Basic textile operations

Level -I

Learning Guide -29

Unit of Competence: operate Cotton Ginning Machines and Control Bale Press Operation

Module Title: Operating Cotton Ginning Machines and Controlling Bale Press Operations

LG Code: IND BTO1 M09 LO2-LG29

TTLM Code: IND BTO1 TTLM 0919v1

LO 2: Operate cotton ginning machineries

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

- Introduction to ginning
- Types of ginning machines
- main parts of ginning machines
- Operation principle of saw gins
- Operation principle of roller gins
- Ginning machine parameters
- Ginning process

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Know concept of ginning
- Know types of ginning machines
- Know main parts ginning machines
- Operate principle of saw gins
- Operate principle of roller gins
- Know ginning machine parameters
- Do ginning process

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 20.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” **in page -.**
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	Introduction

1. Introduction

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.

This process removes foreign matter, control moisture and remove other contaminants that significantly reduce the value of the bale. There are two main types of ginning machines:

1.1. 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.

1.2. 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 (genusGossypium); agricultural crop; harvest product; white fibers (lint) ginned (separated) from the seed; baled produce; and yarn or fabric products. Cotton is classified as upland or extra long staple depending on fiber length.

Cottonseed— The seed of the cotton plant, separated from its fibers. The seeds constitute

40 percent to 55 percent of the seed cotton (depending on the amount of trash) and are processed into

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.

Cyclone robber system- A secondary cyclone trash handling system. These systems are not

Used at most cotton gins.

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). The

Equipment may include one or more devices, including a stick machine, bur machine, green-leaf Machine and a combination machine.

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 µm) cotton fibers, usually emitted from condenserand 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.

Motes may be cleaned and baled.

Picker harvester— A machine that removes cotton lint and seeds from open bolls with

rotating spindles, leaving unopened bolls on the plant. "First pick" cotton is obtained from the initial

harvest of the season. It usually contains less trash than "second pick" cotton, obtained later in the

harvest season. "Ground cotton" is obtained by picking up between the rows at season’s end and has

a high trash content.

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.

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page

1. What is the purpose of ginning? (5 points)
2. What should happen if the cotton is ginned at low or high temperature? (5 points)
3. List some of the product of ginned cotton (5 points)

Note: **Satisfactory rating – above 10 points Unsatisfactory - below 10 points**

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-2	Types of ginning machines

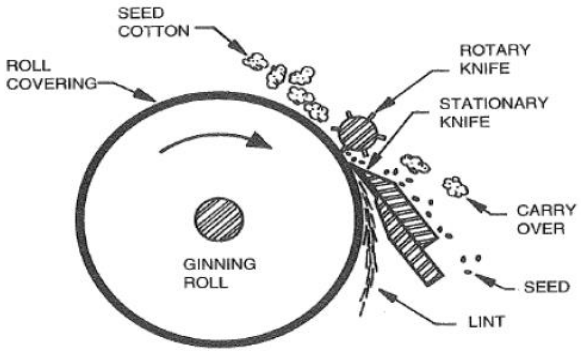
2. Types of ginning machines

There are two main types of ginning machines:

2.1. 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.



Roller-covering material is made from 13 layers of plain-woven cotton fabric cemented together with a white rubber compound. Rotary-knife roller separate fiber from seed by using the frictional forces between a moving roller and fixed stationary-knife surface.

During normal ginning, the roller-to-fiber force is greater than the stationary-knife-to fiber force; therefore, the fiber sticks to the roller surface and slips on the stationary knife surface. Cotton is ginned as fibers adhered to the roller surface slip under the stationary knife which holds the seed.

The rotary knife clears the stationary knife edge of accumulated seed cotton and ginned and partially-ginned seed. Partially ginned seed are either pulled back to the stationary knife or swept along with the seed and later reclaimed.

At the ginning point, seed cotton trash is separated with about 45 to 50 percent going with the lint and the remainder with the seed.

The carryover declaimer removes un-ginned and partially-ginned cotton from the seed flow and returns them to the distributor for ginning.

Cleaning equipment includes cylinder cleaners, stick machines and revolving screen (impact) cleaners. Tower dryers and hot-air cylinder cleaners are commonly used for seed cotton drying.

