Pertanika 11(1), 161–164 (1988)

COMMUNICATION VI

The Design and Fabrication of NOS Ciku Harvester

ABSTRAK

Sebuah alat penuai ciku telah pun dibentuk dengan jayanya. Ia mempunyai sistem yang membolehkan buah tersebut diukur dan dituai sempurna dengan mudah. Ia juga boleh diubahsuai untuk tuaian buah-buahan lain yang memerlukan gerak potong mendatar, berdasarkan orientasi buah-buahan tersebut di atas pokok.

ABSTRACT

A device for harvesting ciku has been successfully constructed. It has a system enabling the fruit to be measured and harvested intact and with ease. It can be modified to harvest other fruits requiring a horizontal cutting motion due to their orientation on the tree.

INTRODUCTION

Ciku or sapota *(Achras sapota* L.) is an evergreen tree which can attain a height of 10 to 30 metres (Lakshminarayana, 1980). Flowering can occur throughout the year although only 11% will turn into mature fruit (Patil and Narwadkar, 1974). The flowering and fruiting behaviour of the tree throughout the year leads to the formation of fruit of different maturity stages at any given time. Although the fruit is of the climateric type, fruit harvested at insufficient physiological maturity will not ripen properly. Such fruit is neither aromatic nor sweet and is usually astringent due to its high phenolic and latex content (Lakshminarayana, Mathew and Parpia, 1969).

The usual practice of harvesting the fruit is to leave the stalk intact, achieved by twisting the fruit and collecting without bruising (Sulladmath and Narayana Reddy, 1985). In doing so, the picker must be physically near the targeted fruit through careful climbing and balancing techniques. Implements such as hooks are used to achieve physical closeness and if the terrain is favourable, a ladder is also utilized. Other than the size, the 'parameters of maturity' adopted are the disappearance of brown scale on the fruit skin and the absence or easy disclocation of the dried spine-like stigma.

Besides the height of the tree, which can obstruct proper visual examination of the fruit, the presence of ants and wasp on many of these trees is also instrumental in hindering a successful harvest. To overcome the difficulties and uncertainties in harvesting the fruit, a device to be constructed must satisfy the criteria that its cutting motion acts on the horizontal plane, and that it enables the determination of fruit maturity.

MATERIALS AND METHODS

A device for harvesting ciku has been constructed at the Faculty of Food Science and Biotechnology. Christened the NOS ciku harvester, it consists of three sections namely the cutting, collecting and pulley sections *(Fig. 1,* Plate 1). The sections are joined using nuts and bolts to a pole made of copper tubing of 1.5 cm diameter and 0.1 cm thickness. The cutting section is constructed from stainless steel of 0.1 cm thickness made up of two plates *(Fig. 2).* The upper plate (A) has a sharpened edge with a tapered bolt and nut making up the upper lock. It also contains a small perpendicular tip (1.0 cm high) with an orifice for easy attachment to the string. The lower plate (B) contains three cutting grooves which will facilitate the positioning of the fruit stalk during harvesting. Plate B also contains a tapered nut

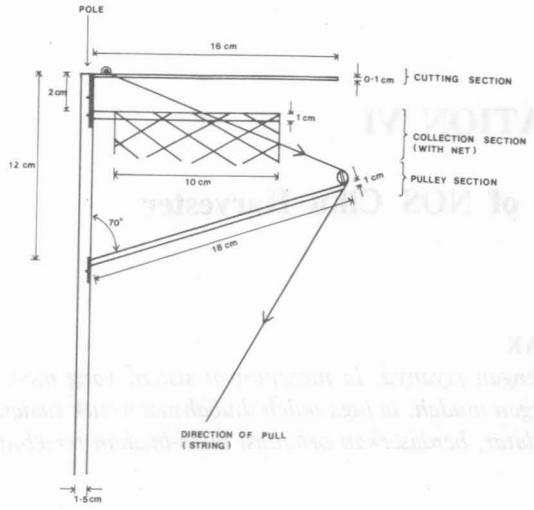

Fig. 1: Diagramiatic presentation of NOS ciku harvester.

