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## Working Paper Series

This Working Paper forms part of the ACIAR project AGB/2012/061

*Improving smallholder farmer incomes through strategic market development in mango supply chains in Southern Vietnam*

Resource: A2.3 Mango productivity and quality improvements in fresh supply chains  
Study focus - Electric trolley concept  
Improving sap burn management with mechanisation

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## 1 Introduction

Mangoes are farmed and handled at Vietnamese packhouses and trading companies, but the process is not efficient. After harvesting, mangoes are collected, de-stemmed and de-sapped immediately (from 1 to 5 minutes) to ensure premium fruit are packed for sale. Injury because of sap on a mango causes post-harvest losses for farmers and traders. Some studies show that mango de-sapping treatment can be done with environmentally friendly chemicals and safely for workers. The results of studies show that the handling of sap helps to reduce damage on the fruit and minimise losses during storage.

Currently, Vietnam studies on mango treatment methods are limited. Some companies and mango packhouses in provinces (Long An and Dong Thap) have been taking into account mangoes damaged by sap burn that have been causing losses and reducing fruit quality by applying de-sapping treatments at the facility. However, this process is still not efficient and takes a long time between the farm and the packhouse facility to undertake the treatment. Therefore, it is necessary to have a mobile mango de-sapping treatment device at the farm level, which ensures flexible operation for the farmers and traders to help improve the value of mangoes in the supply chain.

This study has not been commercialised as the cost to implement is high. The application and long-term benefits to the agricultural sector needs to be further explored to confirm the economic rationale for this piece of equipment. In the context of Industrial Revolution 4.0, high-tech agriculture has a strong development focus in Vietnam.

To meet the technical requirements for modern domestic trade in Vietnam and advance export trade, the application of mango de-sapping at farm level is essential. Therefore, a specialised device to meet the requirements of de-sapping on farms suitable for the soil and terrain of Vietnamese mango farms is required.

Under the project, Griffith University, SIAEP, SOFRI and SCAP studied and developed an electric trolley to improve the management of sap burn by mechanisation in Southern Vietnam provinces.

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## 2 Methodology

From the surveys in Tien Giang and Dong Thap provinces, devices with appropriate parameters were selected to facilitate movement and mango de-sapping immediately after harvesting at farm. The device was selected to minimise the cost of transporting materials and products, reduce the surplus movement between parts, reducing mango production labour.

The device must comply with the regulations on electrical safety, vibration, noise, and to ensure safety for users. The trolley was designed based on the convenience in checking and controlling production activities in the farms, with high flexibility to easily move from this mango tree to another, from this row to another.

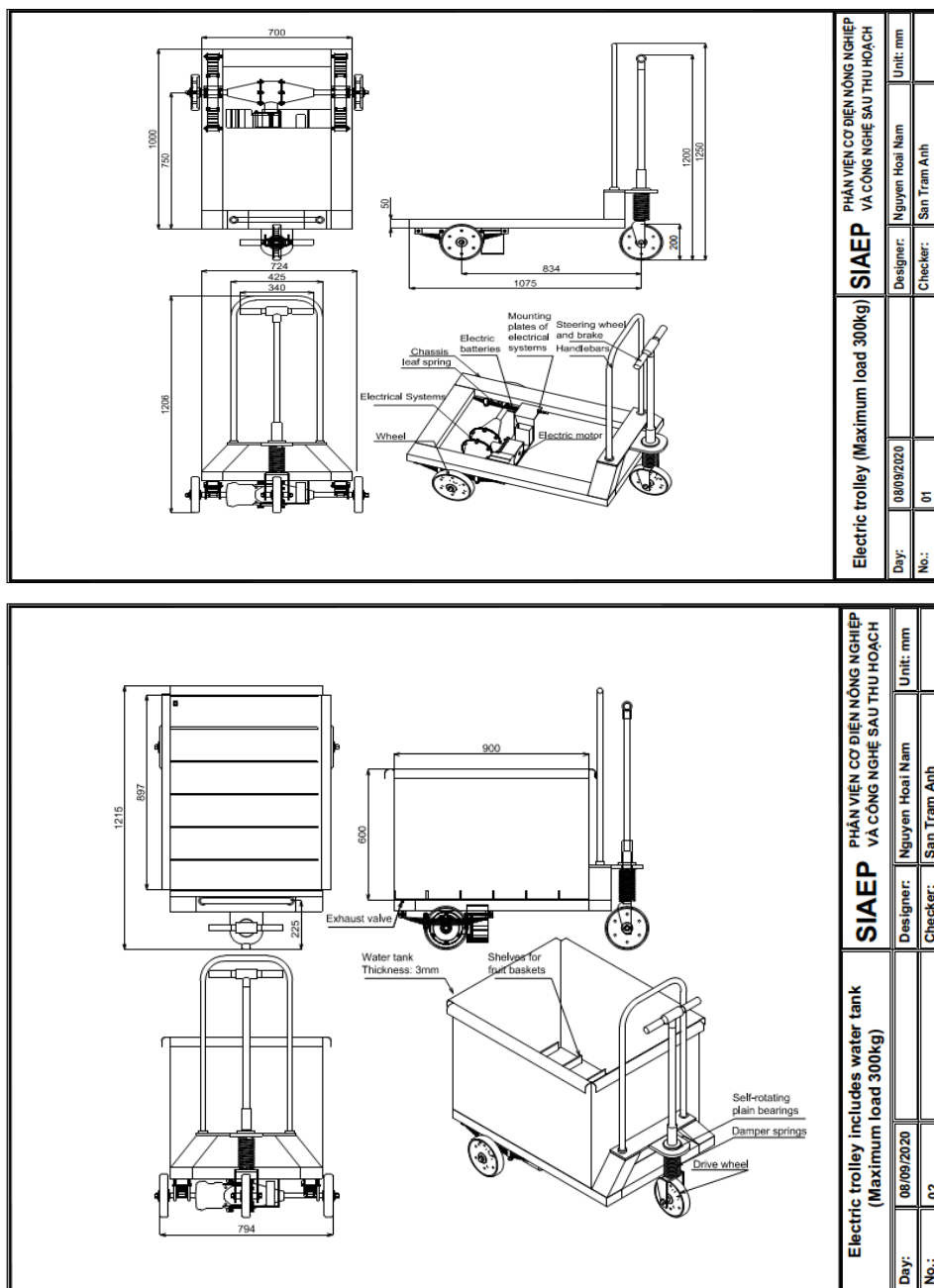
The principles of domestic and foreign de-sap processing equipment were studied to choose the structural principles suitable for the terrain and actual working space in Vietnamese localities. Drawing device design with computer using AutoCAD software and current standard drawings TCVN: 7285: 2003 were applied.