Optimum fiber-moisture content for roller ginning is 5 to 6 percent. Drying below 4 percent cause increased static-electricity problems and fiber breakage

Roller ginning is the most primitive way of removing lint from seeds. There have been many variations and refinements in the machines working in many countries around the world but the fundamental principle of a harsh pulling of fibers from the seed coat has not changed. Fibers are gripped between rollers, blades or a roller and a blade and stretched to be separated from seeds. The space through which fibers are stretched is so narrow that, it does not permit seeds passing through with lint. The process is comparatively slow but considered to be gentle.

Roller-type gins include the reciprocating knife single roller the double roller and the rotary knife roller In a double roller (DR) gin, two leather rollers, pressed against a stationary knife, rotate in opposite direction. When the seed cotton is fed to the gin, fibers adhere to the rough surface of the roller and are carried in between the fixed knife and the roller, and partially gripped between them. Oscillating knives beat the seeds from top and separate the fibers, which are gripped from the seed end. The seeds are carried forward on the roller and doffed out of the machine. F fiber comes out from the bottom side.

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 rotary knife directs seed cotton to the ginning point, sweeps cottonseed away from the ginning point, and releases the seed cotton that was not fully ginned to be drawn back to the tip of the stationary knife for further ginning.

The number of roller gin stands installed determines the capacity of the ginnery (provided that it is not limited b y the capacity of the bale press).

Roller ginning systems in the US normally include similar seed cotton cleaning as used for upland cotton. Cleaning equipment may include cylinder cleaners, stick machines, and revolving screen (impact) cleaners, depending on seed cotton cleanliness (whether it is machine picked or handpicked.) To wet dryer and hot- air cylinder cleaners are commonly used for seed cotton drying. Lint cleaning in roller gins is different from saw gins and varies among locations. The most common lint-cleaning sequence utilizes inc line, impact, and air-jet cleaners. Saw-type lint-cleaners are only used for machine picked cotton to remove motes broken seed, entanglements and pin trash not removed in seed cotton cleaning. Roller ginned cotton is baled using the same pressing equipment as up and cotton.

2.2. 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.

Self-Check -2	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page

1. Compare and contrast between saw gin and roller gin(10 pts)

Note: **Satisfactory rating – above 10 points Unsatisfactory - below 10 points**

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-3	Main parts of ginning machine

Main parts of ginning machine

The **main parts of ginning machines** May include:

- feeder
- dryer
- cylinder cleaner
- stick machine
- lint cleaner
- extractor feeder
- gin stand
- bale press

3.1. Automatic Feed 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.

3.2. Dryers

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. Dryer-temperature sensors should be located as near as possible to the point where cotton and heated air mix together. If the temperature sensor is located near the exit of the tower dryer, the mix point temperature could

Actually be 100-200 °F higher than the temperature at the downstream sensor. The temperature drop downstream results from the cooling effect of evaporation and from heat loss through the walls of machinery and piping.

3.3. 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.

3.4. 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.

3.5. Conveyor-Distributor

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

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. The moisture content of cotton fiber at the extractor- feeder apron is critical. The moisture must be low enough that foreign matter can be easily removed in the gin stand. However, the moisture must not be so low (below 5 percent) as to result in the breakage of individual fibers as they are separated from the seed. This breakage causes an appreciable reduction both in fiber length and lint turnout. From a quality standpoint, cotton with a higher content of short fibers produces excessive waste at the textile mill and is less desirable. Excessive breakage of fibers can be avoided by maintaining a moisture content of 6-7 percent at the extractor-feeder apron.

3.6. Gin Stand

Cotton enters the gin stand through a huUer front. The saws grasp the cotton and draw it through widely spaced ribs known as huiler ribs. The locks of cotton are drawn from the huiler 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. Here the leading edge of the teeth is approximately parallel to the rib, and the teeth pull the fibers from the seed, which are too large to pass between the ribs.

Gin stand adjustments should begin with those recommended by the manu- facturer. 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. However, excessively loose adjustment of the seed fingers results in too much lint being left on the seed.

Ginning at rates above those recommended by the manufacturer can cause fiber quality reduction, seed damage, and chokeups. Gin stand saw speeds are also important. High speeds tend to increase the fiber damage done during ginning.

