

**PRESERVING FIBER QUALITY, INCREASING GIN
TURNOUT AND FARMER PROFITS, DRYING COTTON,
AND DISPOSING OF GIN TRASH¹**

by
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Abstract

Properly controlling the cotton ginning process increases fiber yields and monetary returns to the cotton farmer, improves fiber length distribution, and reduces short fibers, neps and seed-coat fragments. A computerized process control system that utilizes the cotton market price and the performance characteristics of gin machinery to determine the optimum machinery sequence is now available. Cotton moisture, color, and foreign matter measurements are made with electronic devices at three stations in the gin system and are used to control the gin process. Special routing valves are used to bypass or select any combination of seed cotton cleaners, dryers, and lint cleaners. When gin machinery is bypassed, the quantity of marketable lint is increased and the amount of fiber damage is decreased. Ginning characteristics of cotton varieties differ in terms of energy requirements, fiber turnout, and the change

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in fiber quality. In studies at Stoneville, MS, seed cotton cleaning efficiency ranged from 51% to 72% and lint cleaning efficiency ranged from 48.4% to 66.3% across varieties. Lint turnout ranged from 33.1 % to 36.8% and differed from breeders lint percent by 2.9% to 6.8% which suggested unequal response of the varieties to conventional ginning. Several new drying systems are in use that offer some advantages. Spindle-harvested cotton contains 5 to 10% waste. The fibrous component of this waste can be cleaned and marketed advantageously to the gin while the plant parts can be converted to a valuable product by managed composting.

Introduction

Cotton quality after ginning is a function of its initial quality as well as the type and degree of cleaning and drying that it receives during the gin process. Ginning includes drying, trash removal from seed cotton, lint-seed separation, trash removal from lint, bale packaging, and trash collection and disposal. The efficiency of these processes is strongly influenced by the quantity of moisture and trash that the cotton contains. Four stages of seed cotton cleaning are normally used to remove trash from spindle-harvested Upland cotton. These stages consist of spiked cylinders as well as channel-saw type cylinders, though in some cases a combination of both are used. The cleaners are designed to open the seed cotton and to remove trash

fragments. After ginning (lint-seed separation), all lint is cleaned again with a relatively fine-toothed rotating saw cylinder in a device called a "lint cleaner." One to three stages of lint cleaning are used in conventional gins.

All cotton in a particular gin usually receives the same degree of cleaning. This occurs without regard to the amount of trash in the cotton initially or the fiber color, primarily because no automatic method exists for measuring the trash in cotton continuously during gin processing. Processing cotton at the gin is an intricate task which proceeds at rates as high as 16 bales per hour per gin stand and some gins have as many as 8 gin stands. Visual interpretation of the effect of each processing machine on the physical properties of cotton cannot be quickly and accurately done by humans. Previous technological constraints precluded comprehensive online evaluation of the response of cotton fiber to gin processing; however, this is no longer true.

Potential Fiber Quality Improvements

Researchers at Stoneville recently developed the performance characteristics of each type of gin cleaning machinery in terms of their affect on fiber quality as a function of moisture and trash levels as well as cotton varieties (Anthony, 1996). Specifically, the following machine treatments were considered:

- (1) Commander extractor-feeder and Continental 20-saw gin stand only (EFGS)

- (2) Lummus cylinder cleaner and EFGS
- (3) Continental Little David stick machine and EFGS
- (4) Continental Impact cleaner and EFGS
- (5) EFGS and one lint cleaner
- (6) EFGS and two lint cleaners
- (7) EFGS and three lint cleaners
- (8) Cylinder cleaner, stick machine, Lummus Trashmaster, EFGS and two Continental 16-D lint cleaners
- (9) Lummus Trashmaster and EFGS

Samples were taken before gin processing, after all pre-cleaning and drying, and immediately before packaging to determine the characteristics of the seed cotton as well as the characteristics of the lint cotton. Foreign matter and moisture analyses were performed by the Cotton Testing Laboratory (CTL) at Stoneville. High-Volume Instrument (HVI) and Smith-Doxey classifications were done by the Agricultural Marketing Service at Greenwood, MS. Neps, seed-coat fragments and short fiber content were determined at the CTL at Stoneville, MS. Lint moistures after processing were 4.1, 5.5 and 8.4% for the three levels. After processing, lint visible foreign matter averaged 3.0, 4.1 and 7.8% for the three levels.

