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## Performance testing of developed small tractor operated raising platform (Elevator) for mango harvesting

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### Abstract

Konkan region of Maharashtra is one of the largest mango growing belts in the country and Alphonso is highly demanded fruit in the region, which has got lot of export value as well as potential of export. There are several limitations for farm mechanization in Konkan region. Therefore, tractor (above 35 hp) operated machines and related technologies have got very limited scope for farm mechanization in the region. Considering the problems of Konkan region, a small tractor operated raising platform was developed for harvesting, spraying and pruning operations. The basic components on machine consists of turntable, hydraulic tank, hydraulic pump, hydraulic motor, lifting arm, hydraulic cylinder, directional control valve, hydraulic oil flow pipeline and harvesting bucket. A small tractor (18.5 hp) was used to lift the platform up to 6 m height. The machine consists of two arms which rotates through 90° in both clockwise and anticlockwise direction. The developed raising platform was tested for harvesting of mango. It was observed that as the tree height was increased, the lifting time and lowering time of arms for harvesting of mango also increased. The lowering time requirement was found to be less as compared to lifting time of bucket. The average time required for mango harvesting per tree was found to be 0.80 h. The average number of fruits harvested and weight of fruits harvested per tree were found to be 225 per h and 51.50 kg/h respectively. The field capacity of developed elevator was found to be 0.00078 ha/h. The developed small tractor operated raising platform (hydraulic elevator) worked satisfactorily for mango harvesting up to 6 m height.

**Keywords:** Raising platform, elevator, harvesting, mango, lifting time, lowering time

### Introduction

Mango (*Mangifera indica* Linn) is the most important fruit of India and is known as “King of fruits”. Mango (*Mangifera Indica* L.), which belongs to the Anacardiaceae family, is the most important tropical fruit in the world. India is leading mango producer in the world, producing an estimated 24.7 million MT of mangoes annually which accounts for almost half of the entire global mango production. In Maharashtra, mango is occupying an area of 168.15 thousands ha with an annual production of 439.08 thousand MT (Anonymous, 2021) [1]. Konkan region of Maharashtra is one of the largest mango growing belts in the country and Alphonso is highly demanded fruit in the region, which has got lot of export value as well as potential of export. The growers in the region are using the traditional tools and methods for different operations for mango cultivation. Mechanization of the operations is the solution over the severe labour problem of mango growers. The mechanization has potential to complete the required horticultural operation in time, less time, saving in labours and labour cost, improving quality of work, reducing cost of production, increasing profit of margin and also reducing the drudgery involved in various farm operations.

There are several limitations for farm mechanization in Konkan region. The land is fragmented. In Konkan 71.96 percent farmers are marginal. Because of poor economic conditions, small land holding and hilly terrains these conditions do not permit to adopt big machines on farm. Therefore, tractor (above 35 hp) operated machines and related technologies have got very limited scope for farm mechanization in the region. As harvesting, spraying and pruning are important operations in mango cultivation, remaining with lack of mechanization.

It is necessary to develop small machine for harvesting, pruning and spraying whose power source is a small tractor (mini tractor). Hence the study was undertaken to develop a elevator with platform for the operator having maneuverability, the important operations like harvesting of mango, pruning and spraying done in a better way, quick time, with saving of labours and growers can get the benefits of farm mechanization in the region (Subash Sunar *et al*, 2022) [4].

Some of the agricultural universities, institutes and research organizations have also worked on development of raising platform for harvesting in India. A tractor mounted positioner was developed for harvesting of mango fruits at Gujrat Agricultural University, Junagad. The machine consisted of frame, three point linkage, hydraulic jack, supporting links, extension pipe and cage. A hydraulic jack of 2 tones capacity with two cylinders was mounted at the centre of the frame with the help of a pin of 40 mm passing through two plates welded to the frame and lower end of the hydraulic jack. The cage was mounted on top of the extension piece and its sides were folded. The machine was tested for mango harvesting (Gupta *et al* 2004) [2].

