COTTON PICKERS, CONSTRUCTION AND WORKING PRINCIPLES

Mechanical Pickers: The cotton picker performs the work of hand picker in that only the locks of seed cotton are removed from the plant. There are four ways of classifying cotton pickers. They are by method of mounting, by number of rows harvested, by height of picking drums and by type of spindle used. It can be tractor mounted machine or self-propelled of one or two-rows. In this, the cottonseed is removed from open bolls; whereas, green and unopened bolls are left on the plant to mature for later picking. A mechanical picker consists of a device to guide cotton plants to come into picker, device to remove cottonseed from open bolls; a conveying system for picked cotton and a storage basket. These machines should be capable of gathering mature cotton with a minimum of waste and without causing serious damage to the fiber plant and unopened bolls. The high yielding, long fibers and open-boll varieties of cotton are defoliated before the first picking.

Functional components of a mechanical picker

Following are the basic components of a mechanical picker
i) An arrangement for guiding the plants into the picking zone and providing necessary support while the seed cotton is being removed.

ii) Devices to remove the cotton from open bolls.

iii) A conveying system for picked cotton

iv) A storage basket or a container in which picked when is stored temporarily.

Spindles: The basic principle of a revolving spindle penetrating the cotton plant, winding the seed cotton from the open boll and retreating to a doffing zone is employed by all commercial pickers. The rearward movement of the spindles while in the picking zone is substantially the same as the forward movement of the machine so that the spindles do not move forward or backward with respect to the cotton plant. Each rotating spindle merely probes straight into the cotton plant from the side of the row, works on an open boll and then withdraws straight to the side with a minimum disturbance and damage to the remaining plant.
The spacing of spindles (1½ x 1½) is such that they can slip past unopened boll and leave them onto the plant to mature for a later picking.

**Drum type spindle arrangement:** The mechanical cotton pickers have either tapered spindles or small-diameter straight spindles. Spindles are carried either on bars arranged in vertical drums or on vertical slats attached to endless chain. Tapered spindles, commonly employed on drum-type pickers, have 3 or 4 longitudinal rows of sharp barbs for engaging the cotton bolls. Tapered, barbed spindles enter the plant perpendicular to row and wound the exposed lint on the berbs. As the spindles passes slowly, faster rotating rubber-faced buffers remove lint. Speed of spindle varies from 1850 rpm at forward speed of 2.9 km/h to 3250 rpm at 5.0 km/h. Speed of spindle influences the picking efficiency for fluffy bolls and increases from 80% at 700 rpm to 95% at 2300 rpm. The loss at higher speed is mainly due to cotton thrown by spindles and loss at lower speed is mainly due cotton left in burs. Straight spindles are longer than tapered type but smaller in diameter. They may be round or square and may have smooth or rough surface. In general, picking ability of pickers depends upon the spindles being wet when they come in contact with cotton. A stationary cam and followers on the bar achieve the proper orientation of spindle bars in relation to crop row. The two drum picks up from the two sides of the row in succession spring loaded adjustable pressure plate opposite each drum crowds, the plants towards the spindle in the picking zone. In current high drum machines the front drum has 15 or 16 spindles bar and rear drum has 13 or 12 bars, with 20 spindle per bar. This gives a total of 560 spindles per row of cotton, each spindle requiring a precession fit sleeve bearing and being driven through.
the bevel gear by a shaft inside the spindle bar. They are suitable for low growing or medium height cotton. The proper orientation on the spindle bar in relation to row is obtained by means of a stationary cam and a follower in the bar.

**Chain belt spindle arrangement:** The picking process with a chain belt unit is essentially the same as with the drum type picker although the chain belt principle permits the spindle to remain in picking zone for a longer time. The spindle is normally straight. The standard-height-picking unit has 80 vertical slats each with 16 spindles. High units have 22 spindles per bar. Each spindle is rotated by means of a roller in contact with a stationary, rubber drive rail, but only while on the picking side of unit. Guide strip hold the chain in position between the main sprockets and provide a curvature for moving the spindles laterally into and out of row. Each slat is pivoted between the upper and lower chains. While the spindles are being rotated, the action on the drive rails maintains the spindle in a position normal to curvature of the drive rails.

