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Development of Okra-Cutter-Holder

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ABSTRACT

Okra fruits have an almost hair like bristles and prickly surface exposure to which is uncomfortable to the hands of the harvester. In extreme cases, persons with sensitive skin have developed sores or allergic reactions after a prolonged period of exposure to the pods during a harvest. Therefore to minimize above mentioned problems we developed a suitable low cost tool, okra-cutter-holder. This invention is directed okra cutter to an improved okra-cutter-holder, which permits one to harvest okra pods from a plant without touching the pod. The developed tool was tested in the laboratory as well as in the field. The comparative tests were carried out to compare the performance of the newly developed okra-cutter-holder with the old straight blade okra plucker. The feedback from the workers was taken for ease of operation and the acceptance of the tool for the harvesting of okra. The results shown that the new tool could harvest 297-318 okra per hour (10.0 – 10.9 kg/hr) without damaging pods and also provides better protection to the hands of workers.

Key Words: Cutter, Design considerations, Harvesting, Holder, Okra.

INTRODUCTION

In India, okra is generally harvested without any safety to prevent bruising and after harvesting it is dumped at one place, which results mechanical injuries to the ridges of pods. To reduce the post harvest losses in okra, it should be least handled (Dhall *et al*, 2014). Labourers are usually unwilling to take up okra harvesting work and demand exorbitant wages because the bristles on the okra pods cause injury to the skin during the harvesting operation i.e. in hand plucking method. In order to avoid that, it was suggested to wash hands thoroughly after okra plucking operation or wear gloves throughout operation. Okra growing farmers and labourers do not prefer to wear gloves as the same obstructs the movement of fingers necessary to carry out the harvesting operation efficiently.

The tools available in the market (horticulture secateurs, circular snip, okra plucker) were inefficient for harvesting okra, as reported by earlier workers. Secateurs and circular snip could not reach the stalk of the pod easily, because of wider in size and shape. Scissors were having effective reach but much care and time is required in opening the scissors and operating them. Moreover their continuous use resulted in a fatigue in the fingures and thumb. Washing of hand thoroughly after picking is also not effective. The pods harvested with minimum handling and field packaging can retain their green colour, crisp texture. The average postharvest loss of okra at production level was 11.5 per cent (Prasad, 2015). Straight blade okra plucker, was not effective because okra pods have been harvested by holding the pod in one hand and cutting the pod from the plant with the other hand using a cutting tool.

Okra pod harvester and cutter were developed in USA which could harvest and hold the pods (Welborn, 1998). Longer pods could not be cut because of straight cutting and short length of arm. Okra pods grow at the bottom of the forks i.e. from where the branches/leaves come out from these stem

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of the plant. Stalk of the pod is tender and requires very little force to break it or to cut it with the help of a sharp tool. There are very small triangular spaces left on the either side of the stalk of the okra pod. The close harvesting of okra therefore needs to the carried out carefully, otherwise the stem of the plant or the petiole of the leaf may get cut or damaged.

Mechanical harvesting of okra depends on physical properties of the okra like uniformity of plant size and other plant characteristics greatly affect the productivity of machine harvested okra (Aminu *et al*, 2016; Salau and Makinde, 2016 and Pawar *et al*, 2017). So there was necessity to design okra cutter-holder which will provide an okra harvesting tool that not only cut the okra pod from the plant but also holds the okra pod. That avoids injuries of hand which are made by bristles on the pod at reduced cost of harvesting of okra to get maximum profit. To overcome these hindrances the okra cutter-holder was developed.

MATERIALS AND METHODS

Following plant and tool parameters were considered for developing the okra cutter- holder.

Plant parameters

Location of the okra pod on the plant and space available around the pod stalk for inserting the cutting tool, diameter of the pod, stalk diameter and length also the shearing strength were determined and presented in Table 1.

Tool parameters

Size, shape, weight and operational force of tool as well as the size and shape of the blade were major concern while designing the tool.

Safety and comfort parameters

The injuries inflicted on the skin of the palm in general and fingers and thumb in particular along with adaptability, portability and ease of operation of new designed tool were given prime importance while designing.

Constructional details of okra cutter-holder

The harvesting tool was designed based on the physical data of the okra plant at the time of harvesting as described in the Table 1. The tool is having least number of parts for easy operation and low maintenance. It consists fork, blade, pad (with slot) and holder as shown in the Fig. 1. The length of holder was 110 mm to accommodate longest okra length. The width of blade and the holder was 20 mm to cut and hold widest okra pod i.e. 2 cm. the fork length was kept 150 mm to reduce the effort required for cutting. The cutting blade was supported by the nylon pad with slot to help the shearing action of the blade.

The holder with blade and the fork were attached at an angle of 30° on the basis of angle between pod and the leaf. Two screws of 4 mm in diameter were used for connection of each holder plate.

Table 1. Average specifications of okra plant.

