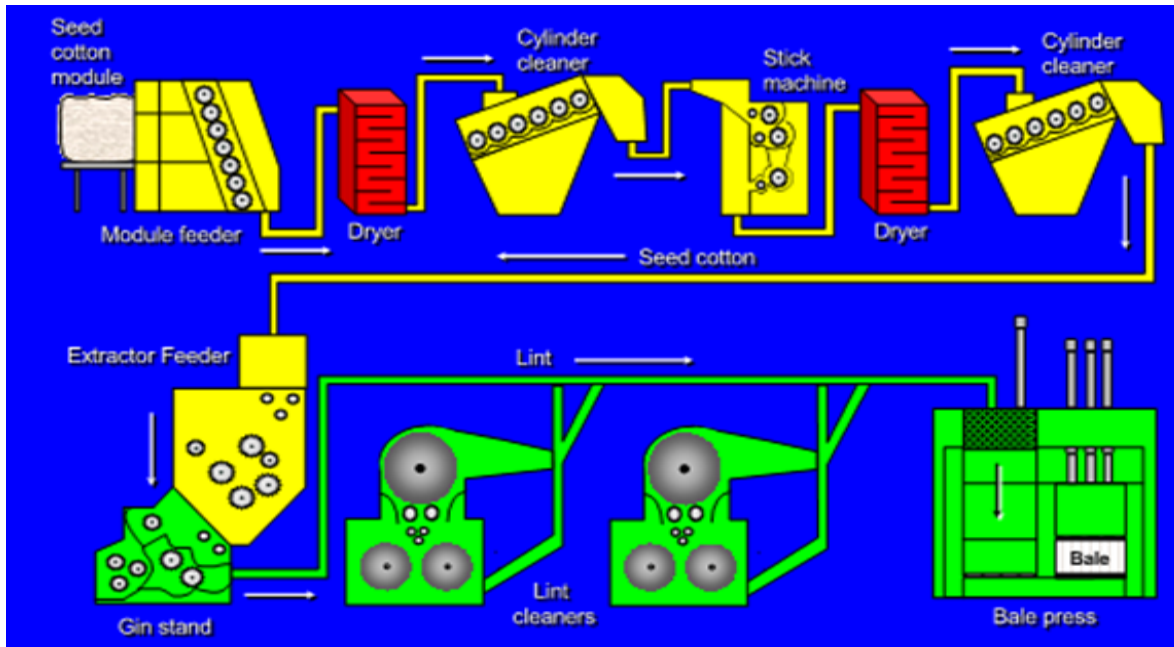


# Ginning and Spinning Operation

## LEVEL – I

Based on March 2022, Curriculum Version 1



**Module Title: - Ginning Operations**

**Module code: IND GSO1 M06 0322**

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## Acknowledgment

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## Acronym

LAP : Learning Activity performance  
PPE: Personal Protective Equipment  
SOPs: Standard Operating Procedures  
WHS: Workplace Health and safety

## Introduction to the module

Ginning is the process of separating cotton fibers from the seed bolls. It is the first mechanical process involved in processing cotton. Ginned cotton referred to as lint and it is used for spinning operations, where lint is converted to yarn.

A cotton ginning is a machine that quickly and easily separates cotton fibers from their seeds, allowing for much greater productivity than manual cotton separation. This process removes foreign matter, control moisture and remove other contaminants that significantly reduce the value of the bale.

Cotton fibers are produced in the seed pods (“bolls”) of the cotton plant; as a result, the fibers (“lint”) in the bolls are interspersed with the seeds. The seeds must be removed from the lint to make the fibers usable.

### This module covers the units:

- Job requirements
- Ginning operations
- Bale or Mote press operations
- Operator Maintenance
- Waste materials disposition
- Product Quality
- Process information

### Learning Objective of the Module

- Determine job requirements
- Perform ginning operations
- Perform bale or mote press operations
- Carry out operator maintenance
- Dispose of waste materials

- Monitor product quality
- Communicate process information

### Module Instruction

For effective use these modules trainees are expected to follow the following module instruction:

1. Read the information written in each unit
2. Accomplish the Self-checks at the end of each unit
3. Perform Operation Sheets which were provided at the end of units
4. Do the “LAP test” given at the end of each unit and
5. Read the identified reference book for Examples and exercise

## Unit one: Job Requirements

This unit is developed to provide you the necessary information regarding the following content coverage and topics:

- Standard operating procedures (SOPs)
- Work health and safety (WHS) requirements
- Appropriate personal protective equipment (PPE)
- Job requirements

This unit will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Follow Standard operating procedures (SOPs)
- Know Work health and safety (WHS) requirements
- Use Appropriate personal protective equipment (PPE)
- Determine Job requirements

### 1.1 Standard operating procedures (SOPs)

Standard Operating Procedures (SOPs) are top-level documents. They describe what actions are to be taken under certain circumstances. An SOP enforces the process of getting tasks or activities completed.

Elements of Standard Operating Procedure Workflows

1. **Input:** These are the resources needed to perform the given steps. Examples of input include team members, machinery, raw materials, assets, and other workflow tools.
2. **Transformation:** Also referred to as *processes*, this workflow aspect refers to the workflow steps that illustrate how to apply the input. Predefined rules are the building blocks that lead to the third element—output.
3. **Output:** This includes the planned physical product, service, or desired outcome. It's worth emphasizing that output isn't limited to deliverables. For example, an onboarding workflow would result in a skilled employee who is now an asset to the organization.



## 1.2 Work health and safety (WHS) requirements

### A. Lifting techniques

Many back problems can be prevented or cured with exercise, weight control, and proper use of the back. The stresses placed on the back during manual lifting are due to a combination of the weight of the object being lifted and the lifting techniques. When lifting heavy objects from the floor/ground can't be avoided, here are some basic principles to prevent back pain and injury:

- Lift only loads you can safely handle.
- Establish good footing.
- Keep the load close to the body.
- Bend at the knees as you grasp it.
- Get a full hand grip and keep your body erect.
- Lift smoothly by straightening the legs (avoid jerky or snatching lifts).
- Avoid the lift and twist action. When turning, shift the position of your feet rather than twisting your body at the waist.
- Reverse the procedure to set the object down.

### B. Using ladder

There are three basic types of ladders used in gins: step, portable/extension, and fixed. Many of the same safety rules apply to each type. Ladders are involved in many accidents in and around gins because they are used quite often to reach the high gin equipment.

### C. Fire in the gin

Fire can be very serious in a gin because the two things required to cause a fire - air and combustible material - are readily available. Fire can "flash" across cotton very quickly, especially when a blast of air hits it. Fire from the cotton can then ignite clothing, cause burns and cause lung damage due to smoke inhalation.

### D. Gin housekeeping

Good housekeeping can be extremely important in keeping a gin safe. Housekeeping can also be an indication of the attention that is given to safety. Good housekeeping is the foundation for a safe, healthful and pleasant place to work.

The general rule for good housekeeping is: "A place for everything and everything in its place".

- Keep materials and equipment out of aisles, passageways and off stairways.
- Have a place to store spare parts - - not in the corners.
- Return tools and equipment to the proper storage place after use.
- Keep floors dry and avoid spilling liquids, especially oils. Clean up all spills immediately.
- Oily rags, old paint cans, oil containers, etc. that have held flammable liquids are a fire hazard.