Length Measurements

From a Machinery standpoint, values for staple length ranged from 36.0 for the EFGS only to 35.1 for the three-lint cleaner treatment. All lint cleaner treatments decreased staple length. HVI length corresponded directly with moisture level and was 1.10, 1.11 and 1.12 in. respectively, for the low (4.1%), medium (5.5%), and high (8.4%) moisture level. No difference existed in length values for the seed cotton

cleaners. Lint cleaners reduced the length by 0.01 in. The short fiber content or fibers less than 0.5 in. long, increased from 4.6% to 8.7% as moisture decreased from 8.4% to 4.1%. Seed cotton cleaners did not increase the short fiber content but lint cleaners did. Lint cleaners increased the short fiber content to 6.8, 8.8 and 9.6%, respectively, as one, two and three stages of lint cleaning were used.

Uniformity and Strength

The uniformity was higher for the high moisture level, 82.8, than for the medium, 82.2, and low, 81.9, moisture levels. The machinery treatments caused the mean uniformity to vary from 81.4 (three lint cleaners) to 82.8 (EFGS only or stick machine) with lint cleaners decreasing uniformity about 1.0; however, machinery differences were not significant. Strength means for moisture were 28.0, 28.6 and 29.2 g/tex, respectively, for cotton processed at 4.1, 5.5 and 8.4% fiber moisture.

Seed-coat Fragments

The number of seed-coat fragments per 3 grams of lint was about 50% higher at the low moisture level than at the two higher levels. Machinery did not significantly influence the number of seed-coat fragments. The weight of seed-coat fragments was significantly influenced by Moisture and Machinery. Means for the high moisture level were significantly higher (33.8 fragments) than for the other two moistures (28.5 fragments). Machinery

strongly influenced fragment weight with the seed cotton cleaners having no effect and lint cleaners decreasing the weight dramatically.

Neps

Small entanglements of cotton fibers called neps increase each time that cotton is manipulated. Earlier studies of samples of cotton fiber collected in seven locations in a gin system and found that neps were increased from 6 to 16 per 100 in.² of web by simply removing cotton from the trailer pneumatically. Two stages of lint cleaning increased the number of neps dramatically from 18 to 34. After two stages of lint cleaning, neps decreased 38% when processed at 8.4% moisture as compared to 4.1%. Neps also decreased by 15% and 42%, respectively, when one and two stages of lint cleaning were bypassed.

Fiber Improvement by Process Control

The research data described earlier clearly indicate the need to selectively process cotton to minimize fiber damage. Control of fiber moisture will: 1) increase length about 4%, 2) reduce short fibers about 47%, 3) increase seed-coat fragment size about 18% and improve their removability at the textile mill, 4) decrease the number of seed-coat fragments about 36%, 5) increase measured strength by 5%, and 6) increase fiber yield 3%.

Eliminating one stage of lint cleaning will: 1) increase fiber length about 2%, 2) reduce short fibers

about 22%, 3) increase seed-coat fragment size about 21% and improve removability at the textile mill, 4) decrease neps about 15%, and 5) increase fiber yield about 2%.

Eliminating two stages of lint cleaning will: 1) increase fiber length about 4%, 2) reduce short fibers about 38%, 3) increase seed-coat fragment size about 80% and improve removability at the textile mill, 4) decrease neps about 42%, and 5) increase fiber yield about 6%.

Development of a Process Control System

A computer model of a cotton ginning system that optimizes farmer profits by selecting the amount of gin machinery necessary to achieve the most beneficial market value yet minimize the machinery used was developed as the basis for selecting machinery and drying. The model utilizes the market price structure for cotton and the performance characteristics for each gin machine to determine the optimum machinery sequence. The model utilizes input information relative to the moisture content, foreign matter, color, turnout, cotton price structure, and energy cost to select the optimum drying and cleaning sequence. Relationships for several other fiber properties are used to evaluate the impact of gin processes without actually measuring the property online. Commercially available infrared-type moisture meters as well as resistance and conductance-type meters are available and have been tested for use in process control systems. Scanning video color and trash meters similar

to those used by the Agricultural Marketing Service of the U. S. Department of Agriculture to class cotton can be used to measure color and trash during gin processing.