A tractor mounted hydraulic operated ladder was developed at TNAU, Coimbatore to reduce the harvesting /pruning cost, increase the harvesting/pruning efficiency and enhance the overall productivity of mango orchards. The developed system was attached to the rear of a minimum 45 hp agricultural tractor. The power was taken from tractor hydraulic system. The hydraulic ladder had the capability to lift a service worker and the required tools to the crown zone as high as 10 m. It was able to rotate from 0 to 360° both in clockwise and anticlockwise direction so that minimum 4 coconut/mango tress could covered by simply operating the directional valve (Thiyagarajan and Tajiddin, 2018) [6]. The self propelled hydraulically operated multi-utility platform for orchard management system was developed at CIAE, Bhopal to increase the accessibility of pickers to fruit on tress and to carry out orchard management practices like spraying and pruning. The platform was designed for vertical reach of 6 m and load carrying capacity of 200 kg (Roul and Bhargav, 2020) [5]. Kolhe and Jadhav (2011) [3] tested tractor mounted hydraulic elevator for mango orchard. The average harvesting capacity for Alphonso mango fruits was observed 192 kg/h (675 fruits/h). the average field capacity of the machine was 0.08

ha/h (10x10 m spacing). The average lifting time required for harvesting bucket to reach up to height of 10.04 m was 38 sec. The average lowering time required for harvesting bucket to lower down from height of 10.04 m was 28 sec. The hydraulic elevator was suitable for harvesting of mango and coconut orchard up to 12 m and pruning of tree up to 10 m height comfortably.

### Materials and Methods

The small tractor operated raising platform was developed for harvesting of mango. (Fig. 1 and 2). The basic components on machine consists of turntable, hydraulic tank, hydraulic pump, hydraulic motor, lifting arm, hydraulic cylinder, directional control valve, hydraulic oil flow pipeline and platform. The control of the elevator works on the principle of hydraulic system and Pascal's law. The power required for hydraulic pump operation was taken from tractor PTO shaft. The hydraulic oil flows from the hydraulic tank to hydraulic pump and from pump to the multi position multi-way directional control valve. The directional control valves with control lever is attached on harvesting bucket. The operator controls movement of fruit elevator. One single operator controls the motion of the cylinder, hydraulic motor and the platform through control panel. In forward stroke, the oil flow from the tank to hydraulic pump and pump to cylinder. While in reverse stroke, the hydraulic oil returns to the hydraulic tank and arm moves downward. The hydraulic motor rotation is controlled clockwise or anticlockwise to control the movement of turn table.

The testing of developed small tractor operated raising platform (Fig. 3) was carried out for harvesting of mango (Kesar). The harvesting of mangoes was done from two sides of a tree and combined results are noted. The elevator was moved near the mango tree for harvesting. The elevator was operated by the person standing in the harvesting bucket with the help of the levers fitted near the harvesting bucket. After reaching the desired height of the elevator towards the mango tree, the operator harvested the mangoes from the tree with his hand and also by manually operated 'Navin' mango plucker developed by Dr. B.S.K.K.V., Dapoli. The operator harvested 4 to 6 mangoes in one catch. The harvested mangoes were collected by the operator in a crets placed in the harvesting bucket. The same procedure was followed for harvesting of mangoes from other trees.