### 1.3 Appropriate personal protective equipment (PPE)

- Every gin worker should use the personal protective equipment which the gin recommends or furnishes. It is your responsibility to use the equipment properly by following the instructions on the package or carton. You are only cheating yourself if you wear the equipment improperly. Use the equipment Wisely and avoid waste so that the supplies will be available when needed.
- Disposable equipment, such as ear plugs and dust masks, are often used for much shorter periods of time than they could be used. Dust masks are approved for a full shift's use.
- Gloves can protect your hands, particularly when handling bale ties at the press. However, their use presents a real danger if you forget to take them off when working around other moving machinery such as gin stands and lint cleaners.
- Think about first-aid equipment also.

### 1.4 Job requirements

Identify job requirements from: specifications, drawing job sheets or work instructions.

- Cotton Cultivation
- Operating Cotton Picking and Harvesting machineries
- Identifying settings and preparation for machinery operation.
- Checking seed cotton for ginning requirements
- Recording and reporting non-conforming materials
- Keeping machine clean.

#### 1.4.1 Cotton cultivation and organic production

Cotton is natural fiber grown on plant related to the hibiscus. The seeds are planted in spring and cotton plant grows in to green bushy shrubs about a meter in height. The plants briefly grow pink and cream-colored flowers that pollinated drop off and are replaced with fruit better known as cotton balls.

Cotton is one of the most important fiber and cash crop of Ethiopia and plays a dominant role in the industrial and agricultural economy of the country. In Ethiopia, there are major cotton growing regions. Afar, Amhara, SNNPR, Gambela.

### 1.4.2 Cotton Species

There are four cultivated species of cotton viz. *Gossypium arboreum*, *G. herbaceum*, *G. hirsutum* and *G. barbadense*. The first two species are diploid ( $2n=26$ ) and are native to old world. They are also known as Asiatic cottons because they are grown in Asia. The last two species are tetraploid ( $2n=52$ ) and are also referred to as new world Cottons.

### 1.4.3 Cotton harvesting and picking

**Cotton harvesting:** is one of the final steps in the production cotton crops, It is one of the most important. The crop must be harvested before weather can damage or completely ruin its quality and reduce yield.

Cotton can be harvested by two ways; **Machine harvesting** and **manual harvesting** **Machine harvesting** is harvesting cotton by using machines

Machine harvesting also requires more defoliants and lint cleaners.

**Hand picking:** Manual harvesting is harvesting cotton by hand Labor tends to be scarce; there is high demand for agricultural workers to harvest “secondary” crops (Rice, corn, vegetables). As a consequence, cotton pickers were needed from outside the area.

#### **Mechanical harvesting:**

Cotton is defoliated or desiccated prior to harvest. Defoliants are used on the taller varieties of cotton that are machine picked for lint and seed cotton, and desiccants usually are used on short, storm proof cotton varieties of lower yield that are harvested by mechanical stripper equipment.



Fig. 1.1 Mechanical harvesting

#### 1.4.4 Maintenance checks and product setting requirements

The following are basic daily critical checkpoints to address before operation:

- Clean seed cotton from deck area, engine compartment, alternator screens, radiator coils, fan shroud, etc.
- Clean cotton buildup from finger grates, basket screens, and sensors in basket.
- Check to make sure the direction vane at the top of the conveying duct is set as desired to direct cotton either into the field cleaner or into the basket, depending on desired operation.
- Check field cleaner for damaged saws, residue buildup on saws, loose or damaged grid bars, loose belts, buildup of large debris, etc.
- Fill fuel tank and inspect tires for proper pressure and damage.
- Check engine oil, hydraulic fluid, and coolant levels.
- Check row units for plugged grate panels, plant stalks, excessively worn or damaged bats and brushes, worn bearings and gears, etc.
- Lubricate basket hydraulic cylinder pivots, basket rock shaft pivots, and basket vane pivot points.
- Lubricate steering axle pivot points and ball joints.
- Follow all recommended maintenance procedures according to manufacturer suggested intervals in the machine operator's manual

#### 1.4.5 Keeping area/machine clean

Area around the machine is kept clean during setting and loading as per standard and safety procedures. This includes:

- Cleaning dust from machine
- Checking and lubricating moving parts
- Removing cotton and other process remains
- Applying kaizen principle to the working area

## Self-check-1

### Part I: Short answer writing

**Direction:** Give short answer/explain to the following questions. Time allotted for each item is 3 minute and each question carry 5 point.

1. What are the elements of SOPs?
2. Give examples of PPE in ginning process.
3. List out the cotton species and explain Cotton cultivation
4. Explain the settings and preparation for machinery operation.

Note: Satisfactory rating – above 60%                      Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

## Unit Two: Ginning Operations

This unit to provide you the necessary information regarding the following content coverage and topics:

- Main parts of ginning machines
- Ginning machine operation
- working area safety and cleaning

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Know Main parts of ginning machines
- Perform Ginning machine operation
- Apply working area safety and cleaning

### 2.1 Introduction

A cotton ginning is a machine that quickly and easily separates cotton fibers from their seeds, allowing for much greater productivity than manual cotton separation. This process removes foreign matter, control moisture and remove other contaminants that significantly reduce the value of the bale.

#### Terms and definition:

Bale— A compressed and bound package of cotton lint, typically weighing about 480 lb.

Batt— Matted lint cotton.

Boll— The capsule or pod of the cotton plant.

Bur (or burr) — The rough casing of the boll. Often referred to as hulls after separation from the cotton.

Condenser— A perforated or screened drum device designed to collect lint cotton from the conveying airstream, at times into a batt.

Cotton— General term used variously to refer to the cotton plant (genus *Gossypium*);

agricultural crop; harvest product; white fibers (lint) ginned (separated) from the seed; baled produce;

Cotton seed— The seed of the cotton plant, separated from its fibers. The seeds processed in to oil meal, linters, and hulls, or are fed directly to cattle.

Cyclone— A centrifugal air pollution control device for separating solid particles from an Airstream.

Cylinder cleaner— A machine with rotating spiked drums that open the locks and clean the Cotton by removing dirt and small trash.

Extractor— Equipment for removing large trash pieces (sticks, stems, burs, and leaves).

Extractor-feeder— A device that gives seed cotton a final light extraction/cleaning and then feeds it at a controlled rate to the gin stand.

Fly lint (or lint fly) — Short (less than 50  $\mu\text{m}$ ) cotton fibers, usually emitted from condenser and mote fan.

Gin stand— The heart of the ginning plant where gin saws (usually several in parallel) Separate the cotton lint from the seeds.

High pressure side— the portion of the process preceding the gin stands (including unloading, Drying, extracting, cleaning, and overflow handling systems) in which material is conveyed by a higher-Pressure air, and exhausts are typically controlled by cyclones.

Lint cleaner— A machine for removing foreign material from lint cotton.

Lint cotton— Cotton fibers from which the trash and seeds have been removed by the gin.

Low pressure side— The portion of the process following the gin stand (including lint cotton Cleaning and batt formation process) in which material is conveyed by low pressure air, and exhausts are typically controlled by condensers.

Mote— A small group of short fibers attached to a piece of the seed or to an immature seed.

Picker harvester— A machine that removes cotton lint and seeds from open bolls with rotating spindles, leaving unopened bolls on the plant.

