



# Mechanized harvesting, the need of coconut growers in India

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## Abstract

The continuous increase in the yield and production rate of coconut orchards has urged the need for mechanization of coconut harvesting in India. The average yield, production and area of coconut is increasing since the last thirty four years. The drudgery in manual coconut harvesting, lack of climbing labours and the operational and safety problems in availing manual climbers have necessitated the need for the mechanization of coconut harvesting. Coconut growers are facing practical difficulty in coconut harvesting due to the height of the tree. The tractor mounted hydraulic elevator (TMHE) developed by Dr. B. S. Konkan Krishi Vidyapeeth Dapoli is a fully automatic harvesting device for harvesting tall coconut orchard. The further development and testing of this elevator is in progress. The coconut harvesting field capacity of the developed TMHE is observed as 4,524 coconuts/day.

## Introduction

India is the second largest producer of fruits and vegetables in the world. The Konkan region is well regarded as the fruit belt of

Maharashtra. The area and production of horticultural fruits in Maharashtra state till 2006-08 is 73000 Ha. Konkan the narrow strip of 40 km width and running 750 km of length from north to south is a hilly terrain lying between sahyadri ranges in the east and arabian sea in west. The production of coconut in India is 14.74 billion nuts (2007-08), while Maharashtra state produces 273 million nuts. Konkan region is indicated 15°36' to 20°21' North latitude and 7°7' to 74°13' east longitude on the world map and is comprised of four districts viz. Thane, Raigad, Ratnagiri and Sindhudurg. The hilly terrain receives heavy rainfall ranging from 2000-4000 mm per annum. The climate is hot and humid almost throughout the year. The climatic conditions are suitable for growing various horticultural fruit crops like coconut, mango, cashew etc. The total geographical area of the region is 29.5 lakh hectares, out of which 9.5 lakh hectares is under cultivation of different crops. Land under forest is 5.54 lakh hectares, barren and cultivable land is 5.34 lakh hectares, land put to non-agricultural uses in 1.93 lakh hectares, cultivable waste land is 3.85 lakh hectares, permanent pastures and other grazing land is

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1.19 lakh hectare and land under miscellaneous crops is 0.47 lakh hectare, fallow land 3.08 lakh hectare and net sown area 8.39 lakh hectares. This paper presents the data of coconut orchard like area, yield, production rate and the need of mechanization in coconut harvesting in India.

### Literature Review

Ibrahim (1981) *et al.* developed and tested a Shaker-system for the selective harvest of date fruit. A shaker-system for the selective removal of mature dates from the bunch has been designed and manufactured. This tractor-mounted system is powered by the tractor power take off shaft. The shaker produces a vertical stroke of 50 mm. The hydraulically-powered shaker produces a vertical stroke of 82.5 mm at a frequency of 600-700 cycles per mm. In 1966 almost 80 per cent of the USA date crops were harvested mechanically. This has reduced harvesting labor by 75 per cent and harvesting cost by 50 per cent. Sumner and Hedden (1982) conducted study on Tractor mounted limb shaker for harvesting of citrus. A tractor mounted limb shaker was developed to harvest fruits. Removing the shaker assembly from the tractor required 4.25 man-hrs and 9.5 man-hrs to remount the shaker on the tractor. This equipment works on the principle of hydraulics and operates by hydraulic flow control valve. The attachment and detachment of the shaker from the tractor was difficult and required excessive time. Morris (1994) conducted study on mechanical harvesting and vineyard mechanization, research initiated in

1968 in Arkansas indicated that mechanical pruning could be accomplished and would reduce hand labor as much as 50 per cent. Two viticulture concerns were addressed in these early research studies. First, it was impossible to treat each vine individually. Since balance pruning according to vine size is the customary method of pruning the labrusca, this method would result in the over cropping or under cropping of individual vines. It was impossible to select and leave only the best fruiting canes since the mechanical prune did not discriminate between canes. Fadel (2005) conducted study on development of a tractor-mounted date palm tree service machine. Two outriggers support the base and other system components avoid excessive tire pressure, while the machine is in operation. The base carries a rotating joint in its middle, where a horizontal hydraulic cylinder is used to swing the joint, and the elevator-platform assembly accordingly. Two control panels are installed to control the machine. One of them is located on the base unit, where it may be used from the ground. The other one is located on the platform to be used by the operator on top. The ground controller controls outriggers, raising, lowering or swinging the platform. On the other hand, the second control panel is placed in the platform where the controller has the ability to control the whole system, including the winch located on the platform. An inertia type limb shaker designed by Erdogan *et al.* (2003) was used for mechanical harvesting of almond. The shaker was completely hydraulically powered and driven by the Power Take Off

