

Development of a small electric work platform with high mobility for apple production in Japan

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Acta Horticulturae 965: 219-224. 2012.

Abstract

Apple production plays an important part in Japanese horticulture. An elevated work platform of suitable size is an essential device for apple growers. The authors have developed a novel electrically powered work platform with high mobility and have conducted a series of experiments to assess its benefits. Compared to existing commercially available work platforms used in apple production in Japan, the developed work platform has the following mechanical and electrical innovations: (1) The developed work platform has a maximum height of elevation of 2 m, a minimum height of 1.6 m and a width of 1.2 m. Its weight of 273 kg allows it to be easily transported in a small pickup truck. (2) An innovative mechanism of sensors and actuators was developed to prevent platform from tipping over. (3) For maneuvering, a chain and wire-based steering system was developed that provided a compact turning radius of 2 m. The authors conducted the following experiments: (1) The tip-over angle of the work platform was measured in the laboratory. At maximum height and with maximum load, the static tip-over angle of the work platform was 23°. (2) In field experiments in Fukushima Prefecture, the workload of orchard workers was assessed by measuring their heart rate. During leaf picking, the heart rate of workers increased by about 10%, both in dwarf trees and in normal trees. When picking leaves from a ladder, the heart rate of workers was increased by 25%. In addition, during harvesting, the increase in workers' heart rate was lower when using the developed platform. These results demonstrate the advantages of the work platform and its capacity to reduce the workload in Japanese orchards.