International Journal of Agricultural Engineering, Vol. 2 No. 2 (October 2009 to March 2010) : 170-175

Research Paper :

Design and development of tractor mounted hydraulic lifter for harvesting spraying and pruning of horticultural fruit trees

K.P. KOLHE

Accepted : *April, 2009*

ABSTRACT

The harvesting, pruning and spraying are still a manual task and need to be mechanized. The study of various control systems such as pneumatic, hydraulic, hydro-pneumatic and electrical control reveals that the use of hydraulic control system will be more beneficial and reliable for the current development. The tractor mounted hydraulic lifter for fruit harvesting, pruning and spraying was developed by integration of Agricultural and Mechanical Engineering concepts, manufacturing processes, material properties and tree characteristics. The principles of hydraulics circuit were used and accordingly turn table, harvesting arm, harvesting bucket and tractor mounting assembly was designed and developed. The cost of tractor mounted hydraulic lifter is Rs.1, 30,000/- (US $ 3250). Research is underway to develop hydraulic man-positioner, which would be easier for harvest, pruning tree and spraying by hand or machine.

Correspondence to:

K.P. KOLHE
Department of Mechanical Engineering, College of Agricultural Engineering and Technology, Dapoli, RATNAGIRI (M.S.) INDIA

Key words : Hydraulic lifter, Fruit harvester, Control valves, Mechanical properties, Weldability

The cultivation of fruit crops like mango, cashew, coconut and arecanut etc. is on large area in India. Harvesting, pruning and spraying of horticultural fruit trees are difficult due to height of trees and non availability of machines. It requires fairly large numbers of seasonal labour. Tree taller than six meter are hard to pick and usually cost more for harvesting, pruning and spraying operations. The number of labourer required dependes upon size of tree, its characteristics and time available within season. Mango (Mangifera indica), the "King of Fruits", has prime importance among the commercial fruits grown in India, the largest producer and exporter of mango in the world. In Gujarat state of India, about 382 thousand tones of mango are produced annually over an area of 57 thousand hectare (Gupta *et al.*, 2004, Anon. 2000). India produces export quality of mango mainly the Alphonso and Kesar varieties. The quality of the fruits mainly depends on their maturity stages, harvest and post-harvest techniques adopted by the mango growers. Manually operated low capacity gadgets and tree-shaking methods prevail, which are time consuming, drudgereous, damage fruits, damage tree branches. The damage and bruising are very serious problem. The fruits should not be allowed to fall on the ground as the injured fruits cause spoilage to other healthy fruits during packaging and storage. Fruits harvested with 8-10 mm long stalks appear better on ripening as undesired spots on the skin caused by sap burn are prevented. Such fruits are less prone to stem-end and other storage diseases (Sapovadia *et al*., 2001). Harvesting of fruits in India is mostly done manually by means of curved knife, pair of scissors or blades attached to a hanging basket to the distal end of bamboo sticks (Devnani, 1980). According to economic studies, harvesting labor represents over 40% of citrus production cost and will need to be cut by 50% in order to maintain global competitiveness (Brown, 2002). In Srilanka, harvesting of coconut is done from the ground with the help of a knife attached to a long bamboo pole. In countries where there is shortage of skilled labour the nuts are not harvested and allowed to fall of their own accord and the fallen nuts are collected from the ground at intervals (Thampan, 1983). RTTC, worked on fruit harvesting devices, manually operated unit worked on the principle of individual fruit cutting by sickle/ blade and collecting the fruit in a bag. The unit was found suitable for average size and big fruits, which would be damaged if allowed to fall freely on the ground. The other unit worked on the principle on mechanical shaking of tree. This unit was suitable for hard fruits. It has been reported that fruits harvested by mechanical shaking have more injuries in the form of splits, internal and external bruising and superficial peel sears than manually-harvested fruits. In cooperation with the Washington Tree Fruit Research Commission an experimental mechanical harvester was developed, tested, and yielded fruit quality comparable to that obtained by commercial hand harvesting as shown in Fig. 1 (a). The experimental harvester also significantly improved harvest labor productivity. Presently, the biggest obstacle to commercialization of this harvesting technique is the fact that tree-training systems in commercial