3.7. Lint Cleaners

It is very important for cotton to flow uniformly and be well dispersed, par- ticularly 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. It is important that the clearance be- tween the saw tips and grid bars be properly set. The grid bars must be straight with a sharp leading edge to avoid reducing cleaning efficiency and increasing lint loss. Increasing the lint cleaner's feed rate above the manufacturer's recommended rate will decrease cleaning efficiency and increase loss of good fiber.

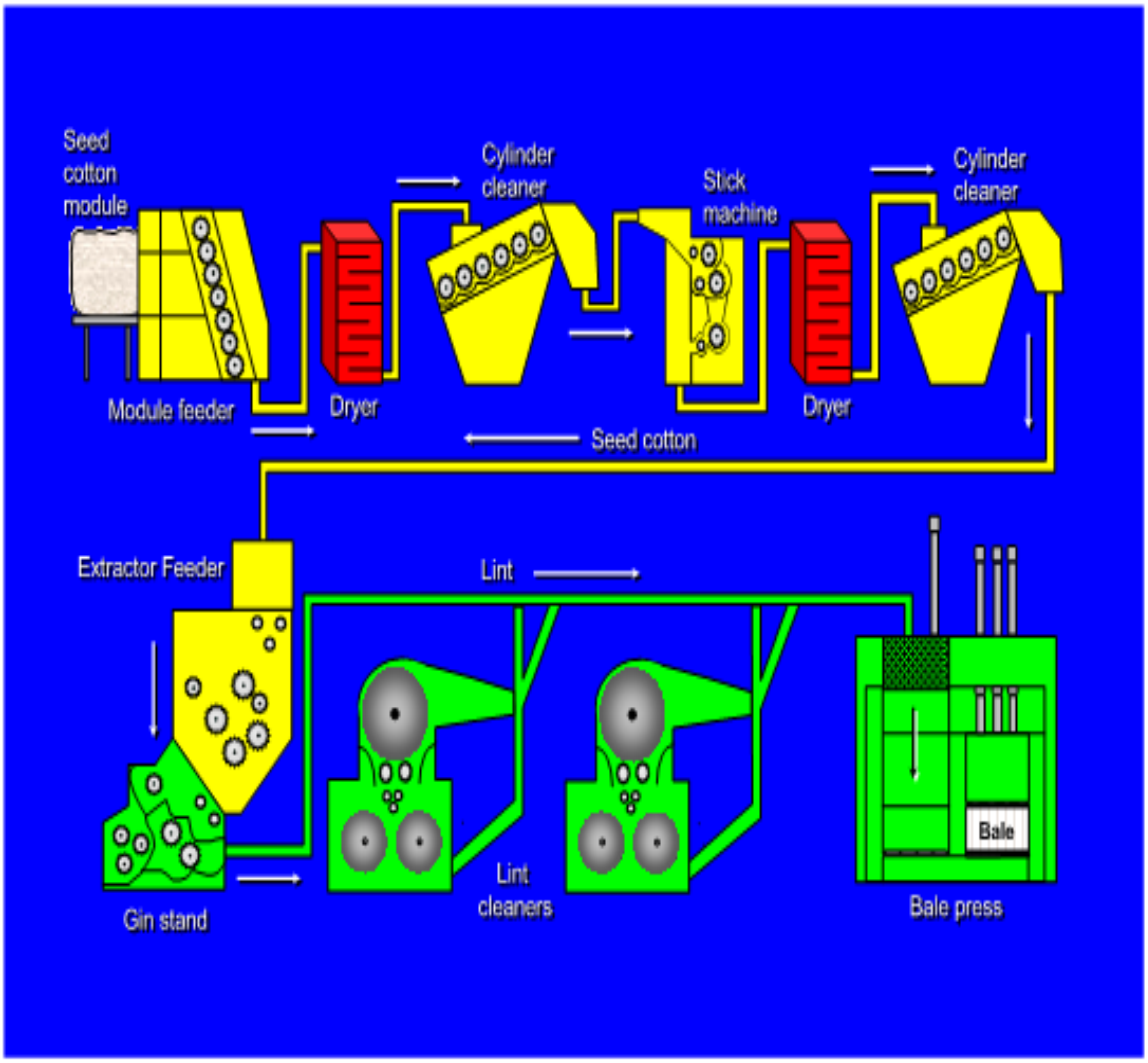
Lint cleaners can improve the grade of cotton by removing foreign matter. In some cases, lint cleaners may improve the color of a lightly spotted cotton by blending to produce a white grade. They may also improve the color grade of a spotted cotton to light spotted or perhaps white color grade.