**Spindle moistening:** Spindle of either type are moistened with waters for two reasons:

a) As an aid in picking because of cotton adheres better to a wet steel surface.

b) To keep spindle clean as some gummy substances stick while these are in picking unit. Some wetting agents are also used which reduces the amount of water required for moistening and at the same time makes it more effective.

A spindle moistening system is provided for each picking unit, water being metered in equal amount to each spindle. Application
is made to each spindle just before it enters the taking zone, by means of a specially designed rubber wiping pad. Water is applied to each spindle just before entering the picking zone by means of a specially designed rubber-wiping pad. The seed cotton is removed from spindles by means of rotating doffer plates. The clearance between surface of spindle and rubber lugs on the doffer should be 0.25-0.75 mm. A pneumatic conveying system is used to move the cotton from the doffing area to storage basket on the picker. The cotton is blown through the discharge ducts against cleaning grates in the basket lid and during this process some of the trash from seed cotton is removed.

**Removal of cotton from the spindle:** On machine with tapered spindle, the seed cotton is removed from the spindle by means of rotating doffer plates. The cotton is forced off as the dogger lug moves over the spindle surface toward the tip. With small diameter straight spindles stripping is accomplished by moving the spindles axially through the space between the closely fitted stripper shoes. Tapered spindles are rotating when doffed, whereas small diameter straight spindles are not.

**Conveying and carrying:** A pneumatic conveying system is used to move the cotton from the doffing area to storage container. The cotton is blown through the discharge duct against cleaning grate in the storage basket lid. This action removes some of the trash from the seed cotton. Machine with dual picking unit have 2 separate elevating systems to provide more uniform and positive conveying from each unit. Some machine use off set arrangement to eliminate contact between the cotton and the fan blades. Storage basket is ordinarily carried on picker with capacities generally in the range of 900 to 1300 lbs for single row machine.
and 2000 to 3300 lbs for 2 row units. Basket is emptied by with hydraulic cylinder.

**Performance of cotton pickers:** There are many factors that affect the performance of cotton pickers. Cotton pickers perform best when cotton plants are of medium size. Medium-sized plants flow through the machine and permit the spindles to engage the cotton better than large plants with many long limbs. The machine requires a well-opened boll with locks that are fluffy and fiber that is long enough to wrap around the spindle. Chemical defoliation is generally done before the picking operation, which helps the simultaneous opening of most of the cotton bolls. A delay in picking and early opening of cotton boll result in atmospheric damage to the exposed cotton fiber. A slight elevation of the soil at the base of plant and weed-free fields are essential for better performance of cotton pickers. Fairly thick and uniform spaced plants aid the performance of mechanical cotton picker.

**Manually-operated Cotton Picker:** Manually operated cotton picker using an endless chain with picking fingers has also been developed. The device is carried by operator and can remove 90-95% of cotton lint. As much as 2% of cotton lint is dropped on the ground. It can pick up to 18 kg/h of cotton lint with trash content of 18.5%.
COTTON STRIPPERS, CONSTRUCTION AND WORKING PRINCIPLES

Cotton stripping machines are of single steel roller, double-steel roller or finger type. Double-brush nylon rollers used in place of steel rollers gives better performance. A plant population of 75-125 thousands per hectare in 1.2 m rows is commonly recommended for stripping harvesting. The double-roll cotton stripper may be centrally mounted on the tractor or it may be self-propelled. There are three different methods of conveying cotton from stripping unit viz. finger-beater rolls, augers and air. The finger-beater rolls are used with finger-type strippers. Auger-type of conveyer is suitable for roller-type strippers. Much dirt and trash can be screened out of the cotton through openings in the housing under the conveyers particularly where revolving beater conveyers are used.

