Beyond The Farm Gate

Ginning

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The ginning industry in Australia is relatively modern, with higher throughput gins compared with other countries. The principal function of the cotton gin is to separate lint from seed and produce the highest total monetary return for the resulting lint and seed, under prevailing marketing conditions. Current marketing quality standards most often reward cleaner cotton and a certain traditional appearance of the lint.

A ginner has two objectives:

- To produce lint of satisfactory quality for the grower's classing and market system; and,
- To gin the cotton with minimum reduction in fibre spinning quality so the cotton will meet the demands of its ultimate users, the spinner and the consumer. The spinner would prefer fibre without trash, neps and short fibres. Unfortunately, the highly mechanised (and productive) harvesting and ginning processes used today, mean that removing trash is difficult without introducing some neps and increasing short fibre content.

The challenge for the ginner is therefore to balance the amount of cotton produced (turn-out), the speed at which it is ginned and the effects that the various cleaning and ginning components have on the fibre quality. Particular settings in a gin for speed or heat can exacerbate nep and short fibre content. The use of lint cleaners, while removing trash, also increases the number of neps and short fibres. Whilst not included in existing classification systems for cotton, the presence of neps and short fibre seriously affect the marketing ability. The ginner must also consider the weight loss that occurs in the various cleaning machines. Often the weight loss to achieve higher grade results in greater removal of lint as well, which results in a lower total monetary return to growers and ginners as they are both paid on a per bale basis.

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- The main concerns during the ginning process are to maintain quality, optimise lint yield and contain the costs of ginning.
- Appropriate ginning and handling practices post-harvest are important to maximise returns for growers and maintain the industry's reputation for high quality cotton.
- Good communication between growers and ginners is a key factor in assisting this process (see Table 1).

TABLE 1:
Summary of key post harvest decisions for optimising fibre quality.

Objectives	At the gin
Maintaining fibre length	In the gin, fibre length can be preserved and short fibre contents reduced, by reducing the number of lint cleaner passages (depending on quality of seed cotton) and ensuring fibre moisture at the gin and lint cleaner should be closer to 7% than 5%; however, fibre moisture at either point should not exceed 7%. Lower combing ratios between feed rollers and the saw of lint cleaners also reduces the amount of fibre breakage.
Reducing the incidence of neps	Lint cleaners are responsible for most of the neps found in baled cotton. Reducing the number of lint cleaners reduces neps. Maintenance of prescribed setting distances, e.g. feed and grid bar distances to the lint cleaner saw reduces fibre loss and nep creation, as does close and proper setting of the doffing brush to the saw. Preservation of fibre moisture as prescribed for length preservation also helps reduce nep creation.
Preventing contamination	Clean gravelled module storage yards. Frequent inspection of tarps on modules. Appropriate bale covering/wrap. Storage and handling to avoid damage.

Cotton quality after ginning is a function of the initial quality of the cotton, and the degree of cleaning and drying it receives during ginning; the exact balance between turn-out and grade will depend upon the particular premium-and-discount (P&D) sheet applied to the cotton in question. For every P&D sheet there will be a point in the balance between turn-out and grade that maximises the return to the grower.