Software to integrate the optimum machine decisions with the moisture and color/trash sensors and control the routing of the cotton was developed and evaluated in a small-scale ginning system at Stoneville, MS. The computerized process control system uses special routing valves to bypass or select any combination of four seed cotton cleaners, two multi-path dryers, and three lint cleaners as directed by a computer. An infrared moisture meter and an HVI color and trash meter were installed at three locations in the gin system (Figure 1): (1) at the feed control before any processing, (2) above the extractor-feeder after most pre-cleaning, and (3) at the condenser immediately before packaging. These measurements are then used in the four dimensional decision matrices that contain machinery decisions based on measurements of moisture, color (reflectance and yellowness), and foreign matter. Increased monetary returns ranged from about \$7 to \$23 per bale.

After successful testing at the Lab, four commercial gins were automated to varying degrees Anthony, et al., 1994). Monetary increases ranged from \$3 to \$11 per bale depending on the degree of sophistication in the control system and its degree of utilization. Field evaluations in commercial gins clearly illustrate

substantial increases in farmer monetary returns. Thus, computerized process control allows the ginner to process each increment of cotton through the minimum machinery necessary to achieve maximum returns and maintain fiber quality. Research clearly demonstrates that process control designed to maximize farmer monetary returns will also minimize the damage to cotton fiber during gin processing. Successful mechanical and software operations indicated substantial savings to the farmer.

Conventional Ginning of Cotton Varieties

Lint Turnout for Varieties

Increased emphasis on fiber quality coupled with the need to improve farmer income has focused attention on the response of available cotton varieties to gin machinery. The ginning characteristics of 30 cotton varieties were determined by processing samples grown in 6 replications in two fields near Stoneville, MS in 1992 (Anthony, 1994). Most of the fiber quality and yield parameters were different for varieties. On the sandy loam soil, lint percent, which is the percent of lint that is ginned from random, hand-harvested bolls, varied from 41.7% for Stoneville 132 to 35.7% for Deltapine 50. On the mixed soil, lint percent ranged from 41.0% for Sure-Grow SGX-501 to 34.8% for Deltapine 50. Lint percent as determined in the genetic selection process, is not necessarily the same as gin turnout but was linearly related to turnout in this study. Much of the

difference is due to foreign matter. Gin turnout is the quantity of lint that is removed from bulk seed cotton during the gin process and represents the marketable lint that is baled. Seed cotton yield was multiplied times the actual lint turnout at the gin in order to provide a lint yield response typical of those at the commercial gin; both were adjusted for moisture.

Lint percentage values are extremely important since they indicate the amount of fiber that is on the cottonseed. Lint turnout values based on gin measurements, however, include the amount of foreign matter in the ginned lint cotton as well as the fiber lost during ginning and represent the marketable product. Thus, lint turnouts were adjusted for equal levels of initial foreign matter by removing the total initial foreign matter as a covariate; the adjusted means are shown in Tables 1 and 2. For the most part, the varieties on the upper and lower ends of the range held their place after being adjusted to a common level of initial foreign matter. When compared to the lint percent, the lint turnout adjusted to a common level of initial foreign matter was about 3.7% lower than the lint percentage but the differences ranged from 1.3 to 5.9. This difference is very important because it indicates that some varieties withstand ginning without fiber damage much better than others.

Lint Turnout for Gin Machines

Each gin machine removes some marketable fiber as it removes foreign matter, and most cleaning machines do not have an internal mechanism specially designed to minimize this fiber loss. Typical reductions in turnout with an extractor-feeder and gin stand only (EFGS) as the reference might be as follows: 1) cylinder cleaner, stick machine, and cylinder cleaner--0.71%, 2) #1 plus one lint cleaner--1.97%, and 3) #1 plus two lint cleaners--2.50%. Since these values include trash and fiber, laboratory techniques were used to separate the fiber from the trash. As a result, the seed cotton cleaning sequence in 1) above wasted about 6 pounds of fiber per 500 pounds of lint and about 21 pounds was wasted by the sequence in 3) above.