All ginners must compromise between degree of cleaning and fiber damage. Fiber length can be damaged by excessive lint cleaning, especially when the cotton is too dry. Ginners should determine the number of lint cleaners that gives maximum bale value based on a compromise between increased grade, reduced staple length, and reduced turnout.

3.8. 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^ for the modified flat and universal density bales, respectively. In most gins cotton is packaged in a "double-box" press wherein the lint is initially com- pacted in one press box by a mechanical or hydraulic tramper; then the press box is rotated, and the lint is further compressed to about 20 or 40 lb/ ft^ by modified flat or gin universal density presses, respectively. Modified flat bales are recompressed to become compress universal density bales in a later operation to achieve optimum freight rates. In 1992, about 90 percent of the bales in the United States were gin universal density bales.

Bales should be packaged and tied only in material approved for storage by the Commodity Credit Corporation loan program.



Typical gin equipment processes for picker harvested cotton.

Gins commonly operate at 3-4 bph

- More material removed at lower rates
- Possibly some effect of rate on fiber loss, cultivar more important factor
- No effect of rate on leaf grade, fiber quality
- Extractor-feeder and lint cleaner operated at low rate
- Increasing machine speeds increased foreign matter removal and fiber loss
- No effect of cylinder or saw speeds on leaf grades or turnout

Cotton Ginning Machine

Gin is short for en-"gin" **Cotton being fed in to gin**

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. List and explain parts of ginning machine.(12pts)

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

Answer Sheet

Score = _____

Rating: _____

Name: ___________________________ Date: ________________

Short Answer Questions

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Information Sheet-2.4	Operation principle of saw gins

4. Operation principle of saw gins

Parts and working of a saw gin cotton ginning machine

This mini cotton ginning machine consists of following Components

- Raw Cotton Input Hopper: Raw cotton is fed to brush 1 through this hopper.
- Lint Cotton Output Hopper: Seed free cotton achieved through this hopper.
- Roller Saw Ginning shaft (main shaft): Saws are mounted on this shaft.
- Brush1 Shaft: Brush is mounted on this shaft which feed raw cotton through rib.
- Bearings
- Foundation frame
- Pulley (7 Nos.)
- Belt (4 Nos.)
- Brush 2 Shaft

Working:

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 the cannot allow seed though 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.

Self-Check -4	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Explain how to operate saw-gin machine. (9 pts)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-5	Operation principle of roller gins

5 Operation principles of roller gins

- The principal purpose of ginning is to separate cotton fibers from seeds.
- In a roller gin, a spirally grooved leather roller pressed against a fixed knife is made to rotate at a definite speed.
- A moving blade, known as the beater or "moving knife" oscillates by means of crank or eccentric shaft, close to the leather roller. Seed cotton, when fed to the machine, fibers adhere to the rough surface of the roller. Then it is carried in between the fixed knife and the roller such that the fibers are partially gripped between them.
- The oscillating knife beats the seeds and separates the fibers, which are gripped from the seed end.
- This process is repeated a number of times and due to the "Push and Pull" the fibers are separated from the seed, carried forward on the roller and dropped out of the machine.
- The ginned seeds drop down to the reserve box. In these machines, the ginning efficiency primarily depends upon the surface speed of the roller and the number of effective working strokes of the moving knife.

Self-Check -5	Written Test

Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Describe the operating principle of roller gin machine.(10 pts).

