

Research Paper :

Testing and performance evaluation of tractor mounted hydraulic elevator

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ABSTRACT

A Tractor mounted hydraulic elevator (TMHE) powered by tractor PTO was tested for the mechanical harvesting of mango orchards by using digital load cell for stability study. The field performance of the above machine was carried out on plane land on horticultural mango plot, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. - Ratnagiri (Maharashtra, India). This machine was tested for the better stability at maximum reach position during mango harvesting of various mango varieties like Alphonso, Totapuri etc. This stability study was carried out by using strain gauge load cell (S-beam) having capacity of 2000 kg. The load cell guiding device was designed and fabricated at College of Agricultural Engineering and Technology Workshop for conducting the above experiments using standard material specifications of American society of testing material. The reaction on rear wheel of tractor was measured by using load cell, which converts the force acting on rear wheel of tractor into electrical signals, which is displayed on the digital control panel. The field capacity of elevator was 0.08 ha/hr for mango harvesting. The net mango harvested by using TMHE was 510 kg/day.

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Konkan region is well regarded as fruit belt of Maharashtra. The production of horticultural fruits in India is 63,503,000 MT and 11,047,600 MT in Maharashtra till 2008. Konkan region of Maharashtra is narrow strip of 40 km width and running 750 km of length from north to south lying between sahyadri ranges in the East and Arabian Sea in West. This region is famous for alphonso mango, vengurla cashew nut, kalipatti sapota and shrivardhane variety of arecanut. The mango is the favourite fruit through out the country and has repeatedly been acclaimed as the "King of fruits". The production and popularity of mango tops the list of fruits. No other country in the world can surpass India in the number of mango varieties and the richness of the flavours. The climate of the country is ideally suited for mango cultivation. Alphonso is a very famous variety of mango fruit all over the world. The manual harvesting of this fruit is drudgerious and time consuming. During peak season, it is very difficult to get required number of skilled labours. Moreover, skilled labours for climbing on mango trees are reducing day by day because of drudgerious involve in this operation. Hence, the Tractor mounted hydraulic elevator (TMHE) Developed by Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli is used for mango harvesting up to 12 m height of tree. The above elevator works on principal of hydraulics and operated by multi position multi direction control valve to control the height of harvesting bucket, position of bucket and angle of rotation of harvesting bucket.

A load cell is an electric device transducer used to convert a force into an electrical signal. It consists of four strain gauges in a whetstone bridge. Through a mechanical arrangement, the sensed force deforms a strain gauge which in turn causes Whetstone Bridge to become unbalanced. This deformation gets converted into an electrical signal and displays on the digital panel. Thus using digital load cell reaction on rear wheel of tractor was measured for testing the performance of TMHE for mango harvesting.

India is the largest mango producing country, accounting about 60 per cent of world production, the export of fresh fruits are limited to Alphonso and Dashehari varieties. India's share in the world mango market is about 15 per cent. Manually operated low capacity gadgets and tree-shaking methods of mango harvesting are time consuming, drudgerious, damage fruits and also damage the tree branches. Mango fruits harvested with 8-10 mm long stalks appear better on ripening as undesired spots on skin caused by sap burn are prevented. Such fruits are less prone to stem-end and other storage diseases (Sapovadia *et al.*, 2001). The mango harvesting was carried out by pluck-and-drop method with a rod of 3 m long pole with a hook at the end. The pole and collection bag method consist of a plucking technique using a rod of convenient length (1 –2 m) equipped with a collecting bag near the hook. The plucked mangos were gathered and selection was made to minimize variation in the sizes. The pluck-and-drop