PRESENTATION + PAPER

Session: **Cotton Quality And Testing**

Title: **The Effect of Various Processing Stages During Ginning on Fibre Quality**

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The Effect of various processing stages during ginning on fibre quality

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Purpose & Objectives of Ginning

Purpose

Is to separate fibre from seed and produce cotton lint that is a saleable and processable commodity.

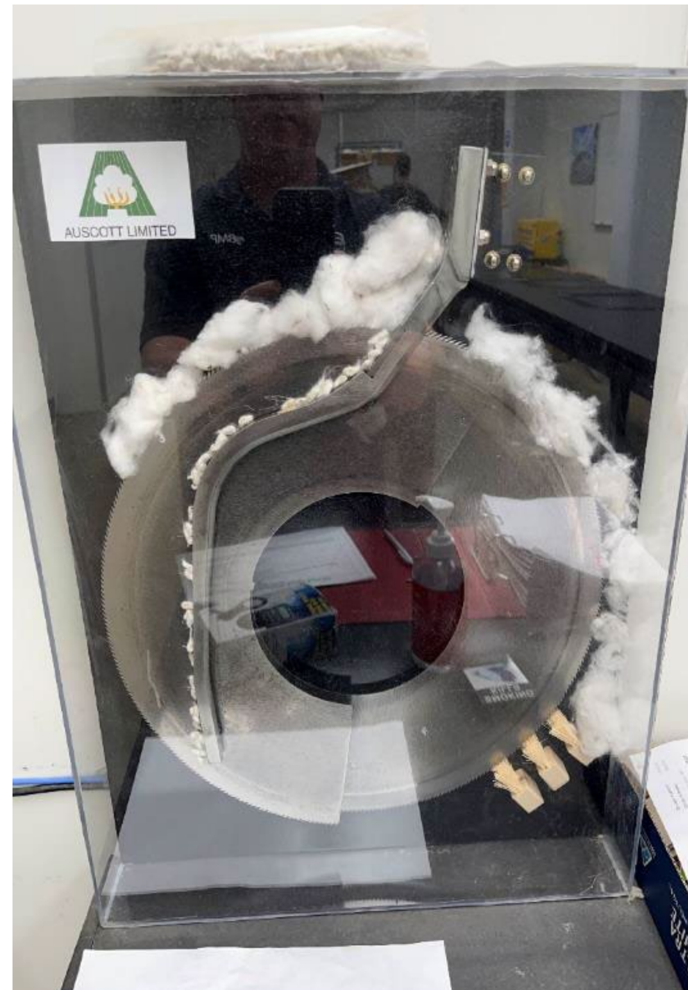
Objectives

- to produce lint of enough quality and quantity to enhance and maximize the return to the grower
- to produce a fibre with minimum damage to satisfy the demand from the spinner.

Ginning is an essential link between the grower and mill.

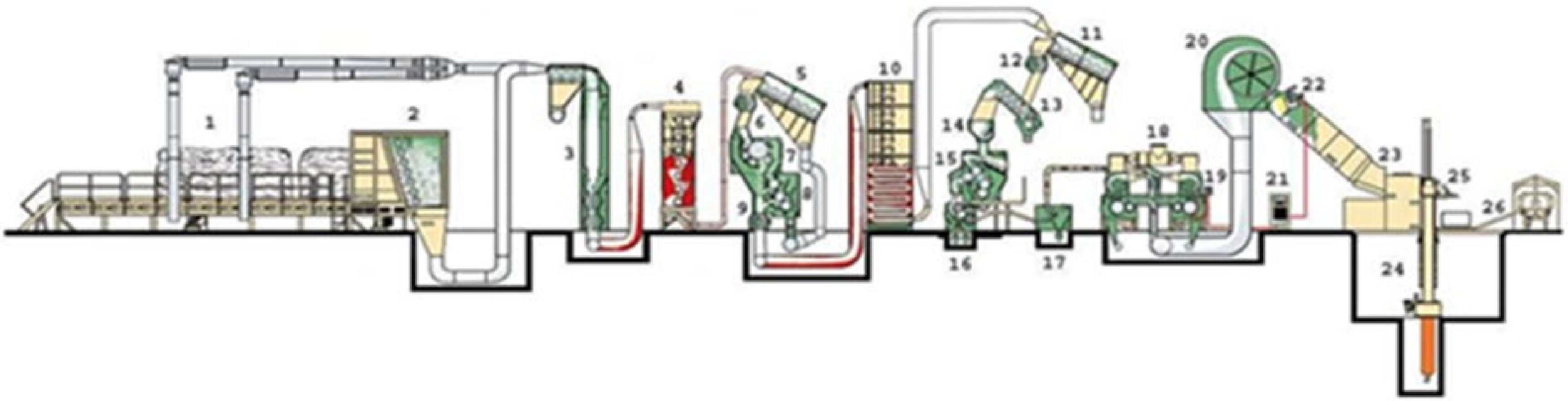
The layout, size, type, and technology of the gin depends mainly on the type of cotton grown, production and harvesting conditions, economic factors, as well customer requirements.

In essence, modern ginning is a combination of thermal, pneumatic, and mechanical processes.



The quality of ginned cotton is directly related to the quality of seed cotton prior to ginning. The gin is only able to maintain the quality of cotton taken from the field, never improve it.