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

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Information Sheet-6	Ginning parameters

2.6 Ginning parameters

Quality and Impact on Lint Prices

Roller ginned upland cotton has a longer staple length, less short fiber, seed coat Fragments and neps than the same cottons ginned with saws. As such, roller ginned cotton Deserves a price premium. Yet, roller ginned cotton often gets contaminated at the gin, and the presence of foreign matter (real or suspected) can offset the premium. According to ginners in ESA countries, roller ginned cotton can fetch a premium of up to 2 cents over the same cotton ginned with saws. However, merchants are very selective in choosing the ginners they purchase from. No premium is offered for cottons ginned in old roller gins which are manually fed from a platform above the gin stands, as this is likely to increase contamination. Fully automatic feeding systems avoid additional contamination.

Saws can also be sharpened after processing 2,000 to 4,000 bales.

The cost of steel in a saw increases used by the square of the diameter; whereas the number of teeth increases only in direct proportion to the diameter. Lummus gins use 12-inch saws, while Continental gins use 16-inch saws.

Important Fiber Properties

In processing and in determining the end use of cotton, the following proper- ties are critical:

1. **Fiber strength**. The strength of cotton fibers is measured by the HVI system and reported in grams of force per tex. A tex is equal to the weight in grams of 1,000 m of fiber. Strength ranges from 20-32 g/ tex for upland cottons and 35-45 g/tex for pima cottons.
2. **Fiber length**. This is expressed as upper-half mean length (the average length of the longest one-half of the fibers) or as the 2.5- percent span length. Fiber length of commercial varieties of upland cottons range from 7/8 inch to 1-1/4 inches (upper-half mean length).
3. **Micronaire. Micronaire** is an indirect measure of fiber diameter (fineness). Within a given family of cotton varieties, micronaire also is a good measure of the thickness of the so-called secondary cell wall, which is a measure of fiber maturity. Maturity is very much related to performance in dyeing for certain end uses.
4. **Grade (trash content and color**). Separate grades are determined for trash content and color by a cotton classer with the assistance of HVI instruments. The classer compares a

sample against a series of cotton standards. Trash content has a direct bearing on how well the cotton processes in the textile mill. The spinner is concerned with the amount and size of trash. The very large particles are easy to remove but small particles, which are commonly called pepper trash, are very difficult to remove. Pepper trash causes unevenness and imperfections in the yam. Many of the small trash particles are actually seed coat fragments. Color is an indicator of field weathering.

5. **Short-fiber content**. The percentage of fibers shorter than one-half inch has a major effect on how the cotton processes, on yam strength, on the number of imperfections found in the yarn, and on the evenness of the yarn. These four properties are most important in governing the performance of yarns in weaving or knitting and in determining the quality of the final fabric.

6. **Maturity**. Textile manufacturers desire mature cotton because of its dyeability in the finished fabric. Clumps of immature fibers, which are commonly called dead fibers, pose particular problems when they are dyed deep colors in certain cotton knits, corduroys, and dress goods—the dead fibers show up as small, white specks that are clearly visible in the fabric. The ginner has very little control over these dead fibers. Variety, environment, and crop management are more important in eliminating these fibers than ginning methods.

7**. Stickiness**. Stickiness in cotton is often called honeydew. In extreme cases, this condition can shut down a yam mill. The fiber can be so sticky that cards, draw frames, roving frames, and spinning frames will clog up and cause repeated breaks in the flow of the cotton. Such breaks are known as ends-down. The principal cause of stickiness is invasion of the cotton by whiteflies or aphids in the last months before harvest; these insects deposit droplets containing mixtures of various tacky sugar compounds on the fiber.

8. **Fiber cohesion**. Simply stated, this is the property that controls the friction between fibers—how they slide past each other in carding, drawing, or spinning and, in turn, how they adhere to each other and affect yam strength of the spun yam. Cotton with very low fiber cohesion is ideal for drawing and spinning because the fibers hold together but slide past each other very readily. Once the cotton is in yam form, a high fiber cohesion is ideal for maximizing the strength of the yam and for maximizing the yam's ability to accommodate very large forces during high-speed weaving and knitting. Fiber cohesion is not currently measured by the HVI system.