Seed cotton— Raw cotton, containing lint, seed, and some waste material, as it comes from the field.

Separator— A mechanical device (e.g., wire screen with rotary rake) that separates seed cotton from conveying air.

Stripper harvester— A machine that strips all bolls — opened (mature) and unopened



(immature or green) — from the plant; strippers are used on short cotton plants, grown in arid areas of than picker harvesters.

### Purpose of ginning:

- To separate lint cotton and seed
- To remove foreign matter,
- To control moisture
- To remove other contaminants that significantly reduce the value of the bale

## 2.2 Main parts of ginning machines

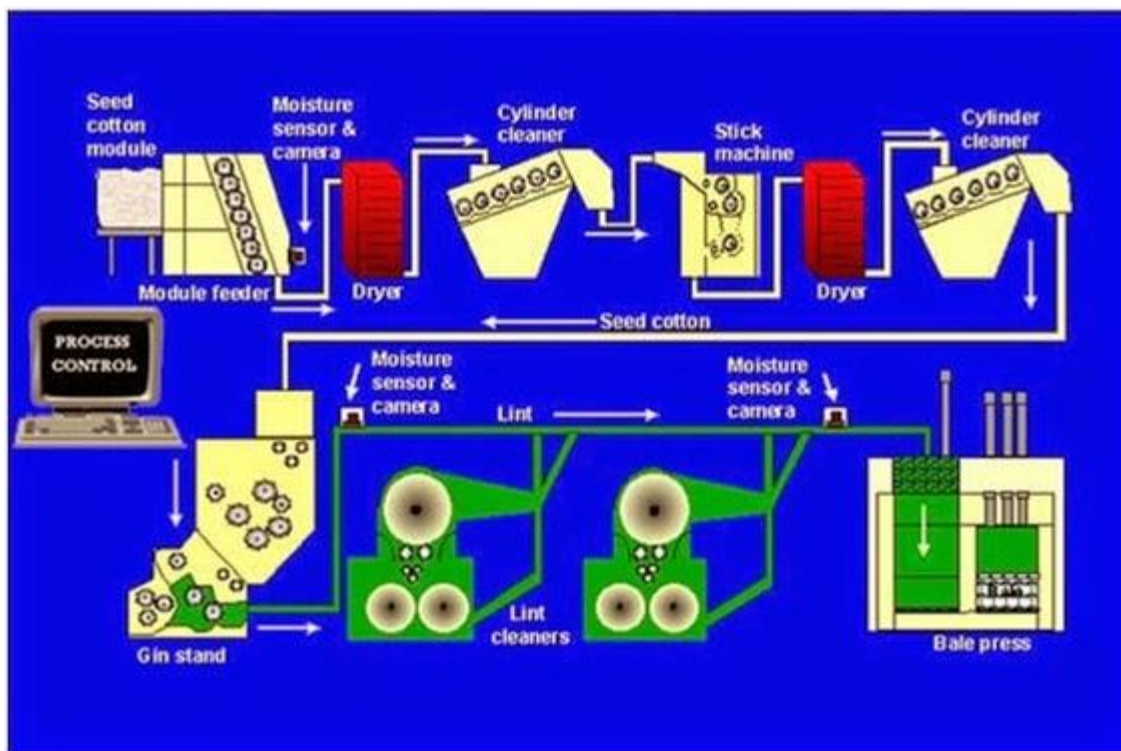


Fig:2.1 Modern ginning plant/Cotton ginning process

### A. Automatic Feeder control

The automatic feed control provides an even, well-dispersed flow of cotton so that the gin's cleaning and drying system will operate more efficiently. Cotton that is not well dispersed can travel through the drying system in clumps, and only the surface of that cotton will be dried.

### B. Dryer

In the first stage of drying, heated air conveys the cotton through the shelves for 10-15 sec. The temperature of the conveying air is regulated to control the amount of drying. To prevent fiber damage, the temperature to which the cotton is exposed during normal operation should never exceed 350 °F. Temperatures above 300 °F can cause permanent physical changes in cotton fibers.

### C. Cylinder Cleaners

The drying continues as the warm air moves the seed cotton to the cylinder cleaner, which consists of six or seven revolving spiked cylinders that rotate at 400-500 rpm. These cylinders scrub the cotton over a series of grid rods or screens, agitate the cotton, and allow fine foreign materials, such as leaves, trash, and dirt, to pass through the openings for disposal. Cylinder cleaners break up large wads and generally condition the cotton for additional cleaning and drying. Processing rates of about two bales per hour per foot of cylinder length are common.

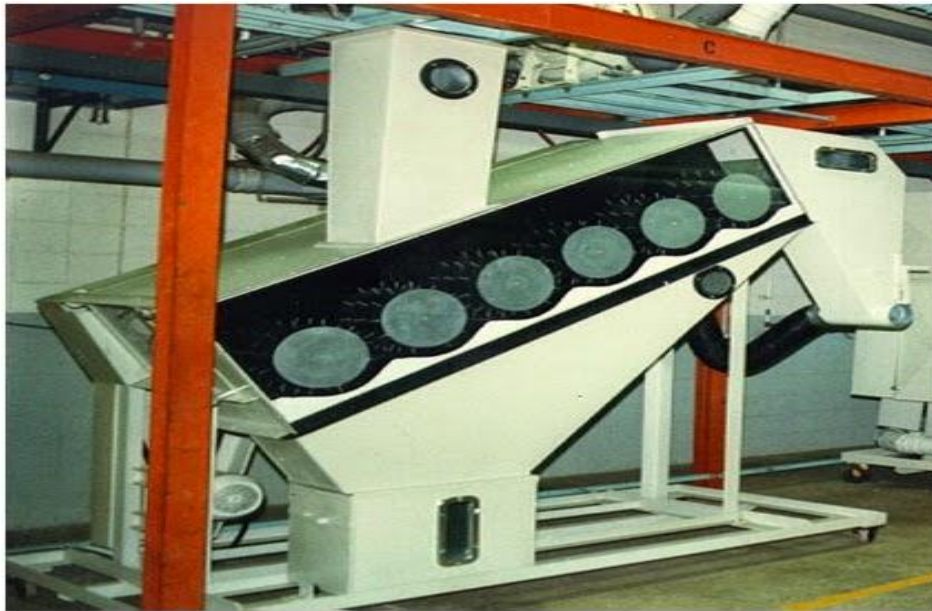


Fig. 2.2 Cylinder cleaner

### D. Stick machines

The stick machine removes larger foreign matter, such as burs and sticks, from the cotton. Stick machines use the centrifugal force created by saw cylinders rotating at 300-400 rpm to "sling off" foreign material while the fiber is held by the saw. The foreign matter that is slung off the

reclaimer feeds into the trash-handling system. Processing rates of 1.5-2.0 bales/hr/ft of cylinder length are common.