Seed Cotton Cleanability

Cleanability of the seed cotton was evaluated by determining the percent of foreign matter removed on the basis of the foreign matter in the raw seed cotton $((\text{initial foreign matter} - \text{feeder foreign matter}) / \text{initial foreign matter})$. Initial foreign matter percentages were used as a covariate with the SAS General Linear Models Procedure to adjust for the differences in the initial foreign matter of the raw cotton so that a common base would be available for comparing the ease of foreign matter removal. Seed cotton cleanability ranged from a low of 51% for HS-23 to a high of 72% for Deltapine 51.

Lint Cleanability

Lint cleanability was calculated by dividing the total feeder foreign matter by the lint turnout which essentially converted the value to lint basis, subtracting the total lint foreign matter (visible plus invisible) based on the Shirley Analyzer, and dividing by the feeder foreign matter (lint basis). Total feeder foreign matter (seed cotton basis) was used as a covariate since the foreign matter values at the feeder differed for the cottons. The means were adjusted for the covariate and ranged from 48.4% for Stoneville 453 to 66.3% for Deltapine 50. Overall cleanability ranged from 80.5% for Stoneville 453 to 88.1% for DPL-50 (Table 2).

Non-traditional Drying Methods

Fountain Dryer

The Fountain dryer is being used in more gins than any other non-traditional system. It uses high air volumes (50 cu.ft./lb of seed cotton), but creates less static pressure than the traditional tower dryer system due to the relatively straight flow and to large air ducts. Consequently, only pull fans are used rather than the push/pull systems needed to overcome the high static pressures in tower dryer systems. The typical fountain system uses only four pull fans, instead of the eight fans required in a push-pull tower dryer system for split 96-in. precleaning. This system uses only one dryer, instead of four. The seed cotton is picked up with hot

air at the module feeder and remains in drying air through all the inclined cleaners. The use of 2.5 times the drying air is not reflected in the air discharge through cyclones because the skimmer allows re-use of the same air in the second cleaning stage.

Hot Shelf Dryer

The basic difference in the hot shelf dryer and the classic tower dryer is the ability of the hot shelf to keep the temperature of the air constant throughout the dryer. Hot shelf dryers have 5-inch vanes located in half the shelves which lift the cotton off the shelf floor allowing the drying air to pass under and through the cotton. Bump-ups on the end of each shelf also increase the relative motion of the air and cotton. This dryer can be set up with two different air flow patterns. The preferred way is to include a separate fan and heater for the heat chambers which recirculates the heating air, replacing a small amount with fresh air for combustion. The second way is to split the air source, sending $2/3$ of the volume through the shelves with the cotton, and bleeding off $1/3$ of the volume which bypasses the shelves. The streams are mixed before the cotton is picked up and conveyed through the tower. The tower has 9 shelves with 12-inch spacings. For a velocity of 2,000 ft/min in the dryer, 12,000 CFM is required to convey the cotton through the dryer. There are 7 heat chambers

between the shelves which supply heat to the cotton stream through the tower walls.

Hi-Slip Dryer

Another non-traditional system for drying cotton currently being used is the Hi-Slip dryer. This machine uses the principle that turbulence and high relative velocities between the cotton and the drying air increase the drying rate. A spike or lugged cylinder retards the cotton flow but allows air to pass through the cotton, creating a high slip rate. According to the supplier, the venturi effect created by the nozzle which injects the hot air into the lugged cylinder allows the cotton to be mixed into the airstream without a vacuum wheel or rotary air lock.

Lummus High-Volume Tower

The Lummus High Volume Tower drying system uses 27-inch shelf spacings, 2,000 feet per minute velocities in the towers, and at least 25 cubic feet of drying air per pound of seed cotton in the first stage. This is a pull through system, eliminating the need for the push fan and motor. Two stages of drying are recommended, but the air volume can be reduced to 16 cubic feet per pound of seed cotton and the velocity in the dryer to 1,500-1,700 feet per minute in the second stage. The turbulent dryer trap removes green bolls, rocks, etc. from the seed cotton.

USDA Belt Dryer

The belt dryer passes seed cotton over an open wire belt through which drying air is pulled. This dryer allows excellent control of the basic factors necessary for good drying. Normal designs keep the cotton on the belt about 60 seconds. Low temperature air at 30-100 cubic feet of air per square foot of belt is used. The belt causes low resistance to air flow which when combined with mechanical transportation, provides energy savings.

