Camellia oleifera* fruits. [Method] Use the designed and developed measuring device for the coefficient of restitution of umbrella - surface collision to simulate the fruit dropping and collecting parts during the mechanized harvesting process of *Camellia oleifera* fruits. Combine two high - speed cameras to record and analyze the test process. Through single - factor preliminary selection tests and multi - factor orthogonal

tests, explore the effects of fruit dropping height, umbrella cloth material, tension force on the umbrella cloth, and the angle between the umbrella -cloth and the horizontal plane on the coefficient of restitution of the collision between *Camellia oleifera* fruits and the umbrella cloth. Determine the primary - and - secondary order of the influence of each factor on the coefficient of restitution of the collision between *Camellia oleifera* fruits and the umbrella cloth and the significance level of each factor. [Results] 1) The analysis shows that the primary and secondary order of the influence of the four factors on the collision restitution coefficient is: the angle between umbrella cloth and horizontal plane, umbrella cloth material, tension force of umbrella cloth, fruit dropping height; 2) The selected optimal parameter combination is the angle between umbrella cloth and horizontal plane of 25° , umbrella cloth material of canvas, and tension force of umbrella cloth of 20N. [Conclusion] This research reveals the main influencing factors of the restitution coefficient when *Camellia oleifera* fruits collide with the umbrella cloth, and presents an optimal parameter combination. It provides references for the optimal design of the inverted - umbrella - type *Camellia oleifera* fruit collection device and a theoretical basis for improving the fruit collection rate and concentration rate of the *Camellia oleifera* fruit collection device.

Keywords: *Camellia oleifera* fruits; collision restitution coefficient; inverted umbrella - type collection device; multi - factor orthogonal experiment; high - speed camera