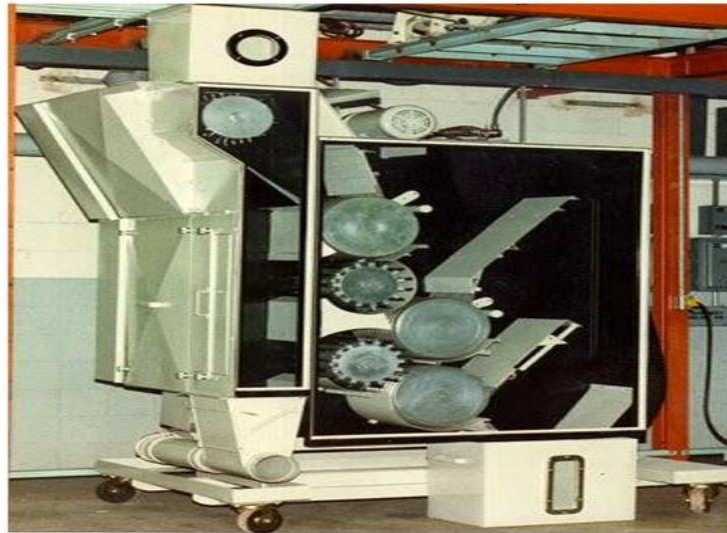


Fig. 2.3 Stick machine

### E. Conveyer-Distributor

After going through another stage of drying and cylinder cleaning, cotton is distributed to each gin stand by the conveyer-distributor. It is important to keep the conveyer-distributor full so that the last gin stand will be supplied with cotton.

### F. Extractor-Feeder

Located above the gin stand, the extractor-feeder meters seed cotton uniformly to the gin stand at controllable rates and cleans seed cotton as a secondary function.

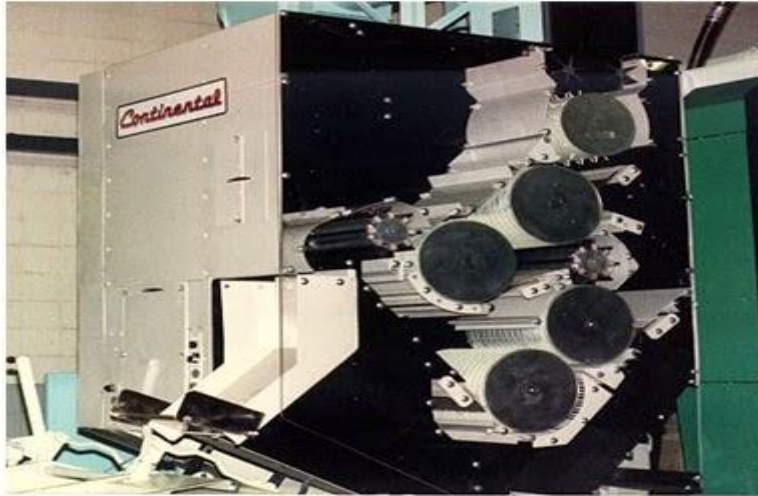


Fig. 2.4 Extractor Feeder

### G. Gin Stand

Cotton enters the gin stand through a hailer front. The saws grasp the cotton and draw it through widely spaced ribs known as hailer ribs. The locks of cotton are drawn from the hailer ribs into the bottom of the roll box. The actual ginning process separation of lint and seed takes place in the roll box of the gin stand. The ginning action is caused by a set of saws rotating between ginning ribs. The saw teeth pass between the ribs at the ginning point.

Gin stand adjustments should begin with those recommended by the manufacturer. While seed roll density can be adjusted by several methods, one method is to adjust the seed finger pressure to make the seeds stay in the roll for a longer period. This tends to reduce the overall ginning capacity of the stand because thorough cleaning of the seed takes more time.

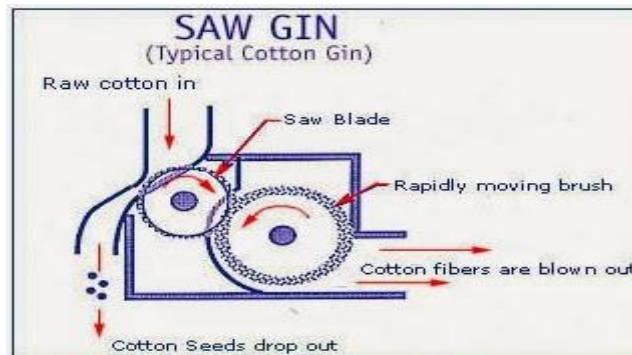


Fig. 2.5 Gin stand

## H. Lint cleaners

It is very important for cotton to flow uniformly and be well dispersed, particularly as it leaves the gin stand. Cotton is conveyed from the gin stand through lint ducts to condensers and formed again into a batt. The batt is removed from the condenser drum and fed into the saw-type lint cleaner. The batt should be of uniform thickness and be evenly spread over the entire width of the lint cleaner; otherwise, poor cleaning and excessive fiber loss will result.

Inside the lint cleaner, cotton passes through the feed rollers and over the feed plate, which applies the fibers to the lint cleaner saw. The saw carries cotton under grid bars, which are aided by centrifugal force and remove immature seeds and foreign matter.

## I. Bale Press

The cleaned cotton is compressed into bales, which must then be covered to protect them from contamination during transportation and storage. Three types of bales are produced: modified flat, compress universal density, and gin universal density. These bales are packaged at densities of 14 and 28 lb/ ft<sup>3</sup> for the modified flat and universal density bales, respectively.

## 2.3 Ginning machine operation

### 2.3.1 Types of ginning machine

There are two basic types of Ginning you may find. These are:

- Saw Ginning
- Roller Ginning

#### A. Roller gin

This consisting of two rollers turning together by means of a hand crank. It is used only for extra-long staple fibers loosely attached with seed. It is not used for fuzzy fibers. Roller gins have a lower capacity than saw gins and consequently, the cost of roller ginning is higher than saw ginning.



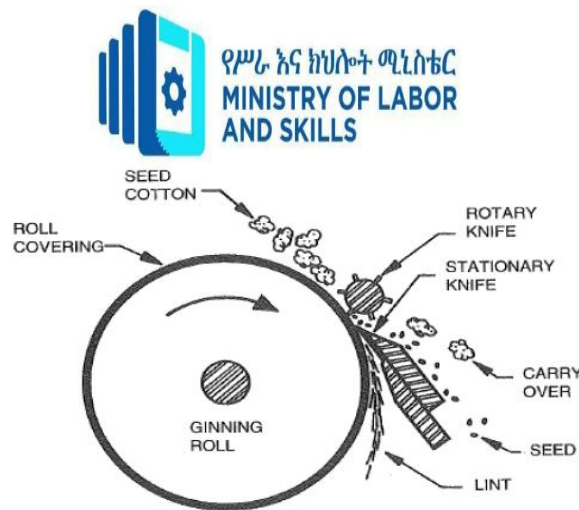


Fig. 2.6 Roller gin

Modern ginning is automatic ginning where productivity is maximized. For industrial purposes, this type of ginning technology is more preferable.

### Advantage of Roller Ginning of Cotton

1. Saw ginning ensures the quality of fiber is better which is better than the other process.
2. High production because of the use of advanced technology in the ginning process.

### The Disadvantage of Roller Ginning of Cotton

1. The moisture of seed mixes up with fiber in processing which causes cake cotton fault.

### B. Saw gin

Saws were spaced on a shaft to provide openings and allowing the seed to drop out the bottom. It is the modern one and separates fuzzy fibers. Saw ginning provides more clean cotton compared with manual or handheld separation process of seed from cotton.

