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Development of an Integrated Harvesting Machine for Taro Fields

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ABSTRACT

Taiwan cultivates a diverse range of agricultural products, among which taro (Colocasia esculenta) is an important root vegetable. Although several harvesters exist for root crops, their applicability remains limited due to crop-specific requirements, and no dedicated integrated harvesting machine is currently available for taro in Taiwan. Farmers still rely heavily on manual labor, using knives or spades to loosen the soil around taro plants before uprooting them individually—a time-consuming and labor-intensive process. To address this challenge, this study developed a specialized taro harvesting machine integrating multiple key modules. Field tests demonstrated that the proposed system successfully performs continuous operations, including soil loosening, conveying, soil removal, and collection. The results indicate that this machine significantly improves harvesting efficiency while reducing labor demands, paving the way for mechanized taro harvesting in the future.

Keywords: Taro, Harvesting Machine, Agricultural products.

INTRODUCTION

Taro is an important food and economic crop in Taiwan, prized for its high nutritional and culinary value, and widely consumed as a popular root vegetable. The cultivated area exceeds 3,000 hectares, with major production areas including Gaoshu (Pingtung County), Dajia (Taichung City), and Gongguan (Miaoli County). Taro is typically harvested 8.5 months after planting, a process currently reliant on manual labor. Workers use tools to cut the roots around the corm, loosen the soil, and carefully excavate the taro. It is not only time-consuming and labor-intensive, but also requires skilled techniques to avoid damaging the taro. To address these challenges, this study aims to develop an integrated harvesting system tailored for taro fields.

MATERIALS AND METHODS

This study adopted a modular design approach aligned with the procedure of taro harvesting to develop an integrated harvesting machine. The prototype was designed to perform continuous field operations including: soil loosening, conveying, soil separation, and collection, all powered by a tractor-based power transmission system.

RESULTS & DISCUSSION

Based on the growth characteristics and harvesting process of taro, a comprehensive improvement and integration enhancement was carried out on an existing prototype harvester. The design of the optimized taro harvesting machine is illustrated in the figure below. Field test results demonstrated that the machine exhibits excellent continuous operation capability. Whether in paddy or dryland cultivation, the harvester operated effectively when the soil surface had dried to a suitable moisture level. It efficiently performed integrated operations including soil loosening, soil removal, and collection, significantly reducing labor requirements and improving overall harvesting efficiency. The integrated design not only streamlined the workflow but also minimized physical damage to the taro corms, ensuring high quality yield while maintaining operational durability under varying field conditions.

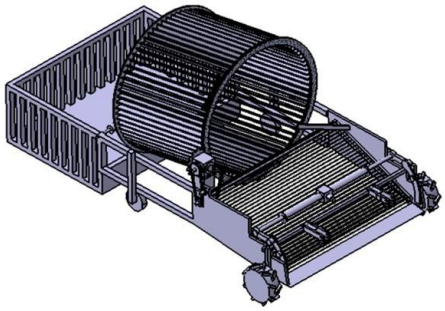

Fig.1 The design schematic of the taro harvester

CONCLUSIONS

This study focused on the development of an integrated harvesting machine capable of performing continuous operations, including soil loosening, soil removal, and collection. Field test results demonstrated that the mechanized harvesting system can reduce labor costs by 50%, while significantly improving the efficiency and consistency of taro harvesting. The successful implementation of this machine addresses critical challenges such as the aging agricultural population and labor shortages in rural areas. Furthermore, it supports the sustainable development of the taro industry by enhancing productivity and reducing dependence on manual labor.

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