Disposal of Gin Wastes

Gins for machine-picked cotton generate from 100 to 150 pounds of trash per 500-pound bale of ginned lint; for stripper-cotton gins, 500-700 lbs/bale of trash is generated (Thomasson and Anthony, 1990). Returning cotton gin waste (CGW) to the soil increases the nutrient level of the soil, making it a "value-added process." Spreading gin trash on the soil either in raw or composted form has certain advantages and disadvantages. Many satisfactory methods of returning cotton gin trash to soil are available and no one procedure is universally applicable. At least four methods that provide a workable alternative for ginners exist. Equipment can be sized based on 140 pounds of CGW per bale of machine-picked cotton, and a bulk density of about 7 pounds per cubic foot.

1. Spreading Raw CGW on Soil

Adding raw CGW enhances the soil by increasing the organic matter content, which improves tilth as well as other soil properties. It also acts as a fertilizer by adding nitrogen (N), phosphorus (P), and potassium (K) to the soil at approximate rates of 25, 12, and 25 pounds per ton dry weight, respectively. Adding raw CGW offers the additional benefit of retarding soil erosion. However, increased infestations of insects, diseases, and especially weeds are possible.

CGW can be collected by cyclone(s) in a covered collection area. The system can be equipped with a horizontal auger to distribute the CGW in a dump trailer. The use of two covered collection areas adds flexibility. A valve can redirect the flow when one trailer becomes full to reduce the need to immediately move trailers. Rear-dump trailers with high-flotation tires have performed satisfactorily in wet conditions, but side-dump trailers are also used frequently. A pivoting-auger system such as the Trashmax® can also be used.

CGW should be spread on soil at the rate of 1 to 18 tons per acre. Ginners have at least four alternatives for spreading the CGW.

1. Dump the CGW on the farmland and spread.
2. Dump the CGW in windrows on unused land, and allow the CGW to decompose with rain as the sole wetting agent (unmanaged composting). Incorporate or spread the windrows with either a disk or a land plane after the material is fully composted.
3. Dump in windrows or a relatively thin layer on farm land and spread immediately while the CGW is dry.

4. Raw CGW can also be spread on hilly land, the dry side of a levee, or other erodible area to help prevent erosion.

2. Managed Composting

Composting CGW in a rapid, managed fashion causes temperatures to increase to a point (up to 180°F) at which virtually no weed seeds, insects, or disease organisms can survive. Slow decomposition of CGW without high temperatures such as occurs when raw CGW is spread on the soil will alleviate these problems. Therefore, the end product of managed composting is beneficial as a soil amendment not only because it adds humus, N, P, and K to the soil, but also because it will not contribute to weed, insect, or disease infestations. Composted CGW contains approximately 50 pounds of Nitrogen, 25 pounds of Phosphorus (as P_2O_5), and 50 pounds of Potassium (as K_2O), per ton dry weight. Composting also reduces the volume of CGW by about 50% which can reduce transportation costs.

An effective method for fully composting CGW is to place the material in windrows, add water to establish and maintain the wet basis moisture content at about 60%, and mix thoroughly at intervals. If water is added appropriately and mixing is performed about once a week for the first month, the CGW should be fully composted in two to three months. A small amount of surfactant in the water used to initially wet the CGW will aid in wetting

and speed the onset of composting. Turning and mixing of the windrows can be performed with a windrow turner, front-end loader, or perhaps a root rake or similar device. A gin with a yearly volume of 10,000 bales requires about 7 acres of land and up to 750,000 gallons of water depending on the rainfall received for managed composting in windrows. If one inch of rainfall were received during the composting period, the requirement would be approximately 700,000 gallons, and so on. After the CGW is fully composted, it can then be disposed of in at least four ways:

1. Load in trailer or dump truck with a windrow loader or front-end loader, then dump on farm land and spread.
2. Apply to the soil with a spreader truck or manure spreader after loading.
3. Market truckloads to farmers.
4. Bag and market.

3. Augering Into A Pile

If adequate space is available, CGW can be piled and store on-site at the gin. This reduces labor and management requirements for CGW disposal until after the ginning season. The main drawback to this system is the possibility of fire in the pile, which could lead to serious smoke problems, and possibly a substantial fine from local, state, or federal environmental regulatory agencies. Therefore, it is generally preferable to move CGW off the gin yard to reduce the chances of sparks or fire being carried to the pile from the gin.