### Advantage of Cotton Saw Ginning

1. Saw ginned cotton is more uniform
2. Cotton is more clean than usual.

### The Disadvantage of Cotton Saw Ginning

1. Possibility of fiber breakage due to draw up the fiber from the surface of the seed.
2. Increase neps
3. Increase short [fiber](#) content

### • Operation principle of saw gins:

Working principle:

The raw cotton i.e. cotton with seed are firstly fed into the machine through input hopper. In input hopper the hard iron wire Brush is mounted on the shaft such that the brush will collect the cotton in input hopper and revolve the cotton with itself. The Input hopper is a square box also

provide with a 6 ribs. Ribs are so spaced that they cannot allow seed through it. The next to input hopper there is square box consist of a shaft on which saws are mounted which are so adjusted that they are come in contact with the raw cotton in input hopper through ribs. These saws extract the cotton from brush through its teeth and drop it in the square box. The seeds are not allowed because of ribs space and it fall below the brush.

- **Operation principle of roller gins:**

Rotary-knife roller separate fiber from seed by using the frictional forces between a moving roller and fixed stationary-knife surface.

The roller gin utilizes a leather roller to draw the fibers between a fixed knife and the roller. The pulling action of the roller on the fibers combined with the pushing action of the moving knife are required to remove the fibers from each seed. The seed then falls through a seed grid and the fibers are removed from the roller by a rotating doffer.

In a rotary knife roller gin, seed cotton is applied to the ginning roller, with the separation of fiber and seed taking place as the lint is pulled under the stationary knife. The number of roller gin stands installed determines the capacity of the ginnery (provided that it is not limited by the capacity of the bale press).

## 2.4 Working area safety and cleaning

- **Lifting techniques**

Many back problems can be prevented or cured with exercise, weight control, and proper use of the back. The stresses placed on the back during manual lifting are due to a combination of the weight of the object being lifted and the lifting techniques.

- **Using ladders**

There are three basic types of ladders used in gins: step, portable/extension, and fixed. Many of the same safety rules apply to each type. Ladders are involved in many accidents in and around gins because they are used quite often to reach the high gin equipment.

The first part of safe ladder usage is to select only good quality, heavy duty ladders. Inspect them regularly. Quickly observe the general condition of a ladder before you climb that first step. See that no rungs are broken or missing, there is no oil or grease on the ladder, and the side rails are not damaged.

- **Fire in the gin**

Fire can be very serious in a gin because the two things required to cause a fire - air and combustible material are readily available. Following are some suggestions for preventing and dealing with fires in the gin:

- Do not smoke in the gin, particularly in trailers and in the overflow.
- Know where fire extinguishers and other fire fighting equipment
- Be aware of the smell of burning cotton and report it immediately.
- As soon as a gin fire is discovered: a) stop the flow of cotton into the plant, b) pull the gin stands breasts so the seed cotton will run out on the floor where you can extinguish the fire, c) let the lint system empty into the press, d) shut down the gin machinery, e) tie out the "tire bale" and get it away from the gin or combustible material, and f) thoroughly check inside all the machines.

- **Gin housekeeping**

Good housekeeping can be extremely important in keeping **a gin safe**. The general rule for good housekeeping is: "A place for everything and everything in its place".

- Keep materials and equipment out of aisles, passageways and off stairways.
- Have a place to store spare parts - - not in the corners.
- Return tools and equipment to the proper storage place after use.
- Keep floors dry and avoid spilling liquids, especially oils. Clean up all spills immediately.
- Oily rags, old paint cans, oil containers, etc. that have held flammable liquids are a fire hazard.

Summary:

A ginner must produce a quality of lint that brings the grower maximum value while meeting the demands of the spinner and consumer. Operating gin machinery in accord with the recommended speeds, adjustments, maintenance, and sequence while ginning the cotton at the optimum moisture level will produce the best possible end product.



## Self-check-2

### Part-I Matching

Instruction: select the correct answer for the given match. You have given 1 Minute for each question. Each question carries 2 Point.

A	B
-----1. Gin stand	A. A device that gives seed cotton a final light extraction
-----2. Bale	B. The capsule or pod of the cotton plant
-----3. Boll	C. The heart of the ginning plant.
-----4. Extractor-feeder	D. A compressed and bound package of cotton lint

### Part II: Short answer writing

**Direction:** Give short answer/explain to the following questions. Time allotted for each item is 3 minute and each question carry 5 point.

1. List out and explain the main parts of ginning machine.
2. What are the basic types of ginning machine and explain their advantages and disadvantages?
3. Explain the operation principles of roller gin.
4. List out the preventive measures and dealing with fires in the gin?

Note: Satisfactory rating – above 60%                      Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

## Operation sheet-2 : Operation of ginning process

**Operation title:** Procedures in Operation of ginning process

- **Purpose:** To practice and demonstrate the knowledge and skill required to practice the activities and procedures in running of ginning machines.
- **Instruction:** Use the given tools and equipment write the letters given in the fig.. For this operation you have given 1.5Hour.
- **Tools and equipment requirement:**
  1. This operation sheets
  2. Ginning machines
  3. Pencil
- **Precautions:** understand each process steps and take considerations to safety issues.
- **Procedures in doing the task:**

Step 1-prepare seed cotton

Step 2- feed the seed cotton

Step 3- checking moisture

Step 4- dry the seed cotton

Step 5- pre-cleaning seed

Step 6- removes stick

Step 7- extracting

Step 8- lint cleaning

Step 9- bale pressing

- **Quality Criteria:** In every step of the process the cleaning level of the fiber should be checked.

## Lap Test-2

Task-1: Perform ginning process.

## Unit Three: Bale or Mote Press Operations

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Main parts of bale press machine
- Operation of bale press machinery
- feed of lint in the lint slide
- Bale tie systems

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify main parts of bale press machine
- Operate bale press machinery
- Monitor the feed of lint in the lint slide
- Perform Bale tie systems

### 3.1 Main parts of bale press operations

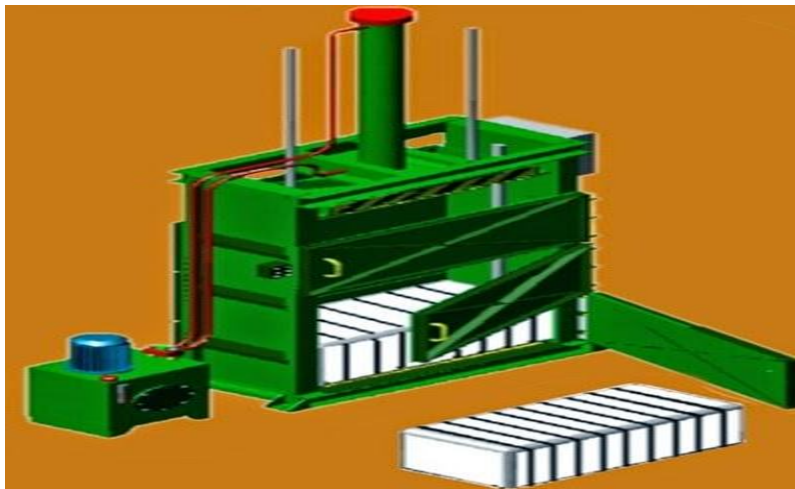


Fig. 2.7 Bale press

The packaging system consists of a battery condenser, lint slide, lint feeder, tramper, bale press, and bale tying mechanism. This system may be supplemented with systems for bale conveying,

weighing, and wrapping. The bale press consists of a frame, one or more hydraulic rams, and a hydraulic power system, start stop button/control panel, motor. Bale presses are described primarily by the density of the bale that they produce, such as low density (flat or modified flat) or universal density (gin or compress).