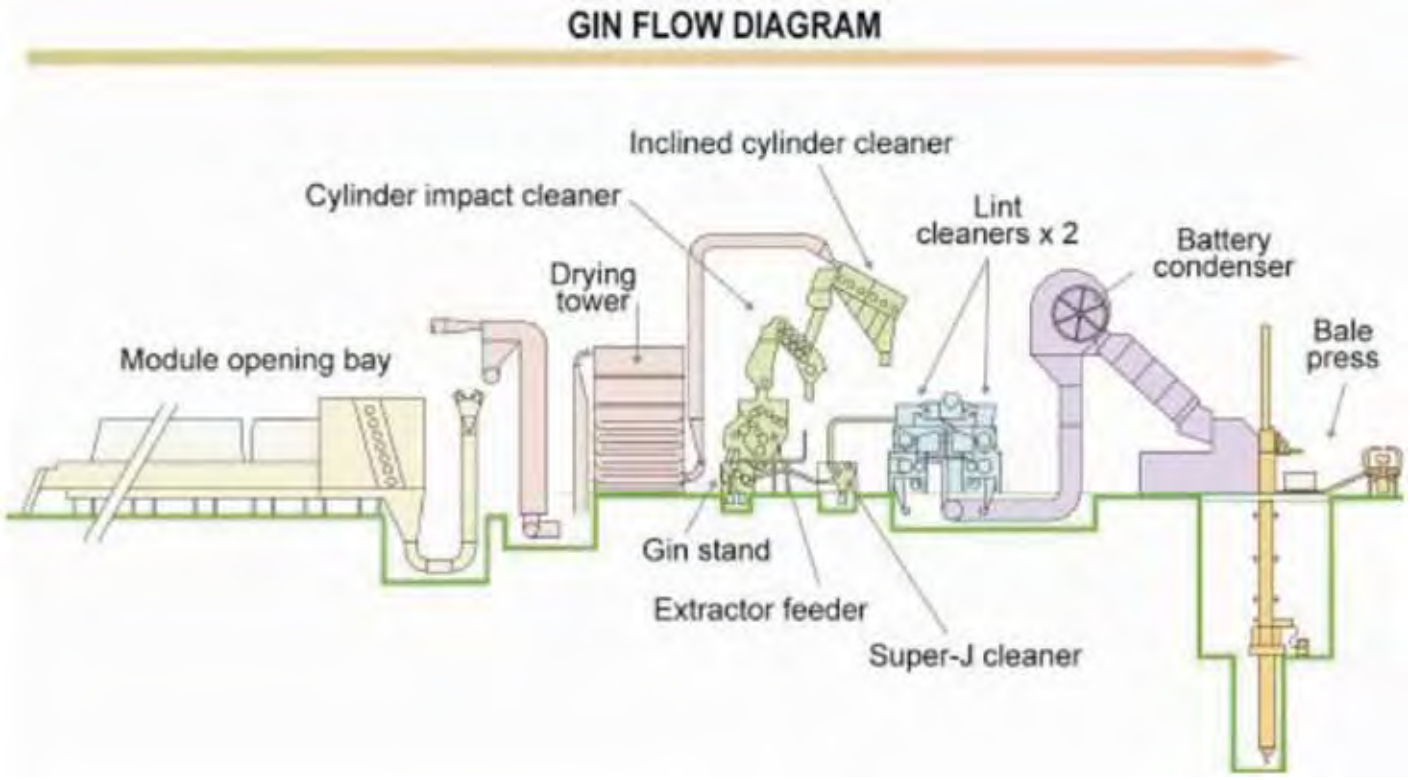
Given this need to balance competing considerations, it is essential that growers seek to:

- Ensure defoliation and harvest practices limit trash;
- Contamination is limited; and,
- The size and moisture of the module are appropriate.

Ultimately it is important that growers communicate with ginners these aspects of their harvest prior to the start of the ginning season. An understanding of the issues that were faced in the field may give the ginner insights on how the cotton can be handled to optimise turn-out and quality together.

Modern gins are highly automated and productive systems that incorporate many processing stages. Gins must be equipped to remove large percentages of plant matter from the cotton that would significantly reduce the value of the ginned lint, according to the classing grade standards. Figure 1 shows the cross-section of a gin with machines that are typical of those found in a modern gin, although it is noted that most Australian

FIGURE 1.
Gin flow diagram showing cross-sections of machines used in a modern gin to process spindle harvested cotton.



gins typically have more pre-cleaning stages. This gives them the flexibility to process both spindle harvested cotton and stripper harvested, which requires more pre-cleaning.