(PTO) shaft. The main frame is mounted on the three point linkage of tractor. The equipment comprises of hydraulic pump, hydraulic motor, tank, flow control valve, hydraulic cylinder, direction control valve and vertical steel tubular frame to support the shaker, pendulum and other auxiliary components. Polat, *et al.* (2007) studied mechanical harvesting of Almond with an Inertia type limb shaker. An inertia type limb shaker designed by Torregrosa, *et al.* (2008) designed and tested an apricot tractor-trailed harvester. In this harvester the two articulated arms at the rear of the chassis, and the wheels are attached at the end of these. These arms move independently on a vertical plane, each of them motioned by a hydraulic cylinder. This movement, combined with the tractor and elevator system, allows for the harvester's leveling in the longitudinal and transverse directions. The trailer's maximum height over the ground is between 0.2 and 1.22 m. This higher clearance allows the unloading of apricots into the boxes or box pallets with a minimum dropping height, preventing fruit damage. The arm wheel hydraulic cylinders are operated by the tractor external oil system. Hydraulic controls are located on the left rear side of the trailer. A person walking next to the harvester with a manual branch shaker could also control the trailer hydraulic system. Kolhe (2009) designed and developed a tractor mounted hydraulic elevator for the mechanical harvesting, pruning and spraying of horticultural fruit trees. The testing of the above machine was carried out for harvesting of



mango and coconut orchards upto 14 meter height using traditional harvesting pole. The comparative study of TMHE and other elevators were studied from the literature. The TMHE noted the most suitable results for the harvesting of mango and coconut orchards.

### Material and Methods

The hydraulic system used in this study shown in fig. 1 can be driven by an electric motor, air motor, gas turbine, or internal combustion engine. The pump increases oil pressure of the pump outlet from 5 to 5000 or more pounds per square-inch. High pressure oil flows in a tube or piping through a control valve. This valve can be used to change the oil flow. A relief valve is used to protect the system; the value can be set at a desired safe maximum pressure. If the oil pressure in the system begins to rise above the safe pressure, the relief valve opens to relieve the pressure and to prevent damage to either the system or the surroundings. The oil that enters the cylinder acts on the piston; this pressure action over the area of the piston develop a force on the piston rod. The force of the piston rod can be used to move a load or device, while the oil from the cylinder returns to the reservoir.

As the oil passes through the filter, dirt and foreign particles are removed from the oil. Each separate unit, such as the pump, valve, cylinder, and filter are the components of the system. A relatively large force can act on a load for a relatively small size of cylinder.

The design of tractor mounted hydraulic elevator is shown in figure 2 ( Ref. 3).The elevator consists of