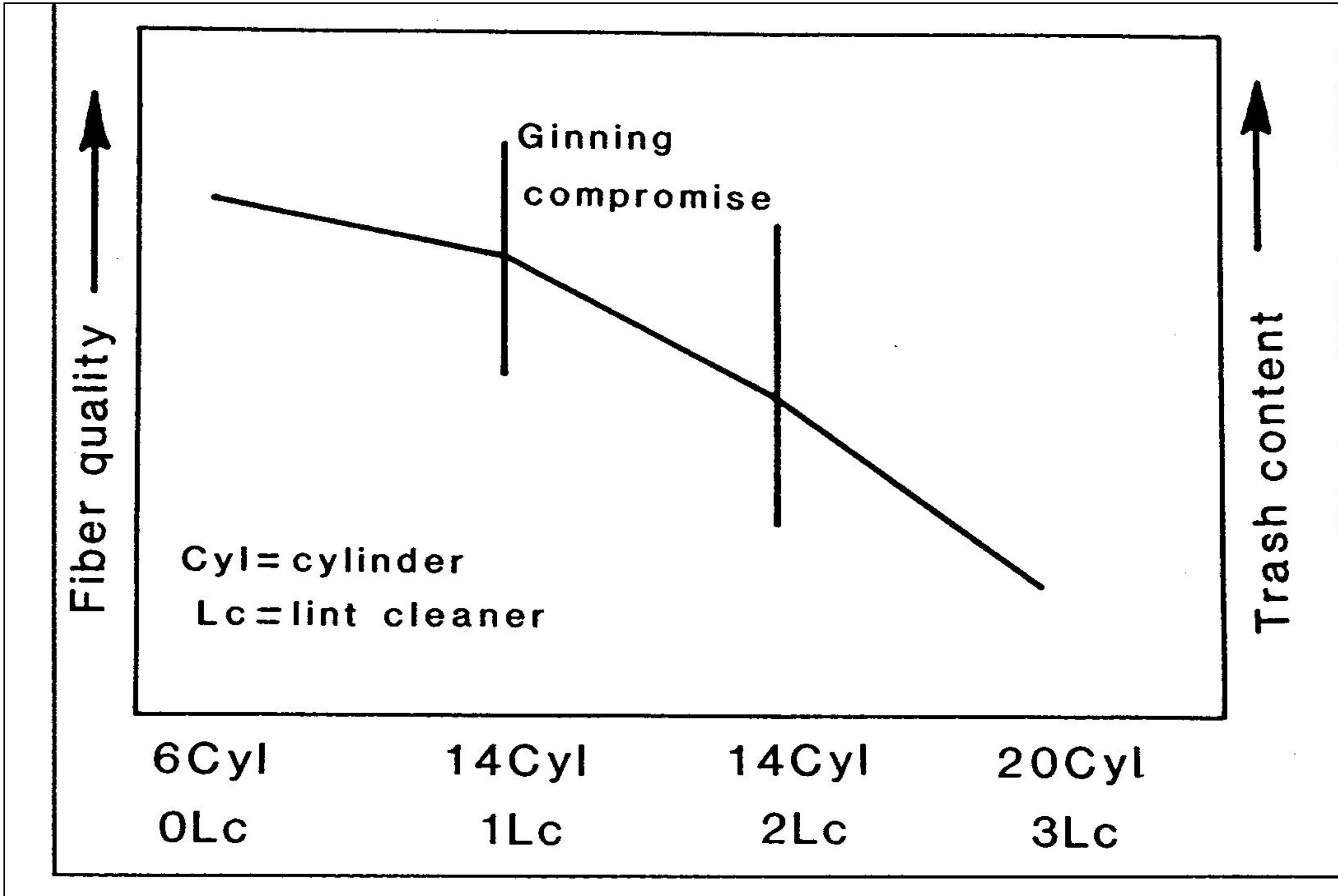
Typical Layout of a modern saw gin



1 – Suction telescope
2 – Module feeder
3 – Big J feed control
4 – Vertical flow dryer
5 – Inclined cleaner
6 – Vacuum feeder
7 – Striper cleaner
8 – Stick machine
9 – Vacuum feeder
10 – Tower dryer
11 – Inclined cleaner
12 – Vacuum feeder
13 – Impact cleaner
14 – Conveyor distributor
15 – Extractor feeder
16 – Gin stand
17 – Centrifugal cleaner
18 – Lint cleaners
19 – Lint cleaner louvers
20 – Battery condenser
21 – Eagle eye imaging
22 – Moisture max
23 – Belt feeder
24 – Press system
25 – Jenglo wire tying
26 – Bale bagging system

Courtesy Continental Eagle PTY. LTD.

Machinery



Courtesy of Cotton Ginners Handbook,1994

Trial Details

For direct comparisons:

- 36 Round Modules from one field (82,380 kg).
- One Variety (Sicot 74BRF)
- Moisture monitored (≤ 12%).
- Modules staged in sequence
- 18 RM ginned in sequence at two gins (78 & 76 bales of 227 kg)
- Ginned within a similar timeframe
- Almost ideal conditions (low heat not exceeding 100 °C)
- Same classing facility

400 to 500 g seed cotton samples collected three times after processing 6, 12 & 15 RM.

Trial Details

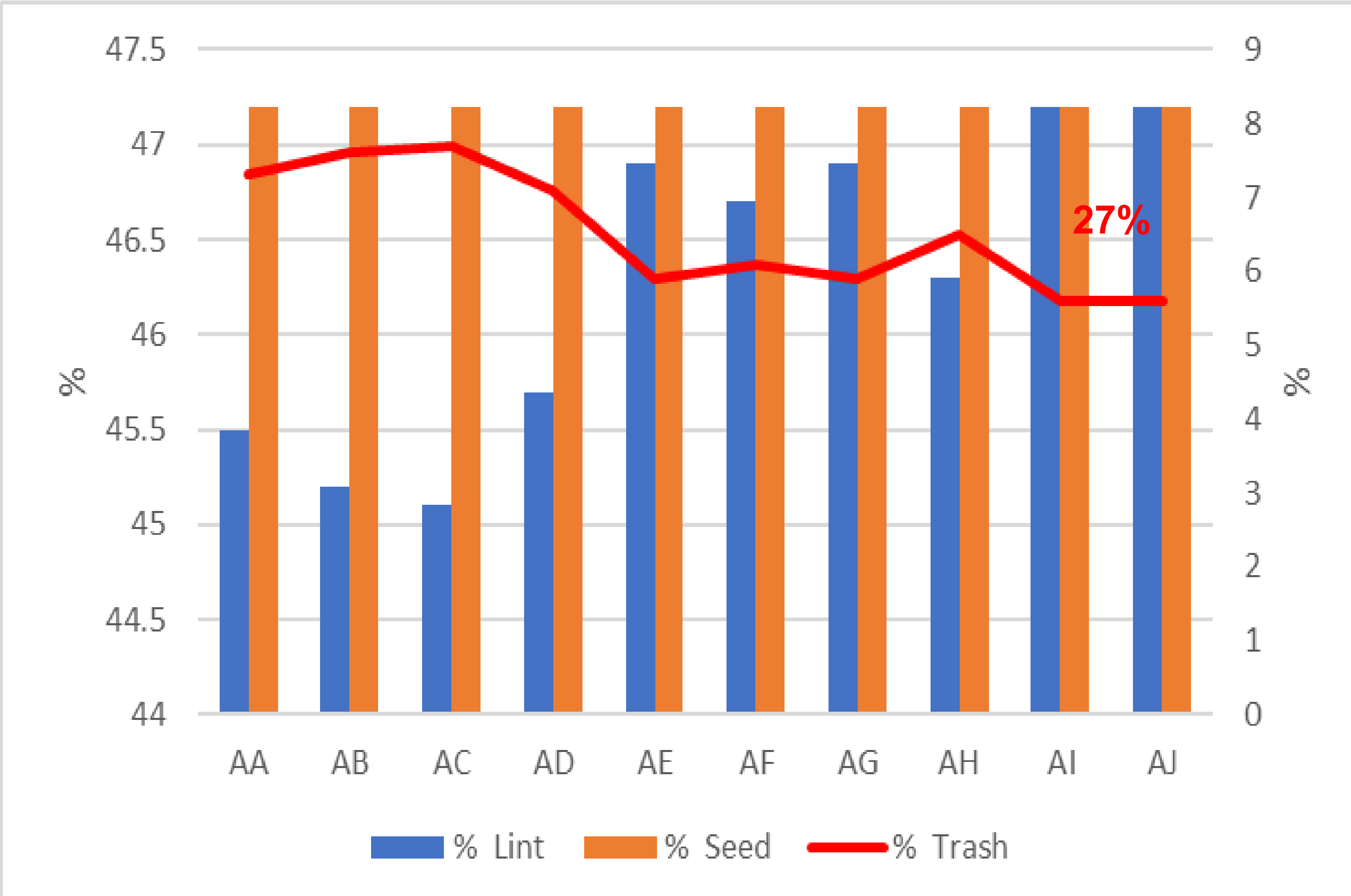
Gin A		Gin B	
Gin Process	**Designation**	**Gin Process**	**Designation**
Module	AA	Module	BA
After Module Feeder	AB	Feeder Belt	BB
After Tower Dryer	AC	Before Hot Air Cleaners	BC
After Hot air dryer	AD	Before Cylinder Cleaner	BD
After Stick Machine	AE	After Cylinder Cleaner	BE
Cylinder Cleaner	AF	Before 2nd Stage H/Air Cleaners	BF
After Collider Dryer	AG	After 2nd Stage H/Air Cleaners	BG
After Hot Air Cleaner	AH	After Conditioner	BH
After Pre-feeder	AI	After Extractor Feeder	BI
After Extractor Feeder	AJ	Gin Stand	
Gin Stand		Air LC	
Air LC		1st L/C[2]	
1stL/C[1]		2nd L/C	
2nd L/C			