A long auger can be suspended on posts and used to form an extended pile of CGW as it falls from a cyclone. Additionally, a spray system can be suspended along with an auger to apply water to the pile, thereby causing it to compost, and reducing the risk of fire in the pile. If a surfactant is added to the water used to wet the pile the CGW will be more easily wet. Water should be added to the pile continually to keep it moist. Piles that have been wetted initially to the point that water runs off, but without the use of a surfactant to help the CGW hold the water, have caught fire in some instances when they have been allowed to dry as the season progressed. Thoroughly wet piles of CGW will get hot when composting, but not nearly hot enough to cause the pile to burn. As an alternative to the long auger, an auger that is moved laterally such as the Trashmax® can be used.

After the ginning season the remaining material can be picked up with a front-end loader and loaded onto a truck or trailer for disposal. The CGW can then be spread on the soil, sold, or given away in the same manner as raw or composted CGW.

4. Compressing, Moving, and Storing

If adequate resources for hauling and spreading are not available, and adequate high and dry land for composting is also not available, the CGW can be baled or moduled, and then moved, and stored at a remote site. It

should be noted that moduling CGW has been occasionally reported to be an unattractive alternative. First, the density of CGW is greater than that of seed cotton which necessitates building smaller modules. Second, excessive amounts of sand and dirt in the material can damage moduling and hauling equipment.

CGW can be collected and baled in a rectangular hay baler or mote press, or a module builder can be placed beneath a cyclone to form modules of CGW. A flat-bed truck can be used to transport bales or a conventional module mover or truck can be used to transport modules to a temporary storage location. This method allows large quantities of CGW to be transported at once. Bales and modules could be sold to farmers and gardeners, or allowed to decompose and then be spread on farm land.

Chemicals

A few of the agricultural chemicals found in CGW are stable in open storage (DEF, Toxaphene, Paraquat, Sodium chlorate, "Supracide" organophosphate insecticide, Omite, and Kelthane). Composting generally breaks down chemicals more rapidly than under ambient conditions. Some exceptions are Kelthane and DEF, which are partially degraded, and Paraquat, which was quite stable during composting. When composted CGW is amended to field soil, residue levels are generally very low to undetectable in the soil, suggesting little potential hazard for a compost and amendment operation. The decline of residues

during composting coupled with the dilution factor when composted waste is incorporated into the soil, suggests that soil residues less than 0.5 PPM and generally less than 0.1 PPM just after incorporation occurs. It is unlikely that toxicity to germinating and developing seedlings will result at these levels, or that residue transfer to subsequent seedlings will result at these levels, or that residue transfer to subsequent crops will result from typical incorporation rates, because the few chemicals that survive composting are not systemic.

Anaerobic decomposition yields partly oxidized compounds and reduces chemicals such as fatty acids, aldehydes, alcohols, hydrogen sulfide, etc. which are capable of continued biochemical decomposition; these end products can be a serious nuisance. Anaerobically composted CGW is brown and gives off an offensive odor.

Thomasson and Willcutt (1996) reported that composting alleviates most concerns about spreading raw CGW. Pilot-scale experiments showed that surfactant speeded the uptake of water by CGW, but the effect was not evident in a test at a commercial gin. Varying the flow of water used to wet CGW in response to the gin's CGW flow was unnecessary. For initially wetting CGW from picker-harvested cotton, it is unnecessary to regulate the flow of water according to the CGW flow rate. Setting the water flow rate at 17 gal per bale of cotton would be adequate to bring CGW at virtually any flow rate

to an acceptable moisture content to initiate composting. The only necessity in regulating water flow rate is in stopping the water flow when cotton is not flowing through the gin. A venturi-type injection system to mix surfactant with water to wet CGW in an auger-type collection/composting system is feasible. Varying concentrations from 0 to 1/2% showed that increasing surfactant concentration speeds the uptake of moisture. For concentrations over 1/2%, this did not hold true.

Disclaimer

Mention of a trade name, proprietary product, or specific machinery does not constitute a guarantee or warranty by the U.S. Department of Agriculture and does not imply approval of the product to the exclusion of others that may be available.