**Fig 1:** Developed small tractor operated raising platform (elevator)

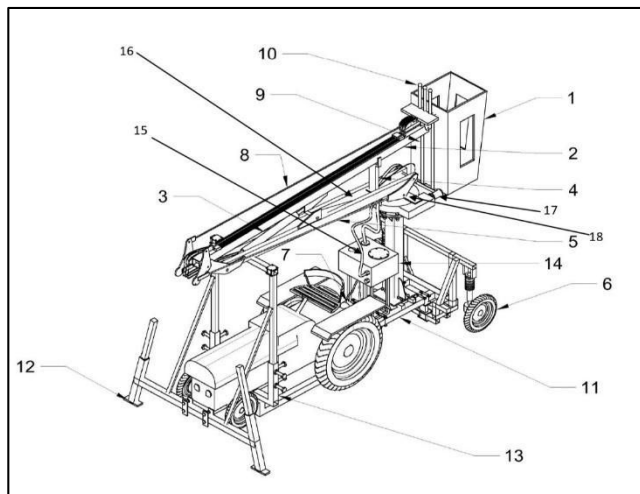


**Fig 2:** Developed small tractor operated raising platform

|   |                             |    |                                  |
|---|-----------------------------|----|----------------------------------|
| 1 | Raising Platform (bucket)   | 10 | Directional control levers       |
| 2 | Upper arm                   | 11 | Main frame                       |
| 3 | Upper cylinder              | 12 | Front support arms               |
| 4 | Upper arm resting support   | 13 | Support for resting of lower arm |
| 5 | Lower arm                   | 14 | Hydraulic tank                   |
| 6 | Rear support wheel          | 15 | Seamless hydraulic hose pipes    |
| 7 | Hydraulic pump              | 16 | Lower cylinder                   |
| 8 | Extension pipes for support | 17 | Hydraulic motor                  |
| 9 | Bucket platform             | 18 | Turn Table                       |



**Fig 3:** Testing of developed small tractor operated raising platform for harvesting of mango

### Results and Discussion

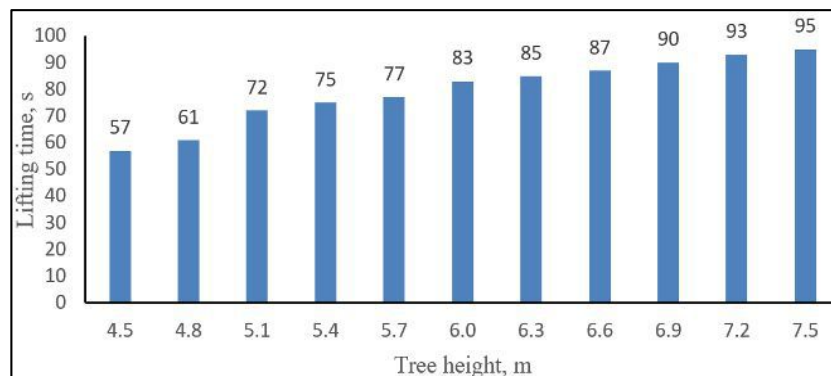
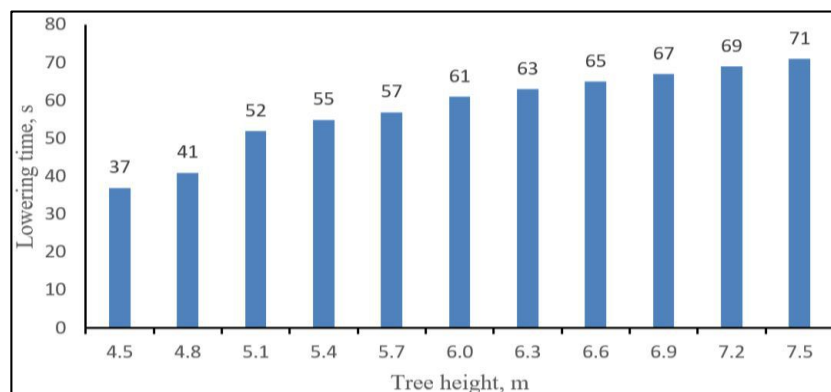
The performance testing of small tractor operated hydraulic elevator for mango harvesting (Kesar) was carried out at farmers field, Hanchinal, Tal: Nipani, Dist: Belgavi, Karnataka. The harvesting of mangoes were done from two sides of a tree and combined results were noted. The developed small tractor operated raising platform with operator standing in bucket allowed to harvest mango trees of Kesar variety. The harvesting of mangoes with developed machine is shown in Fig 3. The test results of the developed small tractor operated raising platform (elevator) for mango harvesting (Kesar) is given in Table 1. The graphical representation of effect of tree height on lifting time of arms of hydraulic elevator is shown in Fig. 4. It was seen that the lifting time of arms was minimum of 57 s for 4.5 m tree height and maximum of 95 s for 7.5 m tree height. As the tree height was increased the lifting time of arms for

harvesting of mango also increased. The graphical representation of effect of tree height on lowering time of arms of hydraulic elevator is shown in Fig. 5. It was seen that the lowering time of arms was minimum of 37 s for 4.5 m tree height and maximum of 69 s for 7.5 m tree height. It was observed that as the tree height increased, the lowering time of arms for harvesting of mango also increased. The lowering time requirement was found to be less as compared to lifting time of bucket. It might be due to effect of gravity while lowering the bucket.