[1] batt-less [2] Controlled- batt

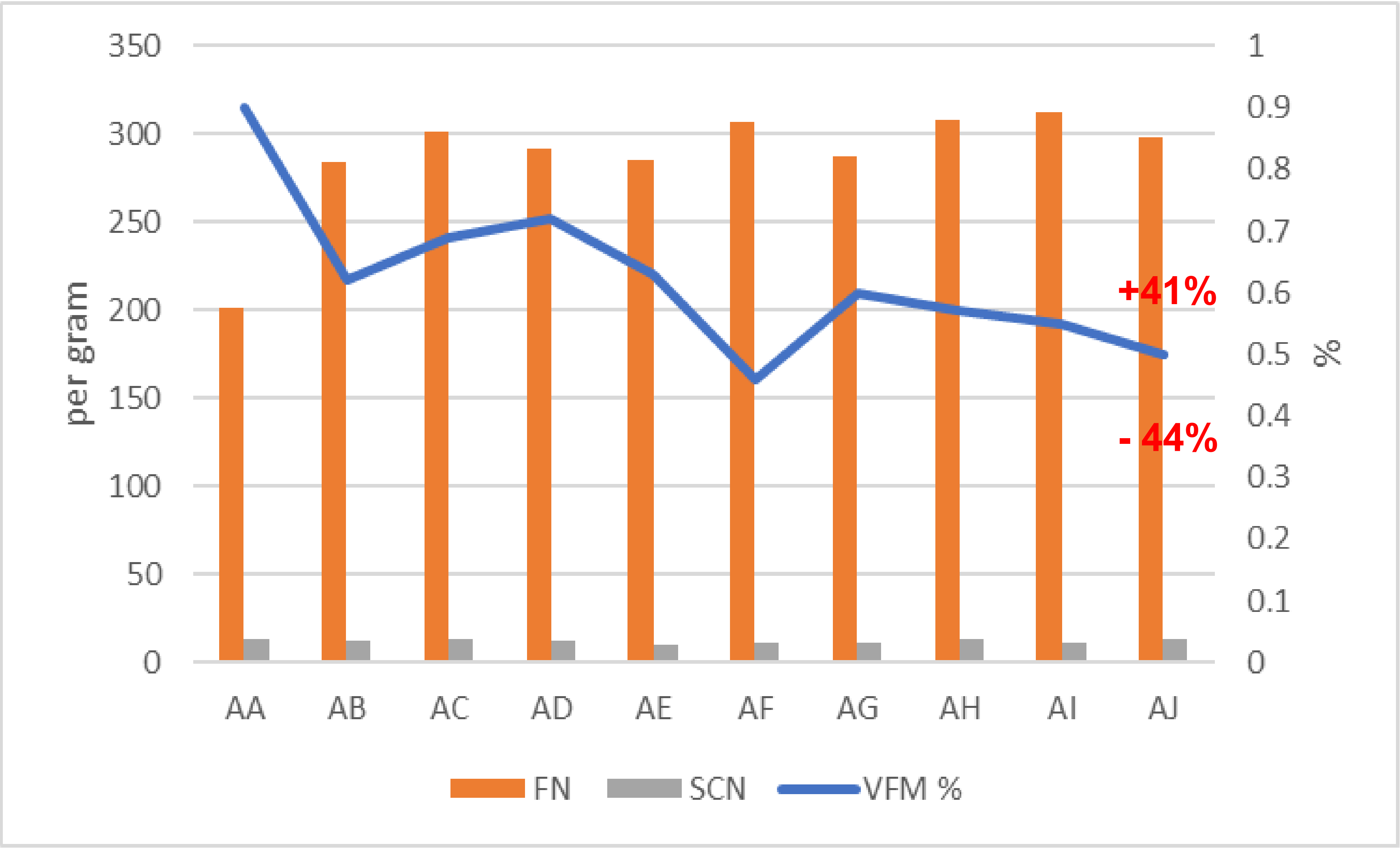
Sample Preparation

- 300 g of each sample ginned on a custom-made Continental 20 saw gin, with a pre-cleaner to remove trash and sticks with no lint cleaning.
- 20 g of the resultant fibre from each stage was then processed twice through the Tianjin Jiacheng Mechatronic Equipment Co., Ltd, DSOP-02 digital-sample opening machine.