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Table 1. Results of 1992 cotton variety trial on a Bosket very fine sandy loam soil at Stoneville, MS.¹

Variety	Variety code	Adj. lint, lb/acre ³	Seed index	Adjusted turnout, %	Lint percent	Difference ⁴
Seed Source S-35	1	900	10.5	33.1	37.4	4.3
Deltapine 20	2	1047	10.8	34.4	38.0	3.6
Deltapine 50	3	959	11.1	32.8	35.7	2.9
Deltapine 51	4	913	10.8	33.8	37.2	3.4
Deltapine 5415	5	851	8.6	35.4	39.2	3.8
Deltapine 5690	6	809	9.7	33.8	37.6	3.8
Deltapine DES-119	7	1067	10.5	34.2	38.6	4.4
Hyperformer SS-195	8	998	9.6	34.2	37.5	3.3
Hyperformer HB 91-SS109	9	997	10.3	34.4	38.5	4.1
Sure-Grow SG-501	10	1075	10.0	36.1	40.3 ⁵	4.2
Stoneville 453	11	1076	11.2	35.6	38.9	3.3
Stoneville 907	12	910	11.2	33.7	37.9	4.2
AES 804	13	972	10.4	33.4	37.8	4.4
Hartz HX-1380	14	971	10.6	35.3	39.4	4.1
Hartz HX-1330	15	1079	11.1	33.8	38.6	4.8
Stoneville LA-887	16	1023	11.2	35.4	39.8	4.4
Stoneville 132	17	1009	10.8	36.0	41.7 ⁵	5.7
Stoneville 9358	18	936	10.4	35.2	39.2	4.0
Stoneville COKER 84-828	19	1038	10.1	35.0	38.8	3.8
Germaines GC 8978	20	857	10.2	34.4	37.3	2.9
Chembred 219	21	971	11.1	33.8	37.4	3.6
Chembred 333	22	938	10.0	33.6	37.9	4.3
Chembred 1233	23	981	10.3	33.6	38.4	4.8
Chembred 1135	24	880	11.1	32.8	39.6	6.8
Terra C-40	25	910	10.4	34.4	38.5	4.1
Terra 207	26	917	10.5	33.8	37.4	3.6
Hyperformer HS-23	27	953	10.5	32.8	37.8	5.0
Hyperformer HS-46	28	816	10.1	34.1	6	6
Hartz HX-1244	29	1102	12.5	36.6	39.9	3.3
Hartz HX-1215	30	1224	11.4	36.8	41.3 ⁵	4.5
Average		946	10.6	34.4	38.7	4.1

¹Planted April 16, 1992 and harvested September 25, 1992²Based on field weights³Adjusted to common moisture and foreign matter levels at ginning⁴Difference between lint percent and adjusted lint turnout⁵Unusually high⁶Data missing

Table 2. Results of 1992 cotton variety trial on a mixed soil at Stoneville, MS.¹

Variety	Variety code	Adj. lint, lb/acre ²	Lint percent	Seed index	Adjusted turnout, %	Difference
Seed Source S-35	1	963	36.4	11.1	33.3	3.1
Deltapine 20	2	1063	37.5	10.6	34.4	3.1
Deltapine 50	3	1073	34.8	11.1	32.4	2.4
Deltapine 51	4	1027	36.9	9.8	34.3	2.6
Deltapine 5415	5	999	37.9	8.6	36.6	1.3
Deltapine 5690	6	1021	36.9	9.1	34.2	2.7
Deltapine DES-119	7	1051	37.8	10.7	34.3	3.5
Hyperformer SS-195	8	1038	37.4	10.6	33.8	3.6
Hyperformer HB 91-SS109	9	1115	37.4	9.9	34.1	3.3
Sure-Grow SG-501	10	1211	41.0	10.1	36.2	3.8
Stoneville 453	11	1160	38.1	10.1	34.4	3.7
Stoneville 907	12	1118	37.5	10.6	34.2	3.3
AES 804	13	953	36.1	10.4	32.6	3.5
Hartz HX-1380	14	1090	39.5	9.8	35.7	3.8
Hartz HX-1330	15	1076	37.1	10.4	33.2	3.9
Stoneville LA-887	16	1069	38.3	11.5	35.6	2.7
Stoneville 132	17	948	39.2	11.5	36.1	3.1
Stoneville 9358	18	893	37.7	10.8	34.2	3.5
Stoneville COKER 84-828	19	1071	38.1	10.1	35.2	2.9
Germaines GC-8978	20	1023	37.8	10.8	35.1	2.7
Chembred 219	21	1006	35.7	11.3	33.1	2.6
Chembred 333	22	1142	37.4	10.6	33.8	3.6
Chembred 1233	23	1073	39.1	9.9	34.0	5.1
Chembred 1135	24	998	36.0	10.9	33.4	2.6
Terra C-40	25	1103	38.1	9.5	34.6	3.5
Terra 207	26	979	36.8	11.2	33.1	3.7
Hyperformer HS-23	27	1213	38.9	11.1	33.0	5.9
Hyperformer HS-46	28	976	37.8	9.5	35.3	2.5
Hartz HX-1244	29	1216	39.9	12.7	36.6	3.3
Hartz HX-1215	30	1312	40.8	10.7	37.2	3.6
Average		1066	37.8	10.5	34.5	3.3