### **Battery Condenser**

Condensers have a slow-turning, screened or perforated metal-covered drum on which the ginned lint forms a batt.

### **Lint Slide**

The lint slide is a sheet metal trough (approximately 54 inches wide) that connects the battery condenser to the lint feeder on the tramper.

### **Lint Feeder**

The lint feeder is a device for moving lint from the lint slide into the charging box of the press.

### **Tramper**

The purpose of the tramper is to pack the lint into the press box under the restraining dogs near the top end of the press box. Mechanical and hydraulic trampers are available.

### **Bale Press**

There are four types of gin presses; each type is named according to the bale it produces—flat, modified flat (bales to be sent for recompression to become compress universal density bales), gin standard, and gin universal.

### **Bale Tie Systems**

Traditionally, most bale tying at cotton gins was done manually, and hot rolled steel bands about 1 inch wide were universally used. Two developments greatly influenced materials and methods used to tie out bales at the gins.

### **Bale Covering**

Bales should be fully covered, and all bale covering material should be clean, in sound condition, and of sufficient strength to adequately protect the cotton. The material must not have salt or other corrosive material added and must not contain sisal or other hard fiber or any other material that will contaminate or adversely affect cotton. Recommended bale coverings are published annually by the Joint Cotton Industry Bale Packaging Committee and should be consulted for current guidance. Bale covering materials can be Woven polypropylene, low-density

polypropylene, Low-density polyethylene, Burlap or cotton spiral bags, New jute and salvage jute.

### 3.2 Operation of bale press machinery

#### Procedures/safety precautions:

Trouble shooting or testing should be performed only by individuals who are familiar with the systems that control the operation of this machine.

Lock air supply in “off” position before working on the pneumatic system, hopper door or hopper diverter gate. The baler is designed for two modes of operation, manual and automatic. Baler power up for operation in either mode is accomplished by satisfying the following conditions:

1. “Emergency stop” push buttons must be pulled “out” to engage control power. control power and machine processing can be terminated at any time by depressing any of these buttons. Emergency stop buttons are located on main control cabinet, operator’s console, and near the baler gate.
2. “Hand” “off” “auto” keyed selector must be in the “hand” position.
3. Operate “master reset” push button to engage and/or restore control circuit power.
4. Operate “motor start” push button to start electric motor.

**Operating temperature:** this equipment will operate correctly in its intended ambient, at a minimum between 41°F (5°C) and 104°F (40°C).

**Relative humidity:** this equipment will operate correctly within an environment at 50% RH, 104°F (40°C). Higher RH may be allowed at lower temperatures. Measures should be taken by the purchaser to avoid the harmful effects of occasional condensation.

**Altitude:** this equipment will operate correctly up to 3280 feet (1000m) above mean sea level.

#### Foreseeable misuse

This equipment is not designed for compacting containers that Contain flammable, toxic, radioactive or bio-hazardous material.

#### Manual mode

The mode selector switch on the operator’s console must be in the “hand” position in order to operate the cylinders using the selector switches.

**The automatic mode:** when the baler is in the “auto” mode, all ram operating levers are

In operative with the exception of the bulk feed hopper door\* and the side hopper\*, which Can be operated in the “auto” mode under special circumstances.

### 3.3 Feed of lint in the lint slide

In order to have uniform output or product, the bale press has to receive equal amount of input coming from lint cleaner. This throughput is controlled automatically rather than manually.

**The advantages of module feeding are as follows:**

1. It increases ginning capacity by 10-25 percent by providing a consistent, uninterrupted flow of cotton to the gin plant.
2. It eliminates suction telescope labor.
3. It frees the module truck for long hauls by enabling continuous ginning of two to six modules.
4. It blends wet cotton in the module with dry cotton.
5. It extracts trash, thereby not only reducing the amount of trash entering the gin but also increasing fan and piping life.

### 3.4 Bale tie system

After the bale is compressed to a given density or press platen separation, ties are applied around the circumference of the bale to restrain the lint within prescribed dimensions. Bale ties are normally either wire or flat, cold rolled steel bands, or wire, and are placed at intervals along the length of the bale. Usually, six, eight, or nine ties per bale are used. The weakest point of a bale tie is the connection. To increase the holding capacity of the tie, connections should be positioned the top or bottom of the crown of the bale. The tie force is considerably less at that point, and the connection is protected because it tends to recess inside the fiber. Tying subsystems may be entirely manual, semi-automated, or fully automated.

### Self-check-3

#### Part I: Short answer writing

**Direction:** Give short answer/explain to the following questions. Time allotted for each item is 3 minute and each question carry 5 point.

1. List out main parts of bale press.
2. Explain advantages of module feeding in bale press.
3. Explain the safety issues in running of bale press.

Note: Satisfactory rating – above 60%                      Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

### Operation sheet-3 : Operation of Bale press

**Operation title:** Procedures in Operation of Bale press

- **Purpose:** To practice and demonstrate the knowledge and skill required packaging of lint cotton and to practice the activities and procedures in running of bale press machines.
- **Instruction:** Use the given tools and equipment. For this operation you have given 2 Hour.
- **Tools and equipment/machine requirement:**
  1. This operation sheets
  2. Bale press
  3. Tying material
  4. Cleaned lint cotton
- **Precautions:** Lock air supply in “off” position before working on the pneumatic system, hopper door or hopper diverter gate.
- **Procedures in doing the task:**
  - Step 1- slide lint
  - Step 2- feed lint
  - Step 3- press bale
  - Step 4- bale tying
  - Steps 5- weigh the bale
- **Quality Criteria:** check feed lint, the tying of bale press and correct weight of the bale

### Lap Test-3

Task-1: Operate bale press.

Task-2: tie the bale

Task-3: Cover and Measure the weight of the bale.



## Unit Four: Operator maintenance

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Minor running problems of ginning machine
- Major machinery product faults
- Minor maintenance and cleaning

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Report minor running problems of ginning machine
- Identify major machinery product faults
- Perform minor maintenance and cleaning

### 4.1 Minor running problems of ginning machine

#### Causes of running problem:

##### 1. Not reading the operator's manual.

"Some farmers have never even opened the owner's manual,". "Most of what they need to know is in there."

Owner's manuals cover everything from maintenance checklists to calibration instructions. Most issues are addressed in the troubleshooting section so farmers can fix the problems themselves without having to wait for a technician.

##### 2. Improper maintenance.

Skipping daily maintenance is another mistake that can cause downtime. It is important to grease all lube points daily and check engine oil and fluids such as transmission fluid and urea or diesel exhaust fluid."

Farmers also should regularly replace fuel filters and check chains, gearboxes and belts for wear and replace when wear is excessive. On gravity wagons, wheels should be checked for tightness and alignment before going to the field

### **3. Poor electrical connections.**

This problem is hard to prevent and is becoming more commonplace as more machinery is electronically controlled, Bates says. When cleaning, use compressed air instead of water to keep moisture away from the wires.