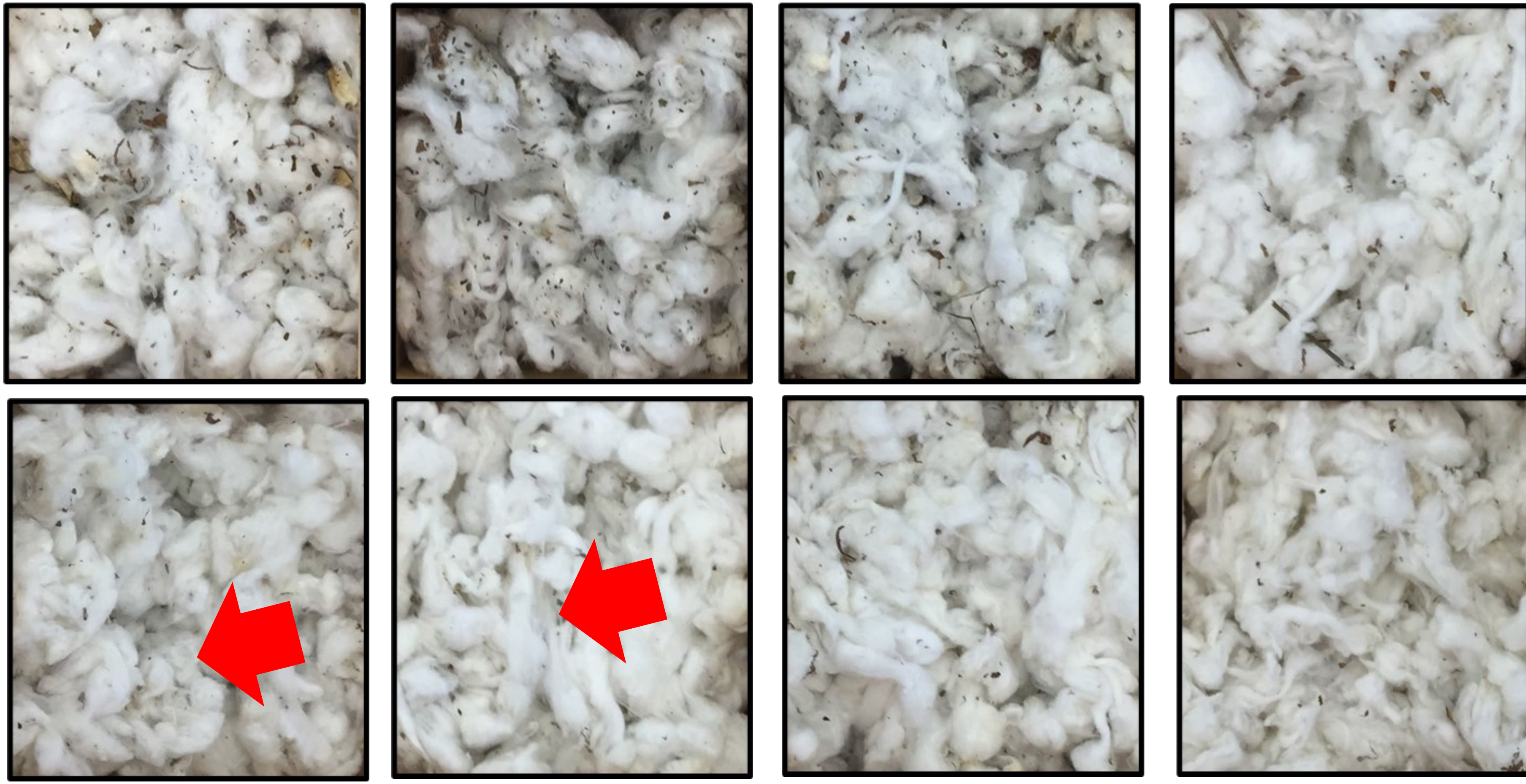
Seed Cotton Results



Seed Cotton Results (AFIS)



FN- fibre neps; SCN- seed-coat neps; VFM %- visible foreign matter



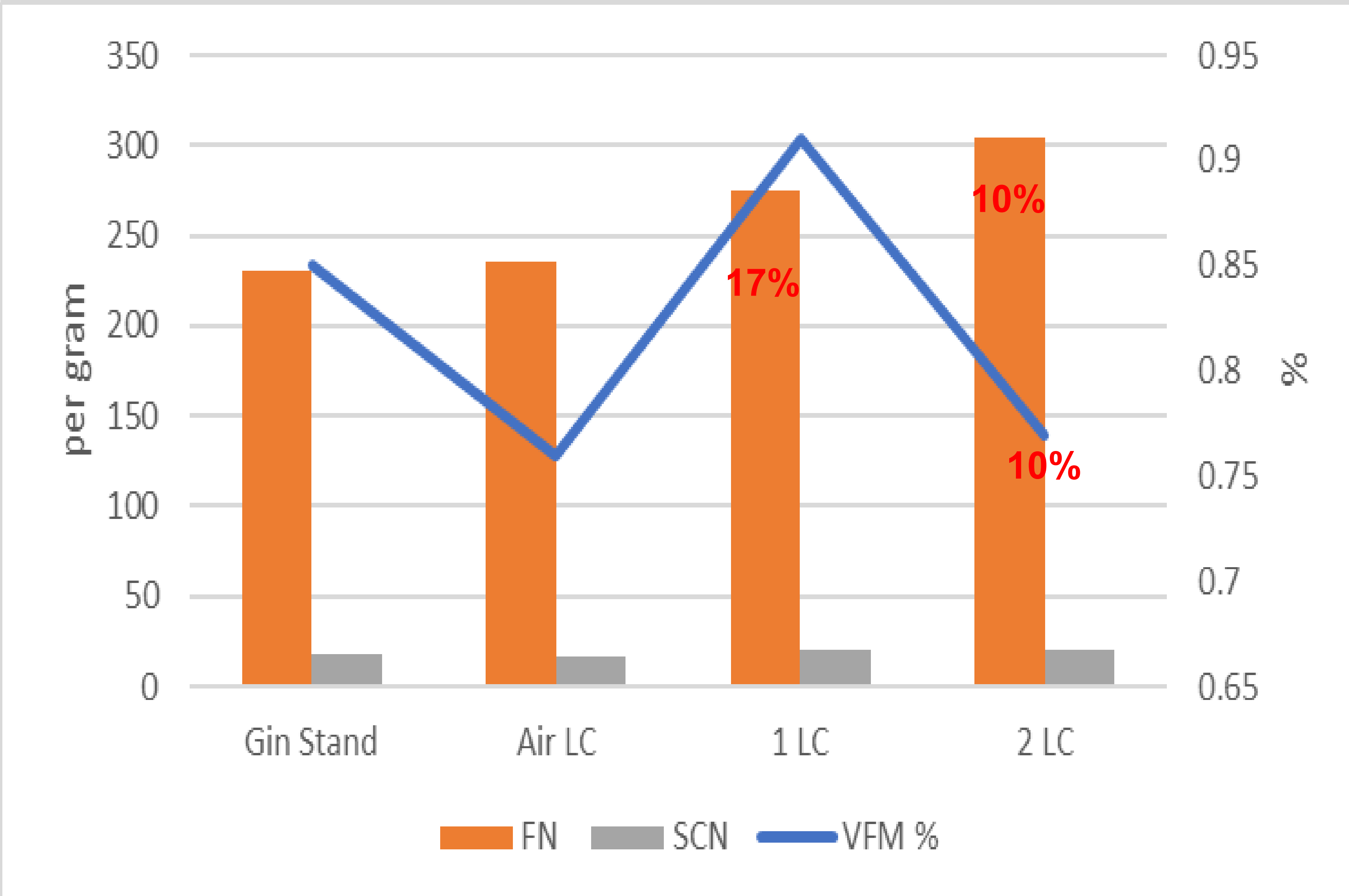
Progress through seed cotton cleaning stages