Self-Check -6	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are quality parameters of ginning? (4 pts.)
2. Define the strength of the fiber. (3 pts.)
3. _____ is often called honeydew.(1 pts.)
   A) Short fiber
   B) maturity
   C) Trash
   D) Stickiness
   E) none
4. _____is the percentage of fibers shorter than one-half inch, which has a major effect on how the cotton processes, on yam strength, on the number of imperfections found in the yarn, and on the evenness of the yarn.(
   A) Short fiber
   B) Maturity
   C) Strength
   D) stickiness

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

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Information Sheet-7	Ginning process

7 Ginning Process

Cotton possesses its highest fiber quality and best potential for spinning when it is on the stalk. Lint quality of the cotton in the bale depends on many factors, including variety, weather conditions, cultural and harvesting practices, moisture and trash content, and ginning processes.

The principal function of the cotton gin is to separate lint from seed, but the gin must also be equipped to remove from the cotton a large percentage of the foreign matter that would significantly reduce the value of the ginned lint. A ginner must have two objectives:

- to produce lint of satisfactory quality for the grower's market
- to gin the cotton with minimum reduction in fiber

Spinning quality so that the cotton will meet the demands of its ultimate

Users—the spinner and the consumer. Accordingly, quality preservation during ginning requires the proper selection and operation of each machine that is included in a ginning system.

Mechanical handling and drying may modify the natural quality characteristics of cotton. At best, a ginner can only preserve the quality characteristics inherent in the cotton when it enters the gin. The following paragraphs briefly discuss the function of the major mechanical equipment and processes in the gin.