Mechanical strippers

There are several factors that have contributed to popularity of strippers in preference to pickers. These are:

i) Lower initial investment & maintenance cost
ii) Better adapted to improved cotton varieties
iii) Improved ginning equipment for separating trash
iv) Trend toward closer row spacing
v) Good recovery of cotton in the field
vi) Higher harvesting speeds
vii) Suitable for picking and cotton suitable for stripping. Stripping a variety that produces a wide, spreading plant with numerous vegetative and fruiting branches results in low recovery of cotton and excessive field losses.
Varieties for narrow row planting should have the general characteristics indicated above for conventional row strippers varieties. However because of higher plant population fewer bolls per plant are needed to produce a given yield. Cotton bolls exhibiting too much of storm resistant characteristic although well adapted to striping are difficult to pick mechanically. The size of plant, the type of growth and the nature of the boll all have more influence on the efficiency of the mechanical picker than does yield. Where the plant characteristic are suitable, a machine will pick up high yielding cotton just as efficiently as it will low yield cotton.

**Performance of mechanical cotton strippers:** There are many factors such as plant characteristics, cultural practices etc affects the performance of all types of mechanical cotton strippers. The desirable plant type for cotton stripper is one which has relatively short-node fruiting branches 20-25 cm in length, less in height and has a stormy-resistant boll. The locks of story-resistant-type cotton are usually not very fluffy and are held tightly in the soil. Fluffy and loosely attached locks are easily caught and held between limbs and thus are pulled through the stripping space and lost. Every effort should be made to keep the field free of weeds, grass and vines. Pieces of grass collected with cotton are difficult to remove and if present in excess reduce the quality of cotton lint. The design and type of stripping unit also affects the performance of strippers.
SUGARCANE HARVESTERS - CONSTRUCTION AND WORKING PRINCIPLES

Sugarcane harvesting involves base cutting of the crop, detopping, detrashing, bundling, loading and transportation. Detopping and detrashing of crop itself takes about two-third of manpower required for harvesting. Several types of sugarcane combines and harvesters are used world over. They are normally used for crops, which are burnt in the field prior to harvesting for trash removal. Some harvesters are used in green crop and cane is burnt in windrow after harvesting. Some machines have been developed which can be used in the cane field without burning. This is particularly done where environmentalists object burning of cane. The sugarcane combine is a one-pass machine, which cuts the cane, detops, cuts in billets, cleans and conveys to transport cart/trolley. In case of sugarcane harvester, it cuts the crop, detop and put on the ground in windrow, which are loaded in trolleys by mechanical loader or grabber. Combine harvested cane must be processed within 16 hours to avoid deterioration and sucrose loss. Most of the sugarcane combines and harvesters is self-propelled machine. However, some tractor-drawn machines are also available. Some of the most widely used sugarcane harvesting systems are discussed below.

Push-rake system: Push-rake system involves pushing and piling of sugarcane. It is made of very sturdy tines welded to a frame. It is mounted in front of tractor. When machine is pushed into standing cane in the field, it breaks the stalks off at the surface of ground and leaves them in piles. The piles of cane is then loaded into truck and delivered to the mills. The main drawback
of this machine is that the cane is not topped and cane delivered to mill contains $\frac{1}{4}$ to one-third of trash. It uproots cane plants, which results in poor ratoon crop.

Windrow harvest system: In this system, sugarcane is cut and windrowed. It has V-cutter harvest system and soldier type harvester. The V-cutter harvest system has two circular horizontal blades spaced at 152.4 cm. The machine cuts the cane in the field and makes a windrow of two rows. The crop harvested by this machine has also a very high percentage of trash. The unit is mounted on a track-type tractor. The front end of the machine can be raised or lowered hydraulically for transport and field
operations. The effective field capacity of the machine is about 0.8ha/h.