# 3 Results and discussion

## 3.1 Results

### Electric bin trolley manufacturing

Technical drawings of the electric bin trolley have been designed, consulted, and approved by specialists in agricultural engineering before manufacturing (see Figure 1).



**Figure 1. Electric trolley bin design**

Source: Author's image

Equipment description: The equipment was designed and manufactured in two main parts.

The first part: Lift frame and electrical system, electric motor was designed with a maximum load of 350 kg, wheel and lift frame was designed flexibly, easy to move, easy to disassemble.

The second part of the device was a chemical container that handles mango latex, the barrel was made of stainless steel, with a thickness of 3 mm, the barrel has two separate compartments for two different chemicals. Each compartment has its own exhaust valve for convenient use.

The overall height of the device was about 1.6 meters, the width was about 700 mm. That makes the car easily move to each tree in the farm and effectively handle the sap burn.

The new trolley was manufactured and tested in the field. After that the trolley was used for the trials of sap burn management and monitoring quality along the chain.

Currently, in order to help farmers perform a latex treatment process in the orchards, it requires a lot of preparatory works, as follows:

- Prepare water source for water treatment and for draining latex, carrying tools to store mangoes such as baskets, plastic crates, working table (very bulky).

The ability to move from one place to another will take a lot of time and effort leading to the cost of harvesting and de-sapping at the orchard was pushed up very high. In fact, in mango orchards, farmers often collect all mangoes into one place for processing (unpacking, sorting, de-sapping, packing). This will cause a huge loss in quantity as well as quality due to the mango being harvested for too long.

Therefore, it is necessary to have a device (electric bin trolley) that integrates the above steps to help farmers carry out the latex treatment process in the orchards easily and conveniently, without much effort and with high flexibility.

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## 3.2 Advantages and disadvantages of electric trolley

### **Advantages**

- Supply input water for the treatment process (using clean water from farmers' domestic water sources, not from rivers, lakes, canals etc)
- Suitable for the terrain, moving easily and flexibly between trees
- Save time and labour costs
- After being de-sapped, the mangoes can be delivered directly and promptly to the packer (skip the centralised stage of processing once at the orchard and then transported to the packer).

### **Disadvantages**

- The manufacturing cost was still high, because the mango quantity treated by the device in the trials was small and there were extra research costs. The cost was a bit high compared to the income of mango farmers in the Mekong Delta.
- The use of device was dependent on weather condition, because the water resistance level of the electrical system was not good so it cannot be used during the rains.
- The device was still quite heavy and needs to be improved on its materials to minimise the weight of the device.

Images using the trolley when testing on mango farms in MRD are shown in Figures 2, 3, 4, 5 and 6.



**Figure 2. Farm trial for the electric bin trolley, movement example**

*Source: Author's image*



**Figure 3. Farm trial for the electric bin trolley, washing example**

*Source: Author's image*



**Figure 4. Mango solution and layout example**

*Source: Author's image*



**Figure 5. Mango solution and soaking example**

*Source: Author's image*



**Figure 6. Mango solution and trolley in use example**

*Source: Author's image*

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## 4 Recommendations

The recommendations are given according to the technical specifications, the overall design drawings and the detailed drawings of the electric trolley parts as well as to the comments of experts and farmers who directly participated in the trials of handling mango latex in the orchards in Dong Thap and Tien Giang.

They are as follows:

- The material of the tank from stainless steel to chemical resistant plastic should be changed to reduce/minimise the weight of the vehicle
- The covers of the electrical and control parts from water should be made to help the vehicle operate well in the rain
- The power steering design and chassis weight should be reduced to the lowest for better flexibility and transport in the terrain of mango farms in the MRD.

In general, electric trolleys have met several specific needs of mango growers and ensured the convenience as well as the ability to move flexibly in the terrain of the MRD. The device helps farmers de-sap mangoes at the orchards before sending them to the packing house, thereby improving the quality and value of mangoes in the current mango supply chain.