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Development of Tender Coconut Dewatering System

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Abstract

The project was initiated to design a prototype of tender coconut trimming, piercing and draining system and test its performance efficiency. The trimming of tender coconut for water is extremely hazardous and requires skilled labor. The machine helps in easy, safe and hygienic cutting when compared to inherent method which is difficult to wield, messy and need skill. The machine frame consists of three sections. The first one has a sharp cutting knife which cuts of the top most portion of tender coconut. The second one has a piercing system that makes the hole at the tip of the coconut. The third compartment is similar to the second one but has a sharp rod with holes on it, which helps in easy draining of water from the shell. Optimal settings include the, shoulder knife height of 70-75 cm from base and the optimal cutting of 45 degree. The total time for the combined cutting and piercing operation is identified to be 16 second on an average and for cutting and draining water was 28 sec. The above machine designed can easily reach farmers and local vendors.

KeyWords: Coconut, Trimming, Dewatering, Labor

INTRODUCTION

The coconut palm, (*Cocosnucifera*), is a member of the family Arecaceae. It is only accepted species in the genus Cocos. The term coconut can refer to the entire coconut palm, the seed or the fruit, which, botanically, is a drupe, not a nut, weighs 1.2-2 kg. It is a tall perennial tree crop, which, when fully matured, attains a height of about 15m to 30 m crowned by 28 to 32 pinnate leaves, with fruit bunches of varying age, one each in each axils.

Tender coconut is one of the most popular fruit grown over worldwide. The edible parts include the sweet juice at the core of the fruit and water is the liquid endosperm is attached to the inner shellJarimopas and Srihawong(1996). Young coconut (Tender coconut) is highly nutritious as itsjuice contains glucose, vitamins, hormones and minerals. It is considered as a refreshing drink all over the world.

The fruit have different part and it's completely enclosed with shell, flesh and juice. Generally, tender coconut is manually trimmed into pentagonal profile to remove the outer layer husk before serving. Manually trimmed young coconut is Inhere tent method of dewatering system are unsafe, difficult to wield, messy and need skilled person and considerable physical strength and very large sharp knife, thus is a dangerous procedure (Jarimopasetal, 2009).The project was initiated to design a prototype of a tender coconut trimming, piercing, draining and test its performance efficiency. The trimming of tender coconut for water is extremely hazardous and requires skill labor. The machine helps in easy, safe and hygienic cutting when compared to inherent method.Therefore, an effort was made to design a prototype for coconut trimming, piercing and draining system.

MATERIALS AND METHODS

Design and operation

The physical and mechanical properties of tender coconut were studied since these characteristics influence the splitting and punching operation was performed by the machine. The machine frame consists of three sections. The first one has a sharp knife which cuts of the topmost portion of tender

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coconut. The second one has a piercing system that makes the hole at the tip of the coconut. The third compartment is similar to the second one but has a sharp rod with holes on it that helps in easy draining of water from the shell. Optimal settings include the shoulder knife height of 70-75 cm from base and the optimal cutting angle of 45 degree.

Characteristics features of knife

The knife used for cutting the tender coconut was of mildly tempered stainless steel. It also has an excellent corrosion resistance for sanitary reasons as well as appearance. At least 14 percent chrome was imparted for stain resistance and ductility. Higher hardness could lead to edge chipping and poor traction on sharpening steel. The knife was electroplated with Nickel coating of 2 mm for better appearance and corrosion resistance. This coating also helps in long lasting of knife.

Optimal knife angles

Optimal knife angle is important parameter for cutting the young coconut. It is the angle made between the cutting surface and the tender coconut. The optimal knife angle was found by trial and error method. Different angles were set by trial and error method by tilting the coconut at 45°,50° and 60°, by keeping one at constant. After the trials the angle to be optimized was 45°.

Piercing section

The unit has a sharp needle of 5 mm to penetrate into the trimmed tender coconut. The holder was provided to hold the coconut intact while piercing. A handle was provided at the backside, to avoid the shaking while processing it.

Piercing section and components

The second section consisted of a simple punch set at particular height to punch the hole. The piercing hole was made sharp so that it easily pieces the outer husk and makes hole of required diameter. The piercing needle was having the diameter of 5 mm diameter for a sharp and deep piercing.