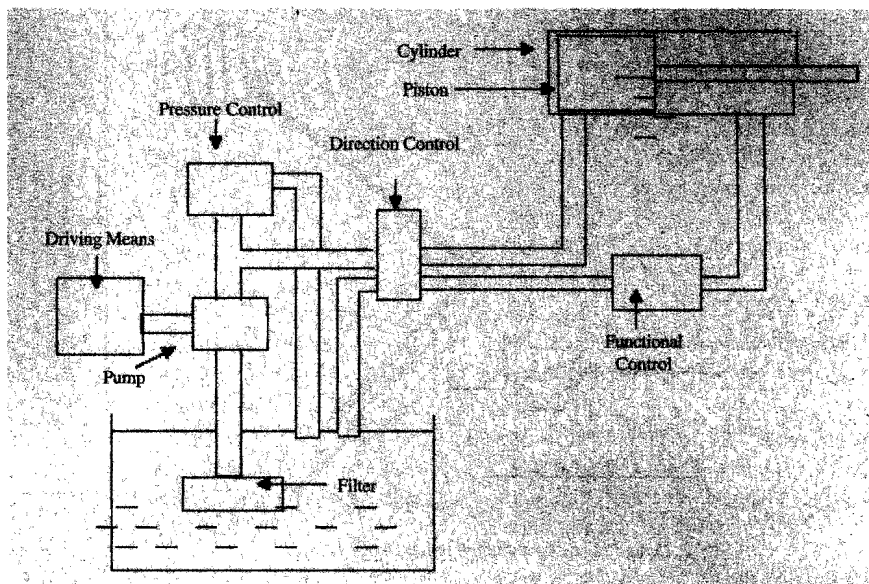


Fig. 1 (a). Block diagram of hydraulic system

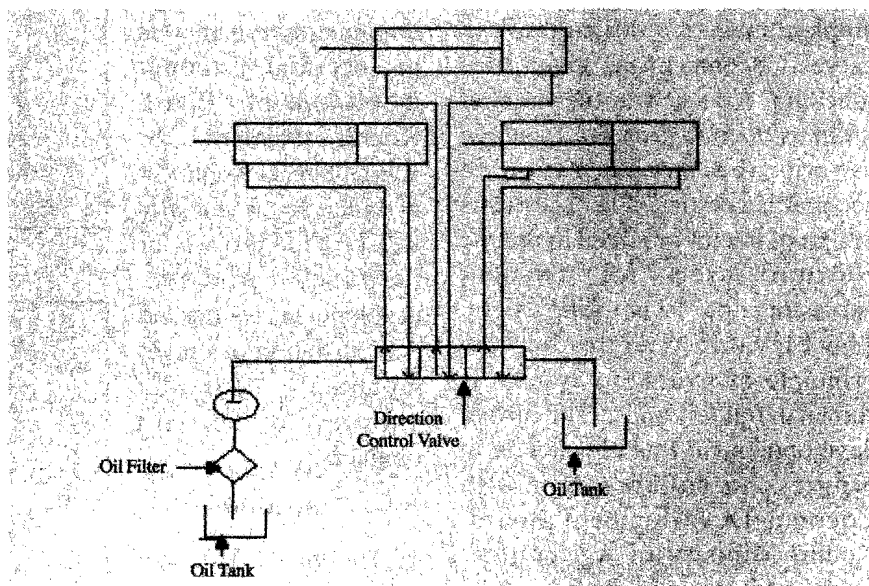


Fig. 1 (b). Hydraulic Flow Diagram of TMHE

turn table, lifting arm and supporting wheel as major components, while the remaining components are hydraulic pump, motor, control valve and oil flow pipes.

### Results and Discussion

Figure 3, 4 and 5 presents, all India yield, production and area of

coconut orchard from 1974 to 2008 of coconut. It is observed from the figure that the average yield and production rate of coconuts are increasing since the last twenty five years consistently but the area of coconut remains same from the last twelve years. The increased production of coconuts adds very

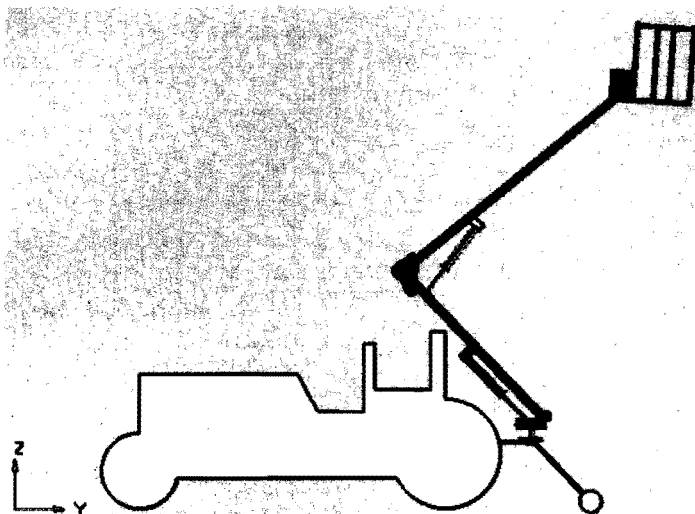


Fig. 2. Design of tractor mounted hydraulic elevator

good economy to the coconut growers in India. But the drudgery in coconut harvesting and labour problem make it a difficult task to harvest coconut in the given time schedule. Hence it is the need of Indian coconut growers to move towards the mechanization in coconut harvesting. Fig. 2 presents design of tractor mounted hydraulic elevator used for coconut harvesting upto 12 m lifting height. The elevator operates on the principle of hydraulic system as shown in figure 1 and 2. The further development in this elevator is in progress in collaboration with Coconut Development Board, Kochi, Ministry of Agriculture, Government of India. The development, demonstration and testing of the elevator is undertaken at Dr. B. S. Konkani Krishi Vidyapeeth Dapoli, Dist:- Ratnagiri (Maharashtra state).

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#### Conclusions

1. The tractor Mounted Hydraulic Elevator is suitable for harvesting, of coconut up to a maximum height of 14 meters using traditional harvesting pole.
2. It takes very less lifting and lowering time for coconut harvesting spraying and cleaning operation.
3. The machine can be operated by any agricultural worker with training.
4. The efficiency of this machine is much more than the manual harvesting.