**Soldier-type cane harvester** tops the cane, cuts the cane from base and places in windrow for mechanical loading. It cuts one row of green cane at a time. A topper with a gathering chain and two discs remove the top from standing crop and drop towards right of row being harvested. Two sets of pick-up chains arranged in a V are used for picking and feeding the cane to the base cutter. The harvested cane is conveyed through a cane conveying system to the windrow. Both the operations of topping and base cutting are performed simultaneously. It does not uproot the cane and its capacity is about 0.4 ha/h.

**McConnel sugarcane harvesting system:** In this system, the machine is mounted on a tractor of 75-90 hp. The machine cuts the top green portion of sugarcane, harvests from the base, cleans the cane and places in a windrow. The cane is further cleaned by labour and loaded manually or mechanically in the truck. It harvests one row at a time.

**Cut-crop-harvest or combine harvest system**

All harvest system described so far namely push, pile and grab system and windrow harvest system have one operation in common. It is the cane being placed on ground for loading after cutting. This operation is partly responsible for cane left in the field and soil and rocks delivered to the mill. A combine harvest system eliminates this operation. The basic components of a sugarcane combine are:

(i) Gathering mechanism
(ii) Topping mechanism

(iii) Base cutter

(iv) Feed conveyor

(v) Chopper

(vi) Elevator

(vii) Cleaning by air blast

**Gathering mechanism:** Its function is to separate sprawled cane and align the row to be harvested. They are made of revolving scrolls fitted on gathering walls. It consists of two triangular walls, approximately 140 cm apart at the tips and converging to the throat width of the machine just forward of the base cutters. The tips of each wall are fitted with ground engaging points to get under and lift stalks that are lying on the ground.

**Topping mechanism:** Its job is to gather, cut and discard nonproductive tops. The gathering operation is performed by gathering chains while cutting is done by a horizontally rotating disc fitted with mower blades which cut against a fixed anvil.

**Base cutter:** Its function is to cut the stalk at or just below ground level. At least one manufacture uses twin contra-rotating discs fitted with a number of replaceable knife blades. Some use single diameter blades for base cutting the cane. Researchers have found that tip speeds below 304.8 m/min do a very poor job of cutting. Recommended tip speeds for Florida conditions is 1524 to 1828 m/min.

**Feed conveyor:** Its function is to convey the whole stalks of cane from the bass cutter to the choppers. In some machines it is made
of endless chain slat conveyor. In others a series of rollers are used. In some machines augers are used for feeding cane to the chopper.

**Choppers:** Their function is to receive the whole stalks from the feed conveyor and chop them into short uniform billets. The design used by Massey Ferguson is a pair of parallel shafts each with paddle shaped blades, which as they rotated came together in the plane containing the shafts, and so gave a flying or travelling cut. There is other mechanism used for chopping. However, flying cut mechanism has the advantage of being aggressively self-feeding, and that once the swath is engaged by the chopper; it will be pulled in continuously until broken or forcibly interrupted.

**Elevator:** Its function is to receive the billets from the choppers and convey them into a receptacle for transporting to the mill. An inclined chain and slat conveyor is used. The elevator can be rotated 180 degrees in most machines. This facilitates in opening of the field and harvesting in either direction.

**Air-blast cleaning:** One of the biggest problems with mechanically harvested cane is the foreign matter in cane delivered to the mill. Foreign matter consists of leaves, tops, dirt, stones and many other materials picked from the field. In some machines one while in others two fans are being used for extracting leaves and dirt from the cane. M.F. 205 has two extractors one at each end of the Elevator.

The basic components combined in a frame and provided with a power unit and vehicle, constitute a cane combine (Fig. 3). It is generally powered with an engine of about 150 hp.
a. Topper  b. Forward feed roller  c. Base cutter  d. Feed roller
e. Butt lifter  f. Intermediate feed roller  g. Smooth top roller  h. Floating feed roller
i. Fixed feed rollers  j. Chopper system  k. Chopper delivery roller
l. Air inlet roller  m. Anti-trash roller  n. Primary extractor  o. Trash directional control
p. Elevator  q. Secondary extractor
SUGARCANE HARVESTERS - DESIGN CRITERIA