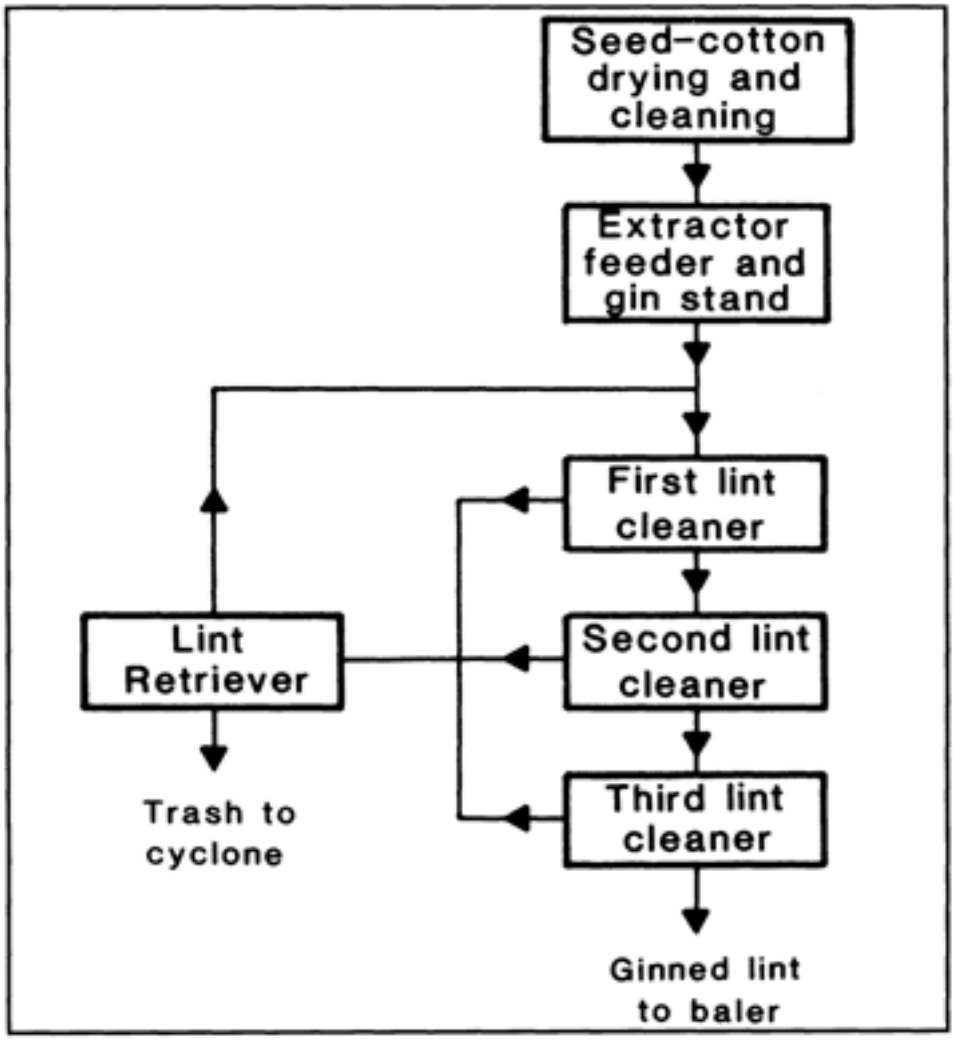

Fig. Ginning process flow

7.1. Green-Boll Trap

Cotton is transported from a trailer or module into a green-boll trap in the gin. The trap removes green bolls, rocks, and other heavy foreign matter. These heavy materials are removed early in the ginning system to prevent damage to machinery and to preserve fiber quality by removing immature cotton contained in unopened bolls.

7.2. **Automatic Feed 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.

7.3. Dryers

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. Dryer-temperature sensors should be located as near as possible to the point where cotton and heated air mix together. If the temperature sensor is located near the exit of the tower dryer, the mix point temperature could 43.

The Ginning Process actually be 100-200 °F higher than the temperature at the downstream sensor. The temperature drop downstream results from the cooling effect of evaporation and from heat loss through the walls of machinery and piping.

7.4. 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.

7.5. 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.

7.6. Conveyor-Distributor

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

7.7. 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. The moisture content of cotton fiber at the extractor-feeder apron is critical. The moisture must be low enough that foreign matter can be easily removed in the gin stand. However, the moisture must not be so low (below 5 percent) as to result in the breakage of individual fibers as they

are separated from the seed. This breakage causes an appreciable reduction both in fiber length and lint turnout. From a quality standpoint, cotton with a higher content of short fibers produces excessive waste at the textile mill and is less desirable. Excessive breakage of fibers can be avoided by maintaining a moisture content of 6-7 percent at the extractor-feeder apron.

7.8. Gin Stand

Cotton enters the gin stand through a huiler front. The saws grasp the cotton and draw it through widely spaced ribs known as huiler ribs. The locks of cotton are drawn from the huiler 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. Here the leading edge of the teeth is approximately parallel to the rib, and the teeth pull the Fibers from the seed, which are too large to pass between the ribs. 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. However, excessively loose adjustment of the seed fingers results in too much lint being left on the seed.

Ginning at rates above those recommended by the manufacturer can cause fiber quality reduction, seed damage, and checkups. Gin stand saw speeds are also important. High speeds tend to increase the fiber damage done during ginning.

7.9. 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. It is important that the clearance between the saw tips and grid bars be properly set. The grid bars must be straight with a sharp leading edge to avoid reducing cleaning efficiency and increasing lint loss. Increasing the lint cleaner's feed rate above the manufacturer's recommended rate will

decrease cleaning efficiency and increase loss of good fiber. Lint cleaners can improve the grade of cotton by removing foreign matter. In some cases, lint cleaners may improve the color of a lightly spotted cotton by blending to produce a white grade. They may also improve the color grade of a spotted cotton to light spotted or perhaps white color grade. All ginners must compromise between degree of cleaning and fiber damage. Fiber length can be damaged by excessive lint cleaning, especially when the cotton is too dry. Ginners should determine the number of lint cleaners that the ginning process gives maximum bale value based on a compromise between increased grade, reduced staple length, and reduced turnout.

7.10. 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^2 for the modified flat and universal density bales, respectively. In most gins cotton is packaged in a "double-box" press wherein the lint is initially compacted in one press box by a mechanical or hydraulic tramper; then the press box is rotated, and the lint is further compressed to about 20 or 40 lb/ft^ by modified flat or gin universal density presses, respectively. Modified flat bales are recompressed to become compress universal density bales in a later operation to achieve optimum freight rates. In 1992, about 90 percent of the bales in the United States were gin universal density bales.

Bales should be packaged and tied only in material approved for storage by the Commodity Credit Corporation loan program.

7.11. 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 -7	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is final output of ginning process?(2 pts)
   a) Yarn b) fabric c) lint cotton d) cloth

2. Write process flow of ginning process.(6 pts)

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 5 points**

Answer Sheet

Score = _____

Rating: _____

Name: _____ Date: _____

Short Answer Questions

1. _____
2. _____
   _____
   _____
   _____
   _____
   _____.


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