### **4. Overrunning machines.**

Constantly pushing machines to run at maximum performance or at the top of the engineering curve can strain joints and cause equipment to die prematurely.

### **5. Not replacing worn parts.**

When a part on a machine breaks, some customers will replace only that part and not check or replace other parts that may have caused the initial failure.

### **6. Misaligned tighteners.**

Tighteners that are not tracking straight with the belt or chain in relation to the main drives can put tension on the belt or chain, causing it to break or wear excessively. It's important to replace worn bushings in the tightener pivot that may be pushing the belt or chain sideways.

### **7. Improper storage.**

Combines and planters can build up dust and debris, which attract rodents. Rodents gnaw on wires and the dust itself can interfere with electrical connections.

### **8. Weather-related issues.**

Operating in wet, muddy conditions can put strain on equipment.

### **9. Ignoring warning signals.**

Warning lights on screens are there for a reason, often signaling issues that need to be addressed, such as low hydraulic pressure, high engine temperature or a shaft that isn't turning.

### **10. Untrained operators.**

As farms get larger, farm owners are having to hire outside help that may not be trained to operate machinery. Lack of training can result in abused machinery and costly breakdowns.

## **4.2 Major machinery product faults**

### **Defects in Ginning Process:**

Some common faults of ginning process are mentioned in the following:

- 1 Gin-cut fiber
- 2 Neps formation,

- 3 Crushed seeds,
- 4 A lot of **wastage**.

Causes for broken seeds:

The seeds that are broken and mixed with the lint during ginning are called broken seeds. Reasons:

1. Improper setting between knife roller and dish rail.
2. Improper setting between knife roller and leather roller.
3. Improper setting of the adjustable plate, Bars in saw gin.

Causes for fibre damages:

1. Too much pressure of doctor knife on leather roller.
2. Knives of the knife rollers are sharp.
3. Sharp edge of the saw disc.
4. Improper setting between doctor knife and leather roller and too close setting between knife roller and dish rail.

Causes for neps formation:

- I. High speed of knife roller and saw roller.
- ii. Blunt edges of knife and saw disc.

To avoid defective ginning, (I) various settings in the gin should be proper (ii) speeds of the rollers should be in correct range (iii) condition of the knife disc and saw disc should not too sharp or too blunt and it should be optimum.

### **4.3 Minor maintenance and cleaning**

The success and profitability of a ginning operation is determined by the effectiveness of its machinery maintenance program. A comprehensive gin maintenance program impacts safety, fiber quality, daily and annual volume, downtime, energy costs, and maintenance costs (material and labor).

Cleaning and extracting machinery is subject to considerable wear from the large volumes of trash and soil particles contained in the seed cotton. Also, seed cotton occasionally contains rocks, scrap metal, large woody debris, or other foreign objects that can damage various machine components. Consequently, all machinery should be inspected periodically for excessive wear or damage. Worn or damaged machine parts should be repaired or replaced on a timely basis and

adjusted to manufacturer's specifications to maintain peak operating efficiency. Extreme care should be taken when cleaning and servicing gin machinery. Cleaners and extractors contain many rotating cylinders that can severely injure or kill negligent employees. Never attempt to unchoke, clean, or service any machine while it is operating! For safety, a machine should be completely stopped and locked out electrically before opening access doors, lids, or panels and before removing guards on belts, chains, or gears. After machines are serviced, access doors and panels and machinery guards should be replaced before restarting the machine.

## Self-check-4

### Part I: Short answer writing

**Direction:** Give short answer/explain to the following questions. Time allotted for each item is 4 minute and each question carry 5 point.

1. List out causes of running problem of ginning machine.
2. Explain major ginning product faults.
3. What is the main advantage of applying minor maintenance for gin machine?

Note: Satisfactory rating – above 60%                      Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

## Unit Five: Waste materials disposition

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Waste minimization in workplace
- Recycling waste
- Waste disposal

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Know methods of waste minimization in workplace
- Know how to recycle waste
- Perform or dispose Waste

### 5.1 Waste minimization in the work place

Waste minimization is a set of processes and practices intended to reduce the amount of waste produced. By reducing or eliminating the generation of harmful and persistent wastes, waste minimization supports efforts to promote a more production in ginning.

Proper waste minimization and disposal can save a significant amount of time and resource. Significant reduction of the waste generated in health-care establishments and research facilities may be encouraged by the implementation of certain policies and practices, including the following: Source reduction: measures such as purchasing restrictions to ensure the selection of methods or supplies that are less wasteful or generate less hazardous waste.

- Recyclable products: use of materials that may be recycled, either on-site or off-site.
- Good management and control practices: apply particularly to the purchase and use of chemicals and pharmaceuticals.
- Waste segregation: careful segregation (separation) of waste matter into different categories helps to minimize the quantities of hazardous waste.

## 5.2 Recycling waste

Cotton recycling prevents unneeded wastage and can be a more sustainable alternative to disposal. Cotton can be recycled from pre-consumer (post-industrial) and post-consumer cotton waste. During the recycling process, the cotton waste is first sorted by type and color and then processed through stripping machines that first breaks the yarns and fabric into smaller pieces before pulling them apart into fiber. The mixes are carded several times in order to clean and mix the fibers before they are spun into new yarns.

The resulting staple fiber is of shorter length compared to the original fiber length, meaning it is more difficult to spin. Recycled cotton is therefore often blended with virgin cotton fibers to improve yarn strengths.

### Uses

- Recycled cotton is often combined with recycled plastic bottles to make clothing and textiles
- In industrial settings as polishing and wiper cloths
- Can be made into a stronger, more durable paper than traditional wood-pulp based paper
- Cotton waste can also be used to grow mushrooms
- Seat stuffing or home and automotive insulation

### Waste materials in ginning section which cannot be reused

- coarse dirt remaining after recycled
- fly from the preliminary filters
- dust from the fine filters

## 5.3 Waste disposal

Gins processing mechanically stripped cotton emit more dust than those processing mechanically picked cotton.

**Common disposal methods** for cotton gin trash include the following: (1) composting, (2) using it for cattle feed, and (3) direct application to land using spreader trucks. Caution should be used when feeding gin trash to cattle, since pesticide residues may be present in the trash. Cotton gin trash from a crop treated with arsenic acid should never be fed to cattle. Incineration is not

allowed in most States and will likely be even less acceptable in the future. Composting of gin trash offers potential to reduce the negative attributes of "raw" gin trash. If this material is composted properly, there should be minimum live weed seeds and live disease organisms and the trash volume should be reduced 40 percent. The resulting compost is valuable as a soil additive because it contains substantial nutrients.

The most common method of disposing of cotton gin trash is direct application to land using spreader trucks.



## Self-check-5

### Part I: Short answer writing

**Direction:** Give short answer/explain to the following questions. Time allotted for each item is 3 minute and each question carry 5 point.

1. How to minimize waste in ginning?
2. List out and explain the use of recycling the waste cotton fibers.
3. Which waste materials cannot be recycled?
4. What are the common waste disposal methods in ginning?

Note: Satisfactory rating – above 60%                      Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

## Unit Six: Monitoring Product quality

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Quality requirements for cotton ginning
- Cotton flow
- Cotton quality
- Product deviations

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify quality requirements for cotton ginning
- Monitor cotton flow
- Maintain Cotton quality
- Recognize, isolate and report Product deviations

### 6.1 Quality requirements for cotton ginning

#### The Selection Criteria of Seed Cotton:

The quality and price of cotton are determined based on several factors: length of individual fibers, or staple; grade (color, brightness, and amount of foreign material contaminating the final product); and character (diameter, strength, uniformity, and smoothness of individual fibers).