While designing the sugarcane harvester agronomical practices followed in the different parts of the country and other details as given below should be kept in mind:

(i) Agronomical practices followed in the different part of the country

(ii) Height of cane (range)

(iii) Stem diameter of cane (range)

(iv) Row-to-row spacing being followed (range)

(v) Moisture content during harvesting (range)

(vi) Method of planting- Ridge planting or flat planting

(vii) Lodging conditions

(viii) Expectations of the farmers/users about field capacity, speed, price and cost of operation

Sugarcane combine harvester: In this system, sugarcane is cut first from the top and then from the base and it is cut into billets and is loaded in transport cart. It does not require separate loader for loading purpose. The machine consists of gathering mechanism, detopping mechanism, base cutter, feed conveyor, chopper, and elevator and cleaning unit (Fig. 3). The machine is generally powered by the engine of 150 hp. Pre-harvest burning is being practiced where harvester is to be used. Mostly it can harvest cane grown at a row-to-row distance of 90 cm. The average capacity of the machine is about 0.4 ha/h. It is most sophisticated machine among all types of sugarcane harvesters.
**Engine operated sugarcane leaf stripper:** This is a portable engine operated machine used for the detrashing and leaf stripping from whole cane. The sugarcane without leaf require less space for storage as well as transportation.

**Whole stalk sugarcane harvesters:** These harvesters are quite suitable for those areas where sugarcane crushing is not possible within short period of harvesting. Delay during transport, loading, unloading, waiting at one or the other stage is unavoidable. Use of whole stalk sugarcane harvesters is also useful for those areas where green tops recovered are used for cattle feed. Such machines are either tractor operated or self-propelled. Introduction of such machines in phases is possible even in those areas where sugarcane is not lodged, canes may be bent up to 10 - 15°. There are only few designs of whole stalk harvesters in use in the world because of difficulty in handling of lodged cane by these machines. Therefore, whole stalk harvesters with base cutting, de-topping and partial de-trashing for erect, medium to low tonnage crop areas may be introduced, especially under those locations where self-stripping / erect type cane varieties are common. Windrowing type
harvesters may be backed up by grab loaders. These machines includes Case Austoft, Moller bin type, Cameco whole stalk, tractor operated Carib, Bonnel & Bunmai harvester windrower. Presently production of this type of machine is almost stopped.
PRINCIPLES OF FRUIT HARVESTING MACHINES

In India, very little efforts have been made to mechanize harvesting operation on fruit and vegetables. It is mainly due to availability of abundance of labour and lack of organized large-scale fruit or vegetable farming. However the nation’s cereal requirements are now being met through systematic approach and importance of fruit and vegetables production is in the process. Now the trend is emerging towards the organized fruit and vegetable farming. As this trend will continue, there is a need to develop simple mechanical devices for harvesting fruit and vegetable. In traditional method of harvesting tall tree fruits such as mangoes, palm, coconut etc many serious accidents happen every year. By developing simple mechanical harvesting devices may avoid such accidents or reduce it.

A lot of efforts have been made towards the fruit and vegetable harvesting, abroad. Harvest mechanization has reached a high level of success and acceptance for number of crops. Successful mechanization of these operations requires a systems approach and need the joint efforts of engineers, plant physiologists, food scientists and others. Mechanical harvesting often causes a reduction in harvested crop value per unit area mainly due to

- Crop do not mature uniformly,
- Fruit and vegetable damage,
- Actual field losses, and
- Reduction in quality.
**Fruit Harvesting**: There are varieties of fruits available, which need to be harvested at their maturity. Many fruits do not mature uniformly, which needs several pickings to obtain maximum yields. In general fruits can be categorized into three types, namely, tree fruits, vine fruits and bush fruits. Tree fruits are mangoes, apples, papayas; vine fruits watermelon, muskmelons etc and bush fruits are raspberries, blueberries, cranberries etc. Various principles and devices have been tried for harvesting fruits and are described below:

**Tree fruit harvesting using shake and cater principle**

This type of machine works on the principle of accelerating each fruit so that inertia force developed will be greater than bonding force between the fruit and the tree. The shaking machines based on this principle are already in use for fruits like walnut, almonds etc. Tractor mounted cable shakers, fixed stroke boom shakers and boom type impact knockers are basically used for nuts. Impact knockers are preferred for almonds, because they are large and rigid trees. An impact knocker makes impulses with the help of mechanical, hydraulic or pneumatic means. An electric wheel or crank on the tractor drives fixed stroke boom shakers clamped to the limb of tree. It may also be powered through self-propelled unit.

