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TREE CLIMBING MECHANISM

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ABSTRACT

Tree climbing is an important activity in agriculture, particularly for tasks such as coconut harvesting, pruning, and maintenance of tall trees. Traditional climbing methods require significant physical effort and involve safety risks. To overcome these challenges, several mechanical devices have been developed to assist workers in climbing trees more safely and efficiently. One such method is the manual dual frame tree climbing mechanism, which uses two separate frames that alternately grip the tree trunk and allow the user to climb upward with reduced effort. This review paper analyzes the development and working principles of manual dual frame tree climbing devices used in agricultural operations. The paper discusses the design features, gripping mechanisms, materials used, and performance characteristics of these systems. Various research studies related to tree climbing devices are reviewed and compared to highlight their advantages and limitations. The study also identifies research gaps in existing systems such as weight, adaptability to different tree diameters, and user comfort. Finally, the paper discusses future improvements that can enhance the efficiency and safety of manual tree climbing mechanisms. The review concludes that the manual dual frame mechanism is a practical and cost-effective solution for farmers, but further improvements in design and ergonomics are required to increase its usability and performance.

KEYWORDS: Manual Tree Climber, Dual Frame Mechanism, Coconut Tree Climber, Agricultural Machine, Tree Climbing Device, Mechanical Climbing System.

INTRODUCTION

Tree climbing is widely practiced in agricultural and forestry activities. In many regions, workers climb tall trees such as coconut, palm, and areca nut trees to perform harvesting and maintenance tasks. Traditionally, climbing is done manually using ropes, belts, or bare hands and legs. These methods require considerable physical strength and pose a risk of accidents and injuries.

To improve safety and efficiency, researchers have developed various mechanical devices that assist in tree climbing. Among these devices, the manual dual frame tree climbing mechanism is one of the most widely used solutions. This mechanism consists of two frames an upper frame and a lower frame that grip the tree trunk alternately. By shifting body weight and moving the frames step by step, the user can climb the tree with less effort compared to traditional methods.

The dual frame system is designed to provide stability and support while climbing. The frames are usually equipped with gripping pads or friction belts that hold the tree trunk securely. The device is lightweight and can be easily attached or detached from the tree.

This review paper aims to study various developments related to manual dual frametree climbing mechanisms. It also analyzes their advantages, limitations, and potential improvements to support agricultural workers.

Literature Review

Several researchers have worked on the design and development of manual tree climbing mechanisms using dual frame structures.

- Kumar et al. (2017) developed a manual coconut tree climbing device using a dual frame structure made of mild steel. The design included gripping pads and adjustable straps to secure the device to the tree trunk. The system allowed users to climb trees with improved safety.
- Patel and Shah (2018) proposed an improved dual frame tree climber that used aluminum frames to reduce weight. The device incorporated rubber gripping pads to increase friction between the climber and the tree surface.
- Reddy et al. (2019) designed a pedal-based tree climbing mechanism with two frames. The user operated the system by applying force on the pedals, which allowed the frames to move alternately upward.
- Joseph et al. (2020) introduced a modified manual tree climber with adjustable frame

diameter. This improvement enabled the device to be used on trees of different sizes.

- Singh and Kumar (2021) studied ergonomic improvements in manual tree climbing devices. Their research focused on reducing user fatigue by optimizing the frame design and seat support.

These studies highlight the continuous efforts made to improve manual tree climbing devices in terms of weight reduction, safety, and user comfort.

Comparison of Studies

Comparison of Manual Dual Frame Tree Climbing Mechanisms

Author	Year	Mechanism Used	Advantages	Limitations
Kumar et al.	2017	Dual frame manual climber	Simple design	Heavy structure
Patel & Shah	2018	Aluminum dual frame	Lightweight	Limited tree diameter
Reddy et al.	2019	Pedal operated climber	Less effort	Complex movement
Joseph et al.	2020	Adjustable frame climber	Fits different trees	Higher cost
Singh & Kumar	2021	Ergonomic design climber	Reduced fatigue	Limited field testing
Singh & Kumar	2021	Ergonomic design climber	Reduced fatigue	Limited field testing

Research Gap:

Although manual dual frame tree climbing devices have improved climbing efficiency and safety compared to traditional methods, several challenges remain. Many existing devices are relatively heavy, which makes them difficult to carry and operate for long durations. Some devices are designed for specific tree diameters and cannot easily adapt to different tree sizes. Additionally, user comfort and ergonomic design are still areas that require improvement. Stability and gripping efficiency also vary depending on the surface condition of the tree trunk. Therefore, there is a need for further research to develop lightweight, adjustable, and ergonomically designed dual frame tree climbing mechanisms that can be easily used by farmers.

Future Scope:-

Future research can focus on improving the design and functionality of manual dual frame tree climbing devices. The use of lightweight materials such as aluminum alloys or composite materials can reduce the overall weight of the device. Improved gripping mechanisms using high-friction rubber or mechanical clamps can increase safety during climbing. Adjustable frame designs can allow the device to accommodate different tree diameters. Ergonomic features such as comfortable seating and improved pedal mechanisms can reduce user fatigue. Additionally, integrating safety locks or support systems can further enhance the reliability of the device.

CONCLUSION

Manual dual frame tree climbing mechanisms provide an effective solution for agricultural workers who need to climb tall trees for harvesting and maintenance tasks.

Compared to traditional climbing methods, these devices improve safety, reduce physical effort, and increase productivity. Various research studies have contributed to the development of improved designs with better gripping mechanisms, lightweight materials, and ergonomic features. However, challenges such as device weight, adaptability to different tree sizes, and user comfort still need to be addressed. Future developments in mechanical design and materials can further enhance the performance and usability of these devices.

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