**Quality:** is one of the most important aspects of producing a profitable cotton crop. The factors that determine cotton quality are:

**Leaf grade:** Leaf grade refers to the leaf or trash content in the cotton.

**Fiber length:** Fiber length is primarily determined by cotton variety, but growing conditions and fertility can affect length as well.

**Length uniformity:** Length uniformity is the ratio between the mean length of fiber and the upper half mean length expressed as a percentage. Low uniformity values are a function of fibers that are more easily broken.

**Strength:** Strength is measured by clamping and breaking the beard of fibers with a 1/8-inch gage spacing between the clamp jaws.

**Micronaire:** Micronaire (mike) is a measure of the fineness of the cotton fiber.

**Trash:** Trash is a measurement of trash present in the lint.

**Color:** Color is the measure of greyiness and yellowness of the lint.

**Moisture:** The Roller Gins can take up to 10-11% moisture but above that the drying process should be adopted before feeding the seed cotton to the ginning

## 6.2 Cotton flow

### Material Handling and Equipment:

Seed cotton can be safely stored in modules or trailers if its moisture content is kept at 12 percent less. Wet cotton or cotton containing the green plant material will heat during storage and quickly deteriorate. Cotton damaged in this manner produces low grades and poor quality seed. If the temperature exceeds 110F it should be ginned immediately.

**Pre-cleaning:** Pre cleaning is done in different ways but in this plant Hot Box is used to clean the seed cotton. The cotton is dried up and Seed cotton cleaners break up large wads and generally get the cotton open and in good conditions cleaning and drying.

**Conveying systems:** After cleaning the seed cotton which is obtained from hot box it is sent to ginning machines by conveying systems. Conveying systems are of two types:

1. Belt conveyor system
2. Screw conveyor system

The main function of belt conveyor is to transport the seed cotton from hot box to cross screw conveyors. The cross screw conveyors have right and left hand screws to carry the seed cotton to the both sides of the gin houses

### ➤ Summary In monitoring of ginning process:

- Raw cotton quality must be checked
- Material feeding process is correctly managed

- Machine setting adjusted according to the process
- Quality should be checked during and after production
- Waste is managed appropriately in every stage of process

### 6.3 Cotton quality

Cotton quality is affected by every production step, including selecting the variety, harvesting and ginning. Certain quality characteristics are highly influenced by genetics, while others are determined mainly by environmental conditions or by harvesting and ginning practices. Problems during any step of production or processing can cause irreversible damage to fibre quality and reduce profits for the producer as well as the textile manufacturer.

Fibre quality is highest the day a cotton boll opens. Weathering, mechanical harvesting, handling, ginning and manufacturing can diminish the natural quality. There are many factors that indicate the overall quality of cotton fibre. The most important ones include strength, fibre length, short fibre content (fibres shorter than 1.27 cm), length uniformity, maturity, fineness, trash content, colour, seed coat fragment and nep content, and stickiness. The market generally recognizes these factors even though not all are measured on each bale.

### 6.4 Product deviations

Recognizing, isolating and reporting deviations

We can use HVI tester machine data how to report recognized and isolated quality deviations  
As follows:

1. **SCI (spinning consistence index)**:-It determine the spin ability of the fiber.
2. **Mic (Micronier value)**:- reflect fiber fineness and maturity as we seen our mixed fibers micronier value (4.24) is between the premium range (3.7-4.29) therefore it is fine and matured.
3. **UHML (upper half mean length)** or staple length: - determine the highest fiber length from the tested sample fibers. For cotton fibers staple length between 26mm-28mm is considered as medium long our result is 28.1mm .
4. **Str (strength)**:- it is the force required to break the bread of fibers the breaking strength of cotton fiber.

5. **CGrd:-** color grade determine the Rd and yellowness(+b). Rd show the brightness of the sample and (+b) indicate the degree of the cotton color (color pigmentation) the cotton whitens between (31-1 to 31-4) is medium white accordingly our test result is between 31-3.
6. **TrAr(trash area ):-** it measure the amount of non-lint fibers (trash) in the fiber .the value of trash content should be within the range from 0-1.6% due to this our result of TrAr (0.69) has limited amount of trash.

## Self-check-6

### Part I: Short answer writing

**Direction:** Give short answer/explain to the following questions. Time allotted for each item is 3 minute and each question carry 5 point.

1. What are the selection criteria of seed cotton?
2. Explain the cotton flow?
3. What are the factors which affect cotton fiber quality?
4. How can we check the product deviations in ginning?

Note: Satisfactory rating – above 60%                      Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

## Unit Seven: Process information

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Record keeping and documentation
- Information of production status

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Record and document information
- Know the required Information of production status

### 7.1 Record keeping and documentation

A typical cotton ginning facility is divided into five processing areas: unloading system; seed cotton drying and cleaning system; overflow system; ginning and lint cleaning system; and battery condenser and baling system. Each stage is shown in Figure and is briefly described previously. The first three stages are usually referred to as the high-pressure side of the plant, while the last two (lint cleaning through baling) are called the low pressure side, reflecting the pressures used in the air conveying systems.

The following criteria are to evaluate source test reports for sound methodology and adequate detail:

**Source operation.** The manner in which the source was operated is well documented in the report. The source was operating within typical parameters during the test.

**Sampling procedures.** The sampling procedures conformed to a generally acceptable methodology. If actual procedures deviated from accepted methods, the deviations are well documented. When this occurred, an evaluation was made of the extent to which such alternative procedures could influence the test results.

**Sampling and process data.** Adequate sampling and process data are documented in the report, and any variations in the sampling and process operation are noted. If a large spread between

test results cannot be explained by information contained in the test report, the data are suspect and are given a lower rating.

## 7.2 Information of production status

### Transferring information between changes in shifts

Instructions for Shift Change:

Take Charge of the Shift

- ❖ Come at least 10 - 15 minutes earlier to the work spot.
- ❖ Meet the previous shift jobber and understand which are the machines part ready for doffing and discuss regarding the issues faced by them with respect to the quality or production or spare or safety or any other specific instruction etc.
- ❖ Understand the trash, lint in kg followed in the bale press for his allocated number bales/ machines for doffing.
- ❖ Check and understand the technical details mentioned in the total kg of ginned cotton.
- ❖ Check for the availability of the seed cotton (unginned).
- ❖ Check the availability for empty materials to press bale for doffing.

### Handing over the Shift:

- Properly hand over the shift to the incoming shift bale pressing Doffing team head.
- Provide the details regarding trash, color, average fiber length for ginning and Seed cotton for allocated bale/machine.



## Self-check-7

### Part I: Short answer writing

**Direction:** Give short answer/explain to the following questions. Time allotted for each item is 3 minute and each question carry 5 point.

1. What are the criteria are to evaluate source test reports?
2. Explain the sampling procedures?
3. If you are ginning operator what are the information that you can transfer for the next shift?

Note: Satisfactory rating – above 60%                      Unsatisfactory - below 60%

You can ask you teacher for the copy of the correct answers

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