Lint Results (HVI)

Gin Process	+b	Rd	UHML mm	UI %	SFI %	Str g/tex	Mic	Trash count	% Area	Leaf grade
Gin Stand	7.0	76.4	31.18	82	8.3	31.2	4.02	31	0.47	3.0
Air LC	7.1	77.0	31.46	82	7.7	31.4	4.01	27	0.41	2.9
1 LC	7.5	79.6	31.12	82	8.3	31.0	4.03	21	0.26	2.6
2 LC	7.4	80.4	30.58	82	8.8	30.1	4.08	16	0.18	2.1

Visual Classing from 41 (Strict Low Middling) after the gin stand and air lint cleaner, to 31 (Middling), after the first and second saw lint cleaner with a leaf grade of 3, which is equal to the Australian base grade.

Lint Results (AFIS)



Conclusions

In essence the main function of the gin is to remove lint from seed, remove trash and form a bale for further processing.

Modern gins can easily cope with trash levels of ≤10%.

Trash levels > 10%; combined with Moisture of > 12% will require excessive drying, increased heat & processes.

The pursuit of grade results in:

- reduction of length by 1 32nd

- increased SFI%

- increased Neps.

- reduced lint turn out

Gin process control and in-line measurement systems crucial

Is grade really that important?

Are spiners aware what the trade offs are?

Acknowledgements

- Cotton Research and Development Corporation

-CSIRO

-Ginners

Mention of product or trade names does not constitute an endorsement by TTS over other comparable products. Products or trade names are listed for reference only.

Please see submitted conference paper for more detail

Thank you

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The Effect of Various Processing Stages During Ginning on Fibre Quality

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Abstract

This study was conducted to determine the effectiveness, in terms of cleaning efficiency and fibre quality of the seed cotton cleaning stages installed in cotton gins that process predominately spindle-picked, irrigated Upland cotton and to determine the effect of the various processing stages during ginning on lint turn out and fibre quality. The study showed that the average amount of trash content present in seed cotton was typically < 10%. The seed cotton cleaning process was able to remove 20 to 40% with the remainder of the trash removed by subsequent lint cleaning stages. The study also showed that the gin stand had no influence on fibre quality provided that it was not overloaded, maintained to manufacturers recommendations, and moisture levels maintained within recommended levels. Flow-through air lint cleaners had no significant effect on fibre quality with minimal reduction in trash. The controlled-batt saw lint cleaners had positive and significant effects on colour and trash and negative effects on length, length uniformity and short fibre content with no effect on strength and micronaire. The batt-less saw lint cleaners had similar effects on fibre quality, although not as severe. The controlled-batt saw lint cleaners were more aggressive than the batt-less saw lint cleaners and removed more trash and hence achieved a better colour grade, with this improvement resulting in notable reductions in lint turn out and fibre length with increased short fibre and nep content.

Introduction

The purpose of ginning is to separate cotton fibre from seed and produce cotton lint that is a saleable and processable commodity. The layout, size, type, and technology of the gin can take on a number of forms, which depend mainly on the type of cotton grown, production and harvesting conditions, economic factors, as well customer requirements. In essence, modern ginning is a combination of thermal, pneumatic, and mechanical processes. Historically, the process of separating the lint from the seed was done either by hand or with an early version of a roller gin, which was laborious and slow and has been replaced by saw ginning. The invention and commercialization of the saw gin resulted in an immediate and dramatic increase in cotton production worldwide.

Irrespective of which method is used to gin cotton, the ginner has two objectives: (1) to produce lint of enough quality and quantity to enhance and maximize the return to the grower, and (2) to produce a fibre with minimum damage to satisfy the demand from the spinner and the consumer. Ginning is, therefore, an essential link between the cotton grower and cotton spinning mill, with the quality of ginned cotton directly related to the quality of seed cotton prior to ginning - the gin is only able to maintain the quality of cotton taken from the field, never improve it. Cotton gins are typically equipped with processing systems that include: (1) module feeder, (2) dryers, (3) seed cotton cleaners, (4) gin stands, (5) lint cleaners, (6) battery condenser, (7) bale packaging, and (8) trash handling systems.

Seed cotton cleaners were introduced in the early 1900s and function to open or break large wads of seed cotton and remove foreign material, such as leaves, trash, carpels, burrs, stems and other plant material, as well as dust. Extractors and stick machines are used to remove sticks, burrs, and other large pieces of foreign matter from seed cotton. Driers were introduced during the 1930s and are now standard equipment in all gins. Irrespective of which system is used, the time of exposure to heat should not be excessive, and the temperature in the drying system should be kept below 177°C to prevent fibre damage

The actual ginning process, that is, the separation of lint from seed, occurs at the gin stand, and hence, the gin stand is the heart of the ginning process. The capacity of the gin and the quality and processing performance of the lint in the spinning process are dependent on the condition and adjustment of the gin stand. Hence, gin stands must be operated as per manufacturer's recommendations as if overloaded can damage cotton seed and fibre quality.

Lint cleaning was introduced during the 1940s and was developed specifically to remove foreign matter left in the lint after the seed cotton cleaning and ginning stages. Lint cleaners remove leaf particles, grass, motes, stems, bark, seeds, fine trash, sand, and dust and can improve the grade of cotton by removing foreign matter as well as by blending light, spotted cotton. Most modern gins have two or more stages of lint cleaning, with two being the most common. The amount and type of lint cleaning required is dependent on the existing market price differentials between grades, the operating performance of the equipment in the gin, and the trash content and colour of the seed cotton itself.

