

# DEVELOPMENT OF HAND OPERATED OKRA CUTTER

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## ABSTRACT

The okra (*Abelmoschus esculentus*) picking is a laborious and time-consuming work causing drudgery to farm workers. During traditional harvesting the Okra hair like bristles affects the fingers and palm of the workers. In extreme cases, the workers develop skin disease and sores or allergic reaction after a prolonged period of exposure to the pods. In the traditional practice of okra pod harvesting, from ancient times to present era, the workers use knife and sickle for the harvesting of okra which also damage the plants. The review of literature indicates there is no such tool developed so far to protects the plants from damage and the injuries caused to the workers during the harvesting of okra pods. The present study focuses on the development of a hand-operated okra cutter aimed at improving the efficiency and convenience of cutting okra pods for kitchen garden as well as in the farmer's field. An okra cutter has been developed and evaluated in the farmers' field with ergonomic and cost-effective parameters that enhances workers' productivity and reduces cost of harvesting the pods. The result shows that the cutter could harvest around 20 - 22 kg okra per hour without damaging pods and also provides better protection to the fingers and palm of workers.

Keywords: *Okra, cutter, harvester, finger, drudgery.*

## 1. INTRODUCTION

Okra (*Abelmoschus esculentus*) is also known as lady's -fingers, gumbo, or bhindi. It is the main vegetable harvest of the tropical and subtropical locales of the world. It has a place with the class *Abelmoschus* and family *Malvaceous*. Okra is a multipurpose yield esteemed for its delicate and delectable cases. In West Africa, leaves, bud, and flowers of okra are also consumed. The dried seeds give oil, protein, vegetable curd, and an espresso added substance or substitute. Okra dry seeds contain 18-20% oil and 20-23% crude protein. Foliage can be utilized for biomass, and the dried stems act as a wellspring of paper mash or fuel. To a limited extend okra is used in canned, dehydrated, or frozen forms. It has a nutritive worth of 3.21 which is higher than tomato, eggplant, and most cucurbit with the exception of bitter gourd. The development of okra reaches out all through the tropics and temperate Asia.

Okra is low in calories however stuffed brimming with supplements. The vitamin C in okra assist with supporting sound safe capability. Okra is additionally plentiful in vitamin K, which assists your body with coagulating blood. Okra contains cell reinforcements called polyphenols, including nutrients vitamin A and C. It likewise contains a protein called lectin which might hinder disease cell development in people. Concentrates on utilizing concentrated compounds from okra showed they hindered the development breast cancer growth cells by up to 63%. Support heart and brain health, control blood sugar.

Okra is an important vegetable crop widely grown in tropical, subtropical and warm temperature regions of the world. Bhindi requires a long and warm developing season with light humidity. The best season for planting in May-June. Ideal temperature range for a legitimate foundation is 25-30 degree Celsius.

The hand-operated okra cutter holds great potential for improving efficiency and reducing labour requirements in domestic and small-scale commercial settings. Its simplicity, affordability, and user-friendly features make it accessible to a wide range of users, including households, small restaurants, and food vendors. Further refinement and optimization of the cutter's design could enhance its durability, cutting precision, and overall functionality.

At the time of harvesting, the harvesters are face many difficulties. The okra has a hair like bristles and this hair exposure to outer surface of okra which affect the hand of the harvester, which is cause skin diseases sores or allergic. When harvest the okra takes more strength, which is damage the plant. For this purpose, the farmers are used knife and sickle which is also damage the plant. From the recent study there is no such tool available in the local market. Therefore, to minimize above mention problem we have developed a suitable low-cost farmers friendly portable handy okra cutter.

## 2.MATERIALS AND METHODS

### 2.1 Plant/pod parameters of collected from field

Sr. No.	Particulars	Dimensional Range
1.	Length of the okra pod	11-15cm
2.	Diameter of the okra pod	1-2 cm
3.	Diameter of the stalk of the okra pod	0.6-0.7mm
4.	Distance between the two-okra pod	7-7.5 cm
5.	Angle between the stalk of okra pod and petiole of the leaf	20-21 degree
6.	Angle between the stalk of okra pod and stem of the plant	5-6 degree
7.	Height of the okra plant	1-2m
8.	Length of the stalk of the okra pod	1-3cm

### 2.2 Materials required for designing hand operated okra cutter

1. Stainless steel plate
2. Blade
3. Nut bolts
4. hand gloves
5. Spring
6. Measuring scale

### 2.3 Constructional details of okra cutter

The okra cutter tool was developed on the basis of the physical data of the okra plant during harvesting. The cutter is having least number of parts for low maintenance and easy operation. It consists frame, nut bolts, blades, spring and gloves as shown in the Fig. The frame is constructed of stainless steel. For making an okra cutter frame we have taken 3 pieces of stainless steel of 4.5×2cm, 5×2cm, and 6×2cm long. Stainless steel has durability, sustainability, easy to work, stiffness is high, low self-weight and noncorrosive. The bolt includes of a head and a cylindrical body with screw threads along a portion of its length. The nut bolt helps bleed fixed with the frame and also used to adjust the cutter according to the required finger diameter of a



farmer. Blades can be constructed of variety of materials. The most well-known being carbon steel, stainless steel, tool steel and alloy steel. Our blade is also made up of stainless steel. The blade is non corrosive in nature, strong, sharp and durable. Due to the sharpness in nature, it will help for faster cutting of okra pods and also consume time. The gloves made up of polyvinylchloride (PVC) and different type of rubber which is flexible in nature. The spring is flexible in nature which is gives free movement to the finger when the harvester harvested the okra pod. Here we use spring because it is fitted in every finger according to its structure and gives comfortability and also give protection from the blade to the index finger to a farmer to harvest the okra pod.