Fruit like apple, mangoes and pears can be harvested by shaking and catch method. The tree trunk or limb is shaken with a vibratory member and fruits are caught on canvas aprons. In some of the machines fruits may be dropped right on the ground. The methods for fruit removal from tree are limb shaking boom and inertia type, trunk shaking, and persuading air and vibration. Inertia type shakers are preferred over the stroke shakers. In an
inertia shaker, the exciting force is derived from acceleration of a reciprocating mass or two opposite rotating eccentric weight. Both arrangements are so designed that it provides sinusoidal or nearly too sinusoidal force vibration. The shaker is generally mounted on the catching frame itself and therefore needs other vehicle. In the trunk shaker type machines, the fruit removal occurs simultaneously over the entire tree and the falling fruits are distributed over the entire catching space. It requires a considerable amount of power and is not suitable for very large trees.

The clamp stroke length for inertia shaker having exciting frequency larger than the fundamental frequency of tree component, can be computed by using the following equation:

\[
L = \frac{2rW}{W_t + W_f}
\]

where,
- \(L\) = Length of stroke, m
- \(r\) = Eccentricity of the unbalanced mass, m
- \(W\) = Total weight of unbalanced mass, kgf
- \(W_t\) = Total weight of shaker, including the unbalanced mass, kgf
- \(W_f\) = Effective weight of the tree component being shaken (limb/tree) kgf

It has been observed that, usually the effective weight ‘\(W_f\)’ of tree component of trunk having a diameter of 12 to 28 cm varies from 365 to 450 kgf and for limbs of diameter 5 to 15 cm ranges from 10 to 30 kgf. Operating frequencies vary from 400 to 1200 cycles per minute for limb shaker and 800 to 2500 cycles per minute for trunk shakers. For delicious fruits, stroke length ranges from approximately 10 to 20 mm for trunk shakers and 38 to 51 mm for limb shakers. The catching units have low profile collection surfaces that extend under the tree, covering all or most of the area to the outer periphery of the tree. Some of the most
commonly used catching arrangements are the inverted umbrellas wrap around type and the pained catching units. A good catching design minimizes the fruit damage.

**Manual fruit harvesting device:** There are two types of manual fruit harvesting devices. One unit works on the principle of individual cutting of fruit by sickle or blade and collecting it in a bag. In this unit, there is a telescopic boom, which can be fixed at required height through adjustable mechanism. Cutting units consists of two blades, one fixed and other movable. The movable blade is moved with the help of wire string. The individual fruit is cut and collected in the attached bag. This mechanism is very much suitable for fruits, which may get damaged if they fall freely on the ground like coconut, orange, mango, papaya and similar such fruits.

The other type of manual fruit harvester is based on the principle of shaking the branches or trunk of the tree. It consists of two tongs, adjustable to different heights by means of extension bars. A crank arrangement, to be operated manually and provided with flywheel to shake the tree at proper frequency, is connected to tongs and placed on the ground. The tongs are fixed with main branch of the tree and shaken to detach fruit. In order to save fruit from damaging, a net around tree can be stretched to collect falling fruits.

**Harvesting of tree fruits with man positioners:** Fresh fruits for marketing in the fruit markets are picked up by using a device called man position. In this device, a self-propelled machine is used which has an arrangement to position the worker’s platform at three-dimensional direction. Picking platforms and other types of man positioners may reduce harvesting cost. This type of
machine can have multilevel picking platforms, which can move along continuously and worker can pick the fruits. The fruits can be put in bin or conveyors.