There are essentially three types of machines used for lint cleaning: the flow-through air lint cleaner, controlled-batt saw lint cleaner, and the batt-less saw lint cleaner. Flow-through air lint cleaners, commonly referred to as air-type lint cleaners have no saw, brushes, or moving parts, with cotton transported by air through a duct with an sudden change in direction, which results in the ejection of trash due to centrifugal forces. These lint cleaners are generally installed immediately behind the gin stand preceding the saw-type lint cleaner. These lint cleaners are less effective in removing trash and improving the grade of the cotton than the saw-type lint cleaner, but they remove less fibre from the bale and do not adversely affect the quality of the fibre as much .

Controlled-batt saw lint cleaners form lint into a batt that is fed through compression rollers onto a saw cylinder with grid bars and then removed by a doffing brush. Controlled-batt saw lint cleaners are the most common lint cleaner in the ginning industry and are based on cleaning principles that were developed in the 1940s. They generally improve the grade of the lint and reduce card room dust levels as well as residue build up in rotors during rotor spinning and are recognized as the standard type of cleaner in the ginning industry. The improper use of controlled-batt saw lint cleaners can reduce ginning turn out and bale value, because fibre length and length uniformity are reduced. Saw-type lint cleaners also can adversely affect nep and short fibre levels, as well as yarn appearance, irregularity, and imperfections. They also reduce the size of any remaining trash particles, making them difficult and costly to remove in the spinning mill.

Batt-less saw lint cleaners were introduced in the late 1990s and feed fibres directly to the saw without forming a batt. Trials showed that there was an improvement in fibre properties such as length and nep and short fibre content opposed to the traditional controlled-batt saw lint cleaner.

This study was initiated for two reasons: (1) to determine the cleaning efficiency and effect on fibre quality of seed cotton cleaning stages installed in gins in removing trash content. and (2) to determine the influence of the various cotton gin processing systems, particularly lint cleaning, in a high production system on fibre quality.

Materials and Methods

The study was conducted with seed cotton harvested from one field which was subjected to standard management practices for irrigated cotton in Australia. The field was subjected to three harvest aids by air, with a mixture of leaf defoliant boll opener and defoliant spray oil and then harvested using a spindle harvester. The ambient air conditions of the field (temperature and relative humidity) were monitored to ensure that moisture content was ≤ 12%. This ensured no excessive drying was needed during the ginning process.

Thirty-six modules, produced sequentially, were chosen for this study, with 18 modules ginned at Gin A and 18 modules at Gin B. All modules were ginned under standard commercial conditions with standard processing stages required for spindle harvested Upland cotton to achieve base grade. Both gins are modern super-high-capacity gins equipped with 4 x 170 saw gin stands that can produce a total of 60 bales per hour.

The layout of the two gins were slightly different. Gin A has a stationary head module feeder, 1st stage burner and tower dryer, hot air cleaner, stick machine, cylinder cleaner, 2nd stage dryer, hot air cleaner, pre-feeder, conditioning hopper, extractor feeder, gin stand, air-type lint cleaner, batt-less saw lint cleaners, battery conditioner/steam roller, press and bale handling. Gin B has a moving head module feeder, hot box burner, rock trap, control bin, 1st stage burner and tower dryers, hot air cleaner, stick machine, cylinder cleaner, 2nd stage burner and tower dryer, hot air cleaner, conveyor distributer, conditioner, moisture conditioner hoppers, feeder, gin stand, air-type lint cleaner, controlled-batt saw-type lint cleaners, battery conditioner/steam roller, press and bale handling.

All samples were collected as per Table 1.

Table 1. Sample collection points and designation for Gins A & B

Gin A		Gin B	
Gin Process	**Designation**	**Gin Process**	**Designation**
Module	AA	Module	BA
After Module Feeder	AB	Feeder Belt	BB
After Tower Dryer	AC	Before Hot Air Cleaners	BC
After Hot air dryer	AD	Before Cylinder Cleaner	BD
After Stick Machine	AE	After Cylinder Cleaner	BE
Cylinder Cleaner	AF	Before 2nd Stage H/Air	BF
After Collider Dryer	AG	After 2nd Stage H/Air	BG
After Hot Air Cleaner	AH	After Conditioner	BH
After Pre-feeder	AI	After Extractor Feeder and	BI
After Extractor Feeder	AJ	Gin Stand	BJ
Gin Stand	AK	Air LC	BK
Air LC	AL	1st L/C	BL
1stL/C	AM	2nd L/C	BM
2nd L/C	AN		

As the seed cotton samples collected during the seed cotton cleaning and drying stages still contained seed, 300 g of each sample was ginned on a Continental 20 saw gin, with a pre-cleaner to separate the lint from the seed and remove some trash and sticks with no lint cleaning. Twenty grams of the resultant fibre from each stage was then processed twice through a Tianjin Jiacheng Mechatronic Equipment, digital sample opening machine. This process was necessary to gently remove trash and dust still present in the fibre to enable fibre quality determination.

Classing samples from opposite sides of each bale were collected at the gin after bale formation. These bale samples as well as the samples collected from the gin stand and lint cleaners were subjected to objective measurement, using an Uster® Technologies HVI™ 1000. Two subsamples of each sample were tested for colour in terms of yellowness (+b), reflectance (Rd), upper half mean length (UHML) (mm), bundle strength (g/tex), and micronaire. Three subsamples from the above samples as well as the samples collected from the seed cotton cleaning stages were also tested to determine total, fibre and seed coat neps (SCN), trash (> 500 μm), dust (< 500 μm), and percent visible foreign matter (VFM%) via a Uster® Technologies Advanced Information System instrument (AFIS). Visual classing of the lint was also conducted to assess colour and trash.

The percentage of the weight of usable fibre per the weight of unginned seed cotton (lint turn out) was calculated by the commercial ginning operators using module and ginned bale weights.

To test for statistical differences between treatment means, ANOVA was conducted on the experimental data using Genstat 16.0 (Lawes Agricultural Trust, IACR Rothamsted, UK). Where significant statistical differences at the $\alpha = 0.05$ and lower level were identified, for ease of interpretation, nonsignificant results were designated as ns. Means with the same letter were not significantly different.