Based on the actual performance of developed system and number of fruits available on mango tree, the average time required for mango harvesting per tree was found to be 0.80 h. The average number of fruits harvested and weight of fruits harvested per tree were found to be 228 per h and 51.50 kg/h respectively. The field capacity of developed elevator was found to be 0.00078 ha/h.

**Table 1:** Performance of developed small tractor operated raising platform (elevator) for mango harvesting

| Tree No. | Tree height, m | Time, sec |            |          | Total time, h | No. of fruits harvested | Weight of fruits harvested, kg | No. of fruits harvested, h | Weight of fruits harvested, kg/h |
|----------|----------------|-----------|------------|----------|---------------|-------------------------|--------------------------------|----------------------------|----------------------------------|
|          |                | Lifting   | Harvesting | Lowering |               |                         |                                |                            |                                  |
| 1        | 4.50           | 57        | 2776       | 37       | 0.80          | 184                     | 41.61                          | 231                        | 52.19                            |
| 2        | 4.80           | 61        | 2892       | 41       | 0.83          | 196                     | 45.08                          | 236                        | 54.20                            |
| 3        | 5.10           | 72        | 2134       | 52       | 0.63          | 140                     | 31.64                          | 223                        | 50.44                            |
| 4        | 5.40           | 75        | 2772       | 55       | 0.87          | 202                     | 44.76                          | 234                        | 51.75                            |
| 5        | 5.70           | 77        | 2766       | 57       | 0.81          | 184                     | 43.78                          | 228                        | 54.35                            |
| 6        | 6.00           | 83        | 2650       | 61       | 0.78          | 178                     | 39.76                          | 229                        | 51.23                            |
| 7        | 6.30           | 85        | 3032       | 63       | 0.88          | 200                     | 45.65                          | 226                        | 51.68                            |
| 8        | 6.60           | 87        | 2564       | 65       | 0.75          | 168                     | 38.38                          | 223                        | 50.85                            |
| 9        | 6.90           | 90        | 2566       | 67       | 0.76          | 172                     | 40.10                          | 227                        | 53.02                            |
| 10       | 7.20           | 93        | 2178       | 69       | 0.65          | 142                     | 32.70                          | 218                        | 50.31                            |
| 11       | 7.50           | 95        | 2690       | 71       | 0.79          | 178                     | 40.21                          | 225                        | 50.81                            |
| Avg.     | 6.00           | 76        | 2733       | 54       | 0.80          | 181                     | 40.91                          | 228                        | 51.50                            |

**Fig 4:** Effect of tree height on lifting time of arms**Fig 5:** Effect of tree height on lowering time of arms

## Conclusion

The developed small tractor operated raising platform worked satisfactorily for harvesting of mango up to 6 m height.

## References

- Anonymous. The production of mango in India. Department of Agriculture, Cooperation and Farmers Welfare. 2021. Available from: [https://agricoop.nic.in/sites/default/files/2021-22%20%28First%20Advance%20Estimates%29%20%281%29\\_0.pdf](https://agricoop.nic.in/sites/default/files/2021-22%20%28First%20Advance%20Estimates%29%20%281%29_0.pdf)
- Gupta RA, Satasiya RM, Mahnot P, Gontia NK. Development and testing of a tractor-mounted positioner for mango harvesting. *Agricultural Mechanization in Asia, Africa and Latin America (AMA)*. 2004;35(1):28-32.
- Kolhe KP, Jadhav BB. Testing and performance evaluation of tractor-mounted hydraulic elevator for mango orchard. *American Journal of Engineering and Applied Sciences*. 2011;4(1):179-186.
- Sunar S, Sapkota D, Dumre A, Bhattarai I, Sharma DR, Sapkota MM. Status of farm mechanization on rice production: A case study of Banganga Municipality, Kapilvastu, Nepal. *Int J Agric Extension Social Dev*. 2022;5(1):28-31. DOI:10.33545/26180723.2022.v5.i1a.120
- Roul AK, Bhargav VK. Stability analysis of self-propelled multi-utility platform for orchard management system using point manipulation method. *Research Square*; 2020.
- Thiyagarajan R, Tajuddin A. Design and development of a tractor-mounted hydraulic operated ladder. *International Journal of Agricultural Engineering*. 2018;11(1):1-12.