Figures

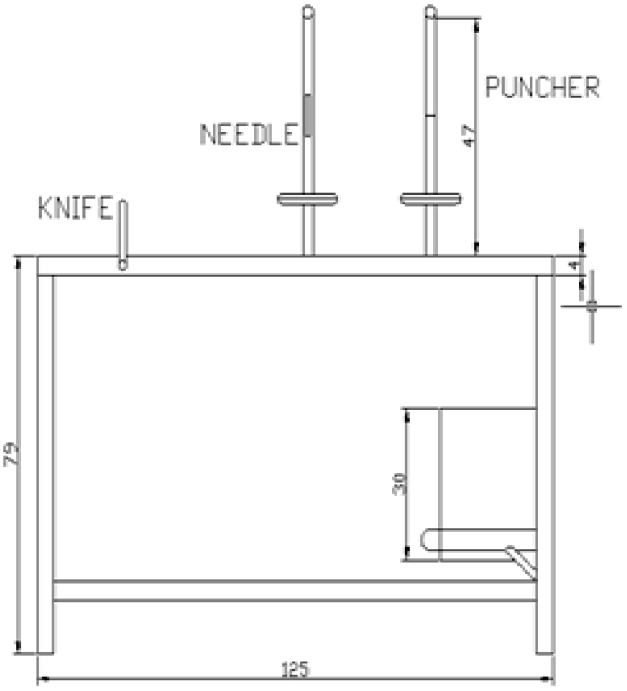

Fig 1 Front View of the equipment (Dimensions in cm)

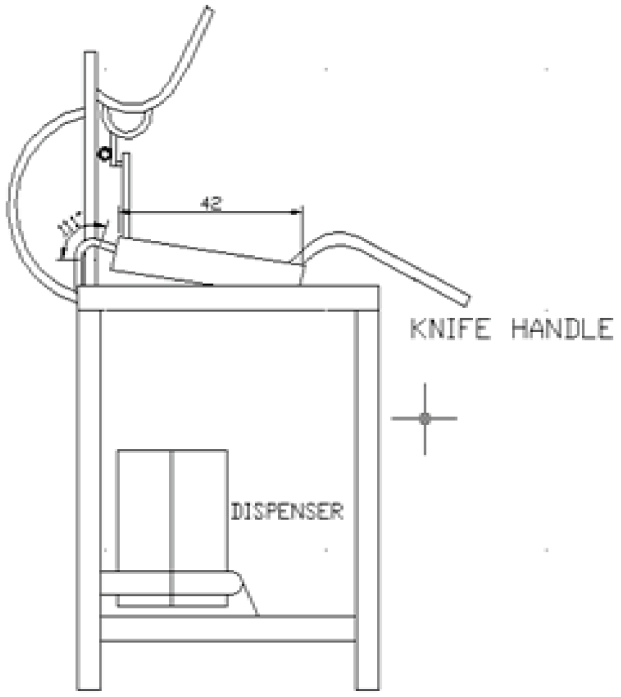

Fig. 2 Side View of the equipment (Dimensions in cm)

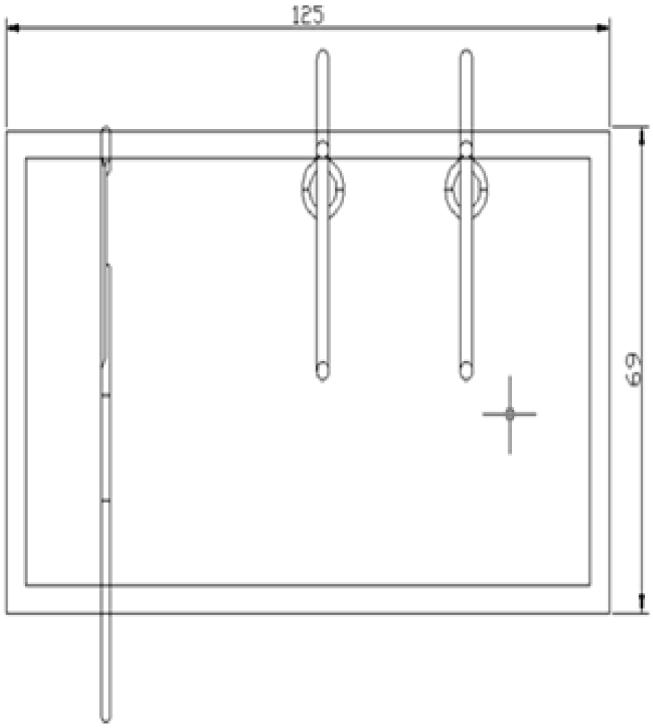

Fig 3 Top View of the equipment (Dimensions in cm)