Sr. No.	Particulars	Dimensional Range
1	Height of plant	0.5 – 1.6 m
2	Length of okra pod	8 – 11 cm
3	Diameter of okra pod (crown)	1– 2 cm
4	Diameter of the stem of okra pod	6– 8 mm
5	Length of the stem of okra pod	1.5 – 2 cm
6	Angle between stalk of pod and stem of plant	15° – 20°
7	Angle between stalk of pod and petiole of the leaf	20° – 25°
8	Safe angular spacing available for cutting the pod	35°

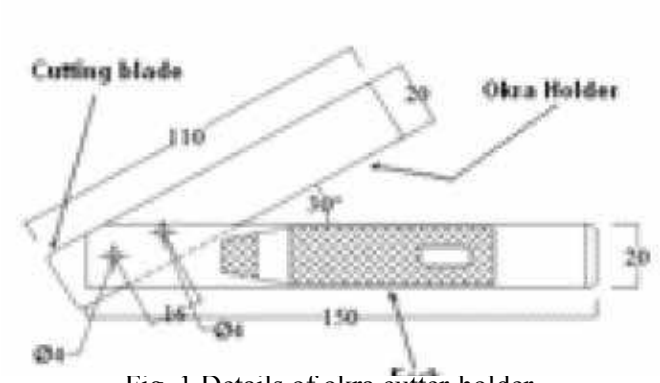

Fig. 1 Details of okra cutter-holder

Operation of tool

The tool is held with the help of thumb and other fingers. The stalk of okra pod is then admitted in the throat between blade and pad. The fork ends are then pressed sufficiently so that the blade would come closer to pad (slot), this process cut the pedicel by shearing and separate the pod. At the end of cutting stroke fork ends come closer and the okra pod is caught by the holders. Then cut okra pod could be placed in the basket or bag without touching it. The operation of the tool is illustrated in Fig. 2.

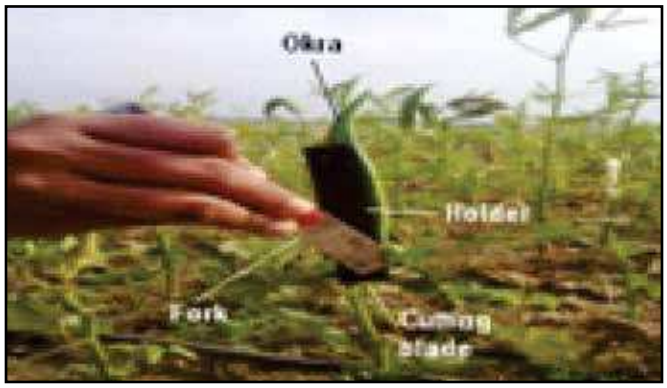

Fig. 2 operation of okra cutter-holder

RESULTS AND DISCUSSION

Functional and operational performance test of the prototype of okra cutter-holder was carried out in the laboratory of Dr. A. S. College of Agricultural Engineering Mahatma Phule Krishi Vidyapeeth, Rahuri by using tender branches of ornamental plants grown nearby the workshop and okra pods with long stalk brought for the specific purpose.

Laboratory test of okra cutter-holder showed that it operated properly and satisfactorily.

Adaptability

Before conducting the field trials, labourers were handed over the prototype and were asked to practice okra harvesting by using them for some time. After giving sufficient practice they were asked to express their views regarding the adaptability of the new tool. All of them given a feedback that the tool is quite handy and convenient for okra harvesting. They confirmed their opinion at the end of field trials. These opinions are given below.

Portability and Ease of Operation

Portability of a tool mainly depends upon its weight. The weight of tool is 102 g so handling and transporting is not a problem. The labourers employed for the field trials also expressed the same opinion. The tool was given to different workers and the feedback was taken to assess the ease of operation. Tool was found handy and easy to operate by the workers.

Harvesting Capacity of the Okra Cutter-Holder

Harvesting capacity of the okra cutter-holder is 297-318 okra per hour (i.e. 10.0 – 10.9 kg/hr). Comparative tests results of okra cutter-holder, straight blade okra plucker, hand picking and okra-cutter-holder shown that Okra cutter-holder could harvest more okra per hour than other methods of harvesting okra (Table 2).

CONCLUSION

The angle between stalk of pod and stem of plant varies from 15° to 20°. The angle between stalk of pod and petiole of the leaf varies from 20° to 25°. The Design of the okra cutter holder was based on these two basic parameters. Quantity of okra collected is 297-318 okra per hour (10.0 – 10.9 kg/hr) which is greater than quantity of okra collected by straight blade plucker method and hand picking method (5.2 – 6.1 kg/hr). The okra could be cut properly without damage. The okra cutter-holder can cut and hold okra pod properly and reduce the injuries due to bristles of the pod to

Table 2. Comparative performance of okra cutter and okra-cutter-holder.

Sr. No	Subject	Age	Okra Cutter		Okra cutter holder	
			Quantity harvested No/hr, kg/hr	Remarks from subject	Quantity harvested No/ hr, kg/hr	Remarks from subject
1	S1	21	180, 6.10	Scratches on hand, hard to operate. pain at center of palm	318,10.9	Easy to Operate, no need to hold the okra.
2	S2	25	172, 5.8	Scratches on hand, thumbs pains after 10-12 min, difficult to operate etc.	308, 10.4	Simple in using, less time required, cannot hold large okra.
3	S3	28	169, 5.75	Unable to hold, scratches on hand, large and extra mature are not cut.	297, 10.0	No scratches, easy to operate. But difficult to cut over matured/large diameter okra.
4	S4	34	176, 6.05	Unwilling to operate, hand pains at thumb and center.	314, 10.6	Some time problem in holding the cutter, no scratches.
5	S5	40	158 ,5.20	Scratches, hard to cut hard okra, pains on palm.	302 10.2	Simple to operate, no scratches.

the hand. Tool was found handy and easy to operate by the workers.

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