¹Planted April 23, 1992 and harvested October 5, 1992²Based on field weights³Adjusted to common moisture and foreign matter levels at ginning

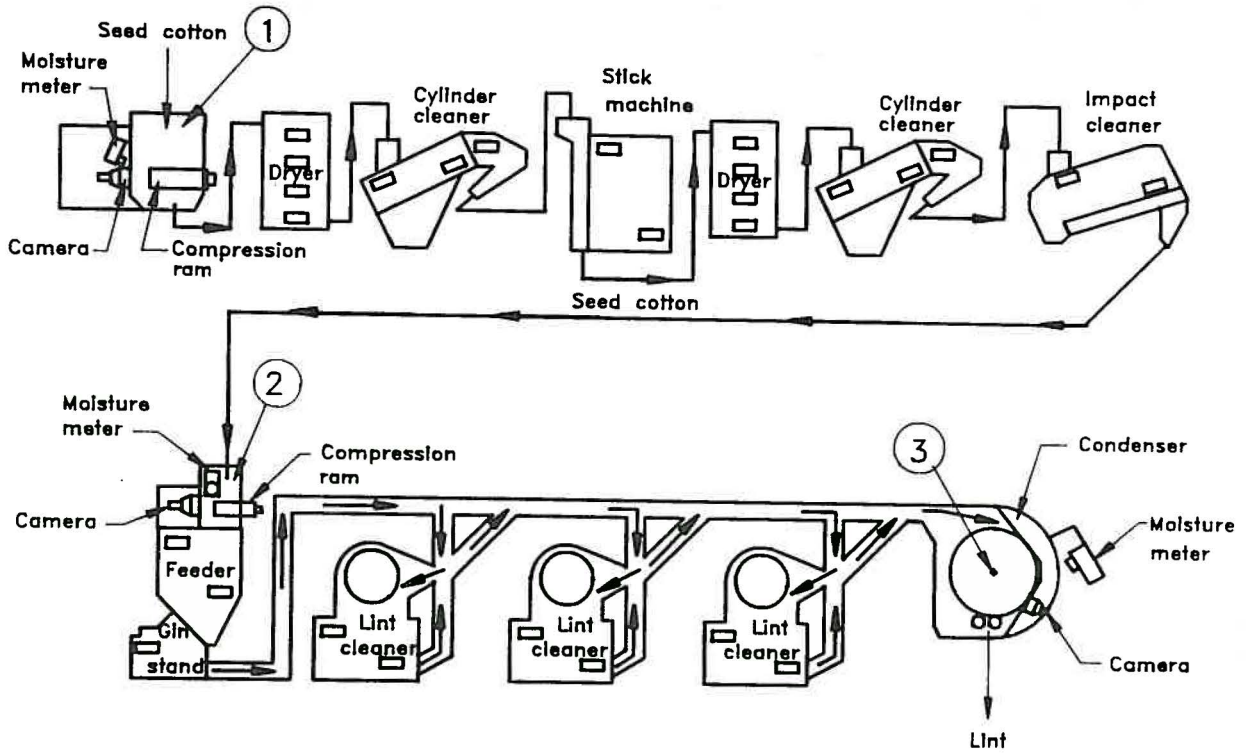


Figure 1. Schematic of a ginning system with video trash cameras installed (1) at the feed control before any processing, (2) above the extractor-feeder after most pre-cleaning, and (3) at the condenser immediately before packaging.