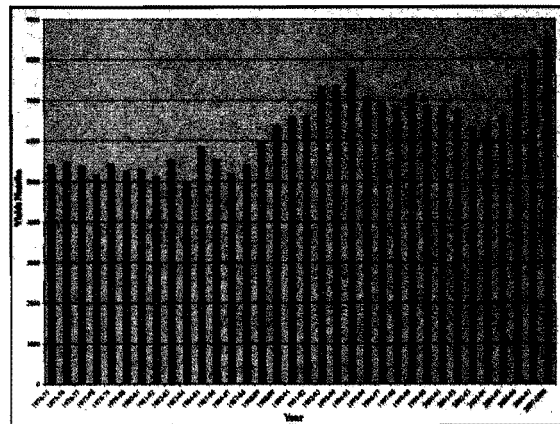


Fig. 3. Yield of Coconut in India (Ref. 10)

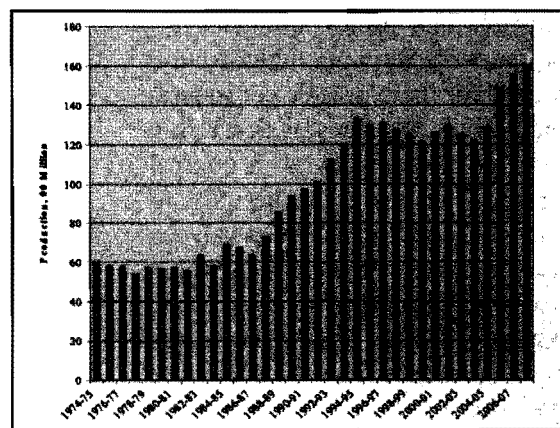


Fig. 4. Production of Coconut in India (Ref. 10)

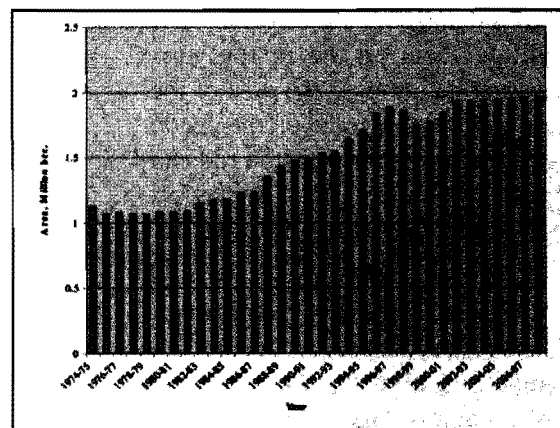


Fig. 5. Area of Coconut orchard in India (Ref. 10)



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## Philippines to use natural pests for fighting *brontispa* infestation in coconuts

If only this will work out, then surely this will be a classic case using a natural way of eradicating coconut pests the harmless way, or chemical-less way.

The Philippine Coconut Authority (PCA) is applying a new discovery: spread a bunch of ant-like parasitoids to wage war against brontispa, a tiny leaf-eating beetle whose alarming presence has been noticed, turning two to three year old and newly-planted young coconuts into virtual dead plants.

But to prove its case, the army of parasitoids must win this war, and to see that it is winning both the PCA and the farmer concerned must be patiently monitoring the progress by the day, said Manuel Sembrano, provincial PCA head.

The test case for a battleground will be in barangay Pinaskohan, this city, the very first barangay where brontispa's growing population was first noted early this year, Sembrano said.

At least 2,000 hectares of coconut plantations have been damaged by coconut leaf beetles that have been feasting on farmlands in Mindanao for the last 3 years Coconut Authority (PCA).

In one hectare of coconut plantation at barangay Pinaskohan, at least five infected trees will be tied with the microscopic parasitoids placed in a plastic bottle peppered with holes as passageways.

Crawling out, the parasitoids would lay eggs - one insect or wasp lays 25 eggs - and this will be spit on a budding brontispa worm, and the colony of eggs, once out of their shells, would have an eating frenzy on the worm, Sembrano said, describing how the fight would look like.

Adult brontispas will not be attacked directly by the parasitoids, who are wise enough to locate the larvae only, and open fire with their eggs there.

Sembrano brushed aside insinuations that the parasitoids will then lead the destruction once brontispa worms are no longer available to eat.

"This is the basic difference of a parasitoid and a parasite. The parasitoid will live in the host plant, and this host plant will live as well. The parasite will live in a host plant, the host plant will die," he explained.

But until such time victory will be secured, it is still a plan B to resort using chemicals in a wide swath of an area infested by brontispa.

For now the parasitoid wasps have been cultured in the provincial office of the PCA after it was delivered here last week from Albay Research Center, ready and waiting to be deployed to war zones.

And coco farmers, with the usual wait and see attitude, will be watching who will be winning the insect war.

Source: pia.gov.ph