Results and Discussion

Seed Cotton Cleaning

Seed cotton consists of fibre, seed, and trash. To quantify the amount of trash removed during the seed cotton cleaning process it was necessary to determine the proportions of the three components. Previous studies conducted in Australia during that time concluded that the average percentage of seed present in seed cotton, irrespective of variety was 47.2%. With this assumption and the measured weight of seed cotton and lint, the amount and percentage of trash was calculated. As can be seen in Table 2, the average trash content present in the seed cotton averaged from 7.3 to 8.2% (AA and BA).

Table 2. Average of % lint, seed, and trash present at various stages for Gins A & B

Gin A				Gin B			
Gin Process	**% Lint**	**% Seed**	**% Trash**	**Gin Process**	**% Lint**	**% Seed**	**% Trash**
AA	45.5	47.2	7.3	BA	44.6	47.2	8.2
AB	45.2	47.2	7.6	BB	45.5	47.2	7.3
AC	45.1	47.2	7.7	BC	45.1	47.2	7.7
AD	45.7	47.2	7.1	BD	45.4	47.2	7.4
AE	46.9	47.2	5.9	BE	45.8	47.2	7.0
AF	46.7	47.2	6.1	BF	45.9	47.2	6.9
AG	46.9	47.2	5.9	BG	45.3	47.2	7.5
AH	46.3	47.2	6.5	BH	46.6	47.2	6.2
AI	47.2	47.2	5.6	BI	47.3	47.2	5.5
AJ	47.2	47.2	5.6				

Gin A. The incoming moisture of the modules averaged < 11%, thus the burner settings for processing the seed cotton during the first stage drying was set at 100 to 65°C, with the burners set at 75 to 58°C during second stage drying, with moisture levels at the gin stand maintained between 5 and 8%. There was an overall reduction in trash content of 22.7%, with a large reduction in trash of 17.9% occurring at the stick machine (AE), with further minimal amounts of trash removed after the first-stage hot air cleaner and the feeders. Interestingly, there was a slight increase in the amount of trash after the module feeder and tower dryer and a large increase of 13.8% after the second-stage hot air cleaner (AH).

Gin B. The incoming moisture of the modules averaged < 10%, thus the hot box burner was set at 60°C with the burners set at 55 to 45°C during second stage drying, with moisture levels at the gin stand maintained between 5 and 8%. There was an overall reduction in the trash content of 32.8%. There was a large reduction of 11.8% after the module feeder (BA), followed by the stick machine (BE) with a reduction of 5.8%, with minimal trash removed by the conditioners and the extractor feeders (BH and BI). The amount of trash increased 5.6% after the feeder belt (BC), which was attributed to dust generated in that area. As was the case in Gin A there was an increase of 8.4% in the amount of trash after the second-stage hot air cleaner (BG).

Lint Turn Out

Average lint turn out for Gin A was 42.4% and 41.7% for Gin B, with the difference of 0.7% significant for a grower in terms of economic return. This difference was not entirely unexpected as the controlled-batt saw type lint cleaner is more aggressive than the batt-less saw lint cleaner and, thus, removed more trash as well as usable lint.

Fibre Quality

Gin A. As can be seen in Table 3, there were significant differences between the average trash and nep results, as measured by AFIS, gathered from the various seed cotton cleaning equipment prior to the gin stand, designated AA to AJ. Seed cotton cleaning had positive and significant effects on total trash and trash counts; negative results on total nep and fibrous neps and no effect on dust count, trash size, VFM% and SCN. As observed in the seed cotton cleaning section, there was a significant decrease in the amount of trash, in terms of total trash content and trash count as the seed cotton was processed through the various cleaning equipment. Although there was an insignificant overall reduction in trash size, there was an increase of 12.7% after the pre-feeders (AI). Although, there was no effect on SCN, there was however, a significant increase of 41% (201 to 284 neps/g) in the number of fibrous neps after the module feeder (AB), with this amount of fibrous neps maintained throughout the rest of the seed cotton cleaning process.

As can be seen in Tables 4 & 5 there were significant differences between the average lint results gathered after the ginning process. The air-type cleaner (AL) had virtually no effect on the fibre properties, with slight and insignificant improvements in AFIS and HVI trash levels. The saw lint cleaners had positive and significant effects on colour and trash; negative effects on UHML and nep content and no effect on strength, short fibre content, length uniformity, micronaire and SCN. The saw lint cleaners improved the colour results in terms of +b and Rd values, resulting in the visual colour grade improving from 41 (Strict Low Middling) after the gin stand (AK) and air type lint cleaner (AL), to 31 (Middling), after the first and second saw lint cleaner (AM and AN) with a leaf grade of 3, which is equal to the Australian base grade for Upland cotton. The improvement in colour coincided with reduced trash and dust counts as measured by AFIS and significant reduced trash count, percentage area, and trash grade as measured by HVI, especially after the second saw lint cleaner.

There was a slight deterioration in UHML after the first batt-less saw lint cleaner (AM), with a larger and significant decrease after the second batt-less saw lint cleaner (AN) of 0.54 mm, which is equal to one 32^{nd} (39 to 38). The total and fibrous neps both increased by 17% after the first batt-less saw lint cleaner (AM) and a further increase of 10% after the second batt-less saw lint cleaner (AN).

Table 3. AFIS determined fibre quality for seed cotton Gin A

Gin Process	Total trash/gram	Total trash size µm	Trash /gram	Dust /gram	VFM %	Total neps/gram	Fibre neps/gram	SCN /gram
AA	254d	368	56c	197	0.90	214a	201a	13
AB	191c	361	43b	148	0.62	296b	284b	12
AC	183b	366	39a	144	0.69	314b	301b	13
AD	197b	375	42b	155	0.72	304b	292b	12
AE	175b	372	40a	135	0.63	296b	285b	10
AF	139a	369	30a	109	0.46	318b	307b	11
AG	162b	363	34a	128	0.60	298b	287b	11
AH	178b	354	35a	144	0.57	321b	308b	13
AI	121a	399	29a	93	0.55	323b	312b	11
AJ	171b	345	33a	139	0.50	311b	298b	13
p value	<0.001	ns	<0.001	ns	ns	<0.001	<0.001	ns

Table 4. HVI & AFIS fibre quality from Gin A

Gin Process	+b	Rd	UHML mm	UI %	SFI %	Str g/tex	Mic	Total neps/gram	Fibre neps/gram	SCN /gram
AK	7.0a	76.4a	31.18b	82	8.3	31.2	4.02	248a	230a	18
AL	7.1a	77.0a	31.46c	82	7.7	31.4	4.01	252a	235a	17
AM	7.5b	79.6b	31.12b	82	8.3	31.0	4.03	295b	275b	20
AN	7.4b	80.4b	30.58a	82	8.8	30.1	4.08	324c	304c	20
P value	<0.001	<0.001	<0.001	ns	ns	ns	ns	<0.001	<0.001	ns