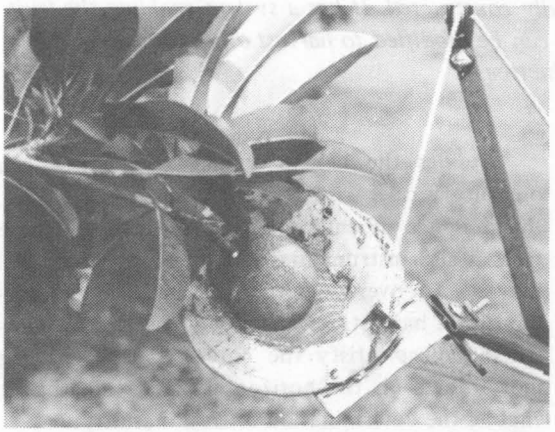

Plate 1: Nos Ciku Harvester in operation (Measuring stage)

and bolt functioning as the lower lock. Both plates are joined together with a pivot and spring. At the resting stage the positioning of the plates provide an aperture of six cm at the mid-section.

The collection section is made up of an iron ring (1 x 0.2 cm) of ten cm diameter lined with nylon netting. The pulley section consists of an iron rod (1 x 0.2 cm) 18 cm long with a 2.5 cm pulley attached to the tip. The string attached to plate A freely passes through this pulley. The cost of the materials for the prototype harvester was $30.00 ringgit.

When the targeted fruit has been identified, tension is applied by pulling the attached string whereby the motion is terminated when the upper and lower locks meet each other *(Fig. 3)*. This

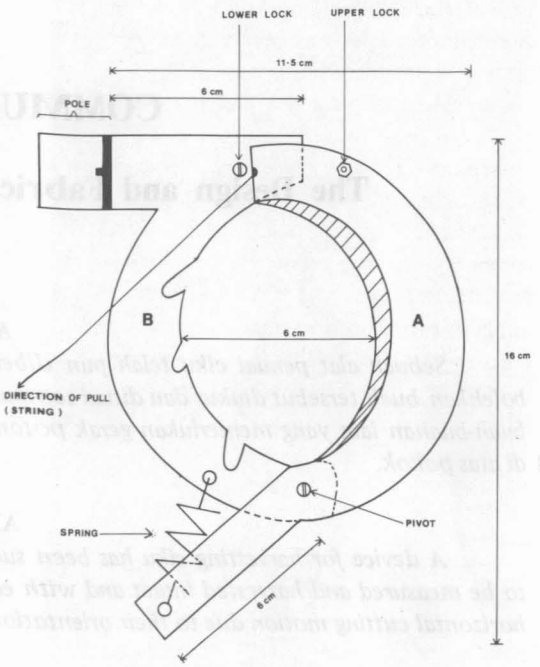

Fig. 2: Resting stage of the cutting section (top view)
A = Upper plate with sharpened top edge
B = Lower plate with cutting grooves

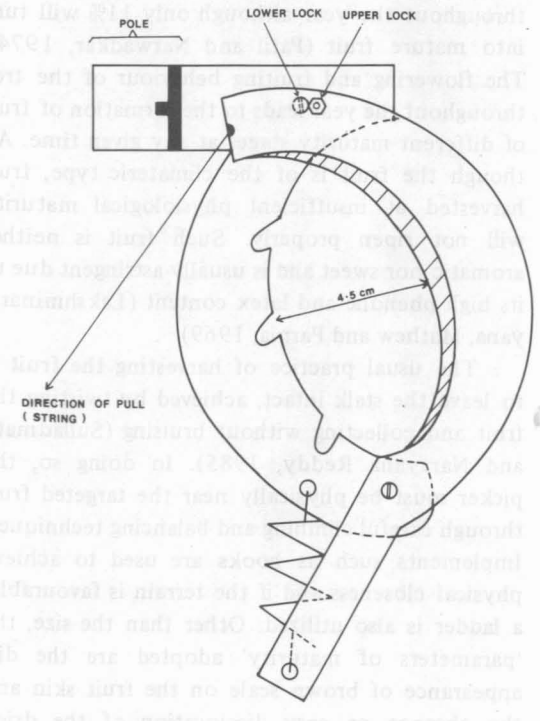

Fig. 3: Measuaring stage of the cutting section (top view).

provides an opening aperture of 4.5 cm which is the diameter which ensures with certainty that the fruit has attained physiological maturity (Abdul-Karim, Tarmizi and Abu Bakar, 1987). Hence, the fruit can be lowered towards the opening. If it passes through with ease, the fruit is not harvested. When a mature fruit is located, the tension is released whereby the cutting section will again resume its resting stage. The fruit can then be lowered through the aperture and tension duly applied pushing the stalk to any of the three cutting grooves leading to its successful detachment from the main branch *(Fig. 4)*. The fruit will then freely drop into the collecting net and can be retrieved at will.