Fig.1 Frame



Fig.2 Nut bolts



Fig.3 Blades for 3 mm cutting edge



Fig.4 Cutter with 3mm edge



Fig.5 Blades for 5mm cutting Edge



Fig.6 Cutting with 5mm edge

## 2.5 Operation of tool

The tool has two parts (a) first part which consists of the blade fits to the thumb and (b) the second part consisting of spring used for safety precautions fits on to the index finger. The blade enters between the stalk of okra pod and stem of okra pod to cut the stalk. During the cutting of okra pod the position of blade is outside the stalk and the spring position is between the stem and stalk. Then detached okra pod is placed in the basket or bag. The operation of the tool is illustrated in Fig.7.



Fig.7 Operation of okra cutter in the farmers field at Angarpada block

## 2.6 Adaptability

The adoptability of a hand-operated okra cutter refers to its suitability and ease of integration into various environments, such as kitchen garden, small farms and commercial farms. In this case, the hand-operated okra cutter is designed specifically for cutting okra, which means it may have limited adoptability compared to more versatile kitchen tools. However, within the context of okra preparation, it can be considered highly adoptable. Its simplicity and compact size make it suitable for use in both domestic and small-scale agricultural settings.

## 2.7 Portability

A hand-operated okra cutter is typically compact and lightweight, making it portable and easy to transport. Its size allows for convenient storage and carrying, enabling users to move it between different locations as needed. This portability is advantageous for individuals or small-scale farmers who may need to use the okra cutter in multiple settings, such as harvesting okra in the field and then processing it in a kitchen. However, it's important to note that the specific design and construction of the okra cutter can impact its portability. A well-designed cutter with a sturdy handle and secure blades will ensure safe and hassle-free transport.

## 2.8 Ease of operation

Hand-operated okra cutters are generally designed to be user-friendly and easy to operate. Those typically feature a straightforward mechanism that requires manual input, such as squeezing or pressing, to cut the okra. The simplicity of the operation makes it accessible to individuals with varying levels of expertise, including both experienced users and those new to okra preparation. The ease of operation is further enhanced by the fact that hand-operated cutters generally do not require any external power source or complex setup. However, like any tool, there may be a learning curve involved in using the cutter efficiently, but with practice, users can quickly become proficient in its operation.

## 3.RESULT AND DISCUSSION

The field observations with three workers for 3mm cutting edge blade is presented below with information on heart rate and rate of harvesting.

Table 3.1 Observation with 3mm cutting edge blade



Sr. No.	Worker	Heart rate (in PRbpm) before harvesting	Heart rate (in PRbpm) after harvesting	Operation Time (minute)	Quantity harvested (kg)	Rate of harvest (kg/hr)
1.	Female 1	85	83	15	3.0	12.0
2.	Female 2	87	88	15	2.9	11.6
3.	Male	93	90	15	5.0	20.0

From the above observation the heart rate of female 1 and 2 is almost same, that's why the quantity of okra harvested is almost same i.e., 12kg/hr and the heart rate of male is higher than females and the quantity of okra harvested is 20kg/hr. Generally, males have more strength and energy than females. The male subject could harvest 20kg/hr as compared to female 1 and female 2.

The field observations with three workers for 5mm cutting edge blade is presented below with information on heart rate and rate of harvesting.

Table 3.2 Observation with 5mm cutting edge blade

Sr. No.	Worker	Heart rate (in PRbpm) before harvesting	Heart rate (in PRbpm) after harvesting	Operation Time (minute)	Quantity harvested (kg)	Rate of harvest (kg/hr)
1.	Female 1	73	78	15	3.7	14.8
2.	Female 2	72	83	15	3.5	14.0
3.	Male	85	91	15	5.5	22.0

From the above observation the heart rate of female 1 and 2 is almost same, that's why the quantity of okra harvested is almost same i.e., 14kg/hr and the heart rate of male is higher than females and the quantity of okra harvested is 22kg/hr. Generally, males have more strength and energy than females. The male subject could harvest 20kg/hr as compared to female 1 and female 2.

From the above Table 3.1 and Table 3.2, we observed that the capacity of harvesting of both the male and female have increased when the cutting edge of the blade increased from 3mm to 5mm. The female harvested quantity is 2kg/hr higher as compared in 3mm and 5mm cutting edge. The male harvested quantity is also 2kg/hr higher as compared in 3mm and 5mm cutting edge. The harvesting capacity of the 5mm cutting edge blade is more than the 3mm cutting edge blade.

### 3.1 Feedback of workers on usage of okra cutter

The worker gives the feedback after using the tool that, the tool is convenient to use, comfortable to wear, when they are harvested without the cutting tool it will take more time but when they use the okra cutter it takes less time. It will protect from the hair like bristle, which causes skin disease.

## 4. CONCLUSION

As per the results of the study on okra cutter usage in okra harvesting and their role in reducing injuries of farm workers, it was observed that they prefer okra cutter and it was also observed that they need protection to both hands and trees while harvesting. Created awareness to farm worker and used this okra cutter for their profitability. The willingness adaptability rate of the okra cutter was good. The farmers have gained knowledge in okra cutter and how to use it. Using okra cutter while harvesting okra gives proper protection to the finger and palm also trees especially from cuts, bruises rashes, itchiness etc., and reduced the drudgery in the finger and palm observed farm workers. Hence, the harvesting capacity of 5mm blade is more than 3mm blade. The construction cost is very less as compare to other tools.

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