Table 5. HVI & AFIS determined trash for Gin A

Gin Process	Trash count	% Area	Leaf grade	Total trash/gram	Total trash size µm	Trash /gram	Dust /gram	VFM %
AK	31c	0.47c	3.0c	280	332a	49	231	0.85
AL	27c	0.41c	2.9c	256	335a	44	212	0.76
AM	21b	0.26b	2.6b	249	350b	46	203	0.91
AN	16a	0.18a	2.1a	213	352b	40	173	0.77
P value	<0.001	<0.001	<0.001	ns	<0.001	ns	ns	ns

Gin B. As can be seen in Table 6, there were no significant differences between the average trash and nep results obtained from the seed cotton cleaning equipment prior to the gin stand, designated BA to BI. There were, however, significant differences in terms of trash, although these differences did not result in an overall reduction in the trash and dust count. For example, there was a large increase in trash values as measured by AFIS after the feeder belt (BC) and after the second stage hot air cleaner (BG), which was mainly due to increased dust and trash counts.

As can be seen in Tables 7, and 8, there were significant differences between the average lint results gathered after the ginning process. The air-type lint cleaner (BK) had little effect on the fibre properties, with slight increase in trash levels mainly due to increased dust count as measured by AFIS. The controlled-batt saw lint cleaners had positive and significant effects on colour and trash and negative effects on UHML, length uniformity, short fibre index, total, and fibrous nep content with no effect on strength, micronaire and SCN. The controlled-batt saw lint cleaners improved colour results in terms of +b and Rd values, resulting in the visual colour grade improving from 31 (Middling) after the gin stand (BJ) and air-type lint cleaner (BK), to 21 (Strict Middling) after the first and second controlled-batt saw lint cleaners (BL and BM) with a leaf grade of 3; which was better than the Australian base grade for Upland cotton and resulted in a small premium. The improvement in colour coincided with significantly reduced trash and dust counts, as well as VFM% as measured by AFIS and significantly reduced trash count, % area, and trash grade as measured by HVI, especially after the second controlled-batt lint cleaner.

There was a slight deterioration in UHML after the first controlled-batt saw lint cleaner with a larger and significant decrease after the second controlled-batt saw lint cleaner (BM) of 0.68

mm, which was equal to one 32nd (39 to 38). There was also a deterioration in length uniformity from 83 to 81 and an increase in short fibre index of just over 1% after the first and second controlled-batt saw lint cleaners. The amount of total and fibrous neps both increased by 17% after the first controlled-batt saw lint cleaner (BL) with a further increase of 10% after the second controlled-batt saw lint cleaner (BM).

Table 6. AFIS PRO determined fibre quality for seed cotton Gin B

Gin Process	Total trash/gram	Total trash size µm	Trash /gram	Dust /gram	VFM %	Total neps/gram	Fibre neps/gram	SCN /gram
BA	261a	351	51a	209a	0.86	278	269	9a
BB	275a	363	58b	217a	0.99	272	258	15a
BC	579b	356	114d	465b	2.16	283	257	26b
BD	364a	379	79c	285a	1.50	305	291	15a
BE	393a	360	74b	318a	1.53	307	287	21b
BF	260a	377	52a	208a	1.11	297	282	16a
BG	361a	354	68b	292a	1.36	334	314	20b
BH	312a	377	63b	250a	1.25	318	298	19b
BI	217a	382	45a	171a	1.01	313	293	21b
p value	<0.001	ns	<0.001	<0.001	ns	ns	ns	<0.001

Table 7. HVI & AFIS fibre quality from Gin B

Gin Process	+b	Rd	UHML mm	UI %	SFI %	Str g/tex	Mic	Total neps/gram	Fibre neps/gram	SCN /gram
BJ	7.5a	78.0a	30.88d	83c	8.2a	30.1	4.23	212a	197a	15
BK	7.5a	78.3a	30.67b	83c	8.4b	30.2	4.22	222a	206a	15
BL	7.6a	78.4a	30.73c	82b	8.8c	30.2	4.23	229b	214b	16
BM	7.9b	80.3b	30.05a	81a	9.9d	29.8	4.19	334c	317c	16
p value	<0.001	<0.001	<0.001	<0.001	<0.001	ns	ns	<0.001	<0.001	ns

Table 8. HVI & AFIS determined trash for lint for Gin B

Gin Process	Trash count	% Area	Leaf grade	Total trash/gram	Total trash size µm	Trash /gram	Dust /gram	VFM %
BJ	34b	0.43b	1	209b	359	40b	169b	0.80b
BK	34b	0.47c	1	250c	358	49c	201c	1.00c
BL	33b	0.41b	1	253c	354	49c	204c	0.94b
BM	26a	0.19a	1	137a	368	29a	109a	0.51a
p value	<0.001	<0.001	ns	<0.001	ns	<0.001	<0.001	<0.001

Conclusion

This study was conducted to determine: (1) the cleaning efficiency and effect on fibre quality of seed cotton cleaning stages installed in Australian cotton gins that currently process predominately irrigated, spindle-harvested Upland cotton, and (2) the influence of the various cotton gin processing systems on fibre quality and gin turn out. Results from this study, and other similar studies show that the amount of trash delivered to Australian gins was typically < 10%, with gins able to reduce the amount of trash by 20 to 40% during the seed cotton cleaning process with the remainder of trash removed by subsequent lint cleaning stages.

In terms of fibre quality, results from the study showed that the gin stand had no influence on fibre quality if they are not overloaded, are maintained to manufacturers recommendations, and that moisture levels are maintained between 5 and 8%. Air-type lint cleaners had no effect on fibre quality, with only minimal reduction in trash. The saw-type lint cleaners generally had positive and significant effects on colour and trash and negative effects on UHML and nep content with no effect on strength, short fibre content, length uniformity, micronaire and SCN. The controlled-batt saw lint cleaners were more aggressive than the batt-less saw lint cleaners and removed more trash, and hence, achieved a better classing grade, with this improvement resulting in an 1% reduction in lint turn out, and a 0.5 mm reduction in length (approximately one 32^{nd}), with an 1.2% increase in short fibre and slightly more fibrous neps.

It must be borne in mind that this study was conducted under ideal conditions in terms of trash and moisture content as well as all equipment operated as prescribed by machinery manufacturers and best practice. Any less than ideal conditions will result in increased fibre damage and processing performance difficulties.

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