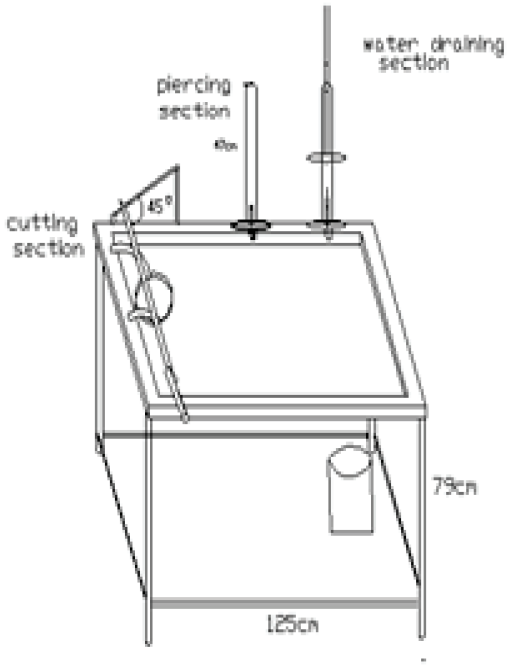

Fig 4 An Isometric view of the equipment (Dimensions in cm)

RESULTS AND DISCUSSION

Efficiency of machine

The cutting direction of the coconut was shown to play an important role on the quality of cutting. It was clear that direction of placing the coconut knife parallel to the coconut did not successfully cut the coconut into half. The optimal knife angle was set up at 45 degree. However, if the direction of placing the coconut fiber was perpendicular to knife edge, the fruit was absolutely cut without any damage at any speed of the pressing unit. The pressing unit speed insignificantly affected the cutting quality. The cutting and piercing time for the equipment was identified to an average of 16 sec. Similarly the cutting and draining time was 28 sec. This was compared with that of manual operation of cutting and draining water.

Cutting time

The cutting time for 30 coconuts of each variety was taken and used as a parameter for doing performance evaluation. Storage days were varied to observe the cutting time fluctuation with the storage duration. Maximum cutting time was observed with 12th day stored coconut in all the cases. It was 19.8 and 16.8 seconds for tall and dwarf variety respectively when done manually. However, it was 18.6 and 15.6 seconds for tall and dwarf variety respectively. Minimum cutting time observed was9.12 and 8.36 seconds for long and dwarf variety when done manually. However it was 8.16 and 7.22 seconds for equipment. Time consumed by the machine was observed to be lesser with respect to the manual operation. Time consumed on dwarf variety was observed to be lesser than the time consumed by longer variety. It may be due to the hardy structure of the long variety coconut. A trend of increasing cutting time with the storage duration was observed for both of the varieties. This may be due to the decreasing moisture content and loss in firmness of the coconut outer surface.

Cutting and piercing time

Cutting and piercing was done on 30 coconuts of both the varieties with varied storage period. Time consumed for the same was measured. For both of the verities, time taken by the equipment was more than that of the manual operation. This may be due to the extra time consumed while going from cutting section to the piercing section.

Cutting and water draining system

Cutting and dewatering was done on 30 coconuts of both the varieties with varied storage period .Time consumed for the same was measured. For both of the varieties, time taken by the equipment was less than that of the manual operation. It may be due to the saved time during dewatering of the coconut in the equipment. On average, manual dewatering took 28-30 seconds while by equipment it hardly takes 18 -20 seconds.

Process time variation with moisture content

The time taken for the cutting, piercing and dewatering was studied by varying the moisture content. The process time increased gradually when moisture content decreased. This was due to the increase in firmness of husk due to loss of moisture.

Moisture content and storage duration

The moisture content of the outer part of both coconuts was measured, at different storage duration (Alonge,2003). Moisture content of the tall variety was found to be greater than the dwarf variety. For both varieties that is tall and dwarf, a decreasing trend of moisture content with storage duration was observed.

CONCLUSION

Recently used inherent methods of trimming tender coconut and extracting water was unsafe, difficult to wield, messy and need skill. So a machine prototype was designed, aimed to reduce the human drudgery also an efficient clean and reliable method for splitting coconut and collecting water from it. The estimated cost of the cutting machine, which includes material, construction cost of Rs 21,500/- which easily affordable by farmers. This performance level was accepted by the local tender coconut vendors.

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