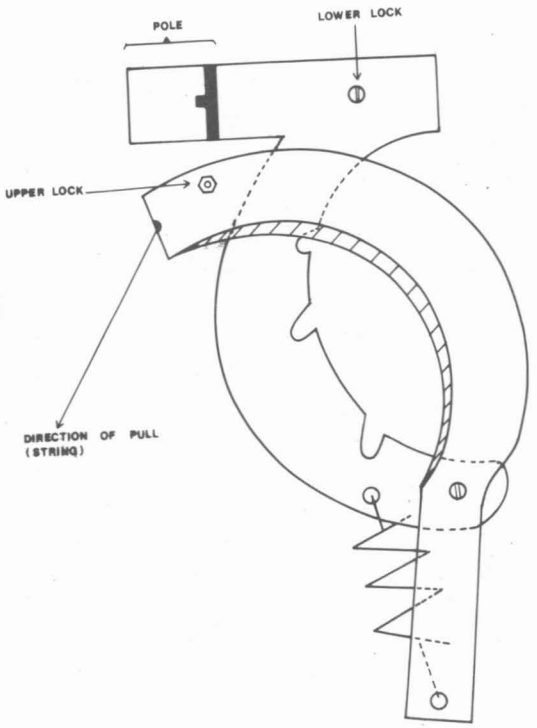

Fig. 4: Harvesting stage of the cutting section at first cutting groove (top view).

RESULTS AND DISCUSSION

The prototype has been successfully tested in the field on ciku and guava *(Psidium guajava)*. The stalk of the fruit has been found to remain intact (unless the fruit is too ripe), and no bruising has been detected on the harvested fruit.

The use of a horizontal cutting motion on the device enables its wider use as a fruit harvester. By modifying the aperture size at the resting stage, ensuring appropriate force at the joint between the pole and pulley section and adjusting the size of the net, it could be applied to other fruits such as soursop *(Annona muritaca)*, starfruit *(Averrhoa carambola)*, pomelo *(Citrus maxima)*, mango *(Mangifera indica)*, custard apple *(Annona squamosa)* and even durian *(Durio zibethinus)*.

The functional part of the harvester could be made more portable by using hollow steel pipe as the pole. The attachment can then be made readily and at will using appropriately sized wooden poles or bamboo of any required lengths. By using a nut and bolt system, the entire functional part may be easily dismantled and reassembled when required.

CONCLUSION

This harvesting device is designed for ciku which requires a selector mechanism achieved in this case by the 'locking' system. The aperture size has been based on studies on ciku of the jantung variety and aperture sizes for other varieties has yet to be determined. A horizontal cutting motion has been found necessary due to the orientation of the fruit on the tree. The stalk of the fruit harvested remained intact and bruising was avoided by use of the net.

ACKNOWLEDGEMENT

The author wishes to thank Encik Mohd. Soib bin Yusof who fabricated the prototype.

MOHAMAD NORDIN BIN ABDUL KARIM

Department of Food Science
Faculty of Food Science & Biotechnology
Universiti Pertanian Malaysia
43400 Serdang, Selangor, Malaysia.

REFERENCES

ABDUL-KARIM, M.N.B., S.A. TARMIZI, A. ABU BAKAR (1987): The physico chemical changes in ciku *(Achras sapota* L.) of jantung variety. *Pertanika* **10(3):** 277–282.

LAKSHMINARAYANA, S. (1980): Sapodilla and pricky pear. In Nagy, S. and Shaw, P.E. (Eds.) Tropical and subtropical fruits: Composition, properties and uses . AVI Publishing Inc., Connecticut, 415–441.

LAKSHMINARAYANA S., A.G. MATHEW and H.A.B. PARPIA (1969): Changes in polyphenols of sapota fruit *(Achras sapota* L.) during maturation. *J. Sci. Fd. Agric.* **20:** 651–653.

PATIL V.K. and D.R. NARWADKAR (1974): Studies on flowering, pollination, fruit set and fruit drop in ciku. *Hort. Abst.*, **46:** 712.

SULLADMATH, U.V. and M.A. NARAYANA REDDY (1985): Sapota. In Bose, T.K. (Ed). Fruits of India: Tropical and subtropical , Naya Prokash, Calcutta. 438–469.

(Received 11 May, 1987)