**Citrus harvesting:** Citrus fruit like orange, kinnow, malta and similar such fruits can be harvested by using inertia type limb shakers. It can also be harvested by using an oscillating air blast. In one arrangement, air at very high speed is discharged from 2 outlets, which is directed towards one side of tree as the machine moves down the row. This system is attractive because of its high potential capacity. Fruit removal percentage varies from 60 to 90%.

**Grape harvesting:** Development of grape harvesting machine is complicated due to number of reasons, like variety difference, raising methods, topography etc. Attempts have been made to harvest grapes with vertical stroke harvesters, which have one impacted per row. This is a self-propelled machine, which may have a stroke of 12 cm or more, with frequency of 250 to 500 rpm. In this machine, shaking is carried out by slopping the vines from the sides.

**Can fruits, bush and strawberry harvesting:** Machines that provided with vibrating devices could harvest bushy fruits such as blueberries, blackberries, and raspberries. One type of harvesting machine has radial, vertical vibrated fingers on free turning vertical cylinders. In other type of design, horizontal stroke peddles or panels of fingers vibrated vertically or horizontally. In such devices leaves are taken out with the help of air blast. It also removes other lighter materials from harvested fruit. It has been observed that blueberries and can fruits ripening takes several weeks and hence it makes necessary to have
multiple harvesting. Selective mechanical harvesting is possible because mature fruits detach more easily than immature fruits. Strawberries are low growing, easily bruised and highly perishable and require multiple harvesting when picked manually by hand. Because of above problems, most of such harvesting machines have some stripping or combing type of mechanism. Leaves and other lighter materials are cleaned with air blast. In this type of harvesting machines some immature fruit also comes up which are removed by hand.
TYPES OF FRUIT HARVESTING MACHINES

Hold on and twist type

It is a manual-harvesting tool with which individual fruit is first held between two jaws of the device and then twisted to shear off the stock. The jaws are made of 14 gauge mild steel sheet. These are held together by a tension spring on a pivot fitted on 10 mm mild steel rod. A handle can be fitted to the tool. One of the jaws has a lever bracket and rope arrangement for operating the jaw. Three mm thick rubber sheet padding is provided on inside of the jaws to avoid any skin damage while holding the fruits. After its detachment, fruit is released by pulling the cord in to a ring. A cloth conveyor or net is provided below the jaws for collection of harvested fruits at ground level without any damage. The tool is suitable for harvesting peach, pear and orange. Its field capacity is 250-300 fruits /man-h.

Manually Operated Sapota Harvester

The harvester is used for harvesting of small fruits like lemon, sapota etc. It consists of main body of PVC having cylindrical shape. The upper end of the body is closed while bottom end is open to which nylon net for collecting the fruits is tied. A stretched string closes the other end of the net. A gate is made on the body for entry of the fruits to be harvested. On the lower surface of the body a metal holder is fixed to hold the
bamboo of required length. Two fingers cut in V-shape and with small sharp blades are provided at the closed end of the body of the harvester. The fingers help to select and hold the fruit to be harvested from the bunch. By pulling the harvester, fruit is detached from the bunch, which falls in the body and rolls into the net. To unload the harvested fruits in the net a stretched string at the closed end of the net is loosened.
HARVESTING OF FRUITS FROM TALL TREES

Tree climber

In order to harvest coconut and arecanut at faster rate with proper safety, TNAU, Coimbatore center has developed a tree climber. The developed tree climber is free from any accident risk during its operation.

Constructional Details: The climber made of M.S. square pipe consists of two components. Adjustable belts connect the components. The upper component is provided with a seating arrangement and lower component is having provision for holding the foot. The rubber cushioning is provided at the portion of frames, which comes in contact with tree to avoid any damage of tree.

Performance of machine:
By standing on the lower component, the upper component can be moved up or down over the tree (Fig. 1). The operator can safely climb a tree of 10 m height in 1.5 min without any risk.