At ginning the lint is separated from the seed. Moisture can be added to dry cotton prior to the gin stand at either the pre-cleaning stage or after the conveyor distributor above the gin stand. However, in Australia the moisture addition at these points is not common. After ginning, fibre travels by air to one or two lint cleaners for further cleaning and preparation. At the lint cleaners, moisture content is critical to prevent cotton from significant damage (neps and short fibres). Cotton that is too dry (< 5.5% moisture content) will be damaged to a greater degree during the lint cleaning process.

This information has been adapted from FIBREpak chapter 13 – post harvest management.

Classing

Acknowledgements: Helen Dugdale (CRDC); John Stanley (UNE, Australian Classing Services)

The quality of cotton can be expressed by a number of different measurements which are performed by cotton classers. These measurements are described in a wide range of grades (Figure 1), and affect the final price that is paid for a bale of cotton.

Once cotton is ginned, and while it is being baled, a sample (of 120g – 170 g) is taken from both sides of every bale and bulked together and sent to the classing facility for classification.

Historically, the cotton industry has employed both visual and mechanical methods to determine quality. Most aspects of visual cotton classing are gradually being replaced as they are considered to be subjective, by the HVI (High Volume Instrument) instrument which is able to assess various important textile quality related fibre properties byobjective measurement.

Visual methods are based on the United States Department of Agriculture (USDA) standard grade boxes for Upland and Pima cottons of colour and foreign matter, and then assigning such cotton to a certain

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- Classing is a complex process, whilst this chapter gives an overview, a more detailed understanding can be gained from visiting your nearest classing facility.








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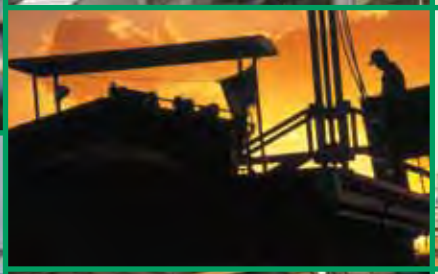


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FIGURE 1:
Interpretation of Base Grade: 31–3–36, G5

BASE GRADE: 31 – 3 – 36, G5

31 – Colour; 3 – Leaf; 36, – Staple Length; G5 – Micronaire

Colour	
Descriptor	**Code**
Good Middling (GM)	1
Strict Middling (SM)	2
Middling (MID)	**3**
Strict Low Middling (SLM)	4
Low Middling (LM)	5
Strict Good Ordinary (SGO)	6
Good Ordinary (GO)	7
Below Grade (BG)	8

Discount applies

Colour	
Descriptor	**Code**
White	**1**
Light Spotted	2
Spotted	3
Tinged	4
Yellow Stained	5

Leaf	
Descriptor	**Code**
Level 1 (least)	1
Level 2	2
Level 3	**3**
Level 4	4
Level 5	5

Staple Length	
Measurement	**Code**
1 inch	32
1 1/32"	33
1 1/16"	34
1 3/32"	35
1 1/8"	**36**
1 5/32"	37
1 3/16"	38
1 7/32"	39

Actual length applies so this table is just an example of possible staple lengths

Micronaire	
Measurement	**Code**
2.4 and below	G0
2.5 through 2.6	G1
2.7 through 2.9	G2
3.0 through 3.2	G3
3.3 through 3.4	G4
3.5 through 4.9	**G5**
5.0 through 5.2	G6
5.3 and above	G7

established standard grade. This will beto describe cotton for buying and selling. Cotton classers are skilled in determining those grades visually. Currently in Australia classer's grade is still used to describe colour, leaf and preparation, with moves underway to replace this with HVI colour.

The price received for cotton is dependent on the quality of each bale of cotton. Cotton prices are quoted for 'base grade' 31-3-36, G5 (see Figure 1). Premiums and discounts apply for higher and lower grades respectively. These pricing adjustments reflect the change in suitability for the spinning and dyeing process (see Chapter 20, Table 1 'Consequences of poor fibre quality' right column). For this reason, variability in any quality characteristic may influence the price. Some of the key quality characteristics are outlined below:

- Colour
- Leaf
- Preparation
- Staple Length
- Micronaire
- Strength

Colour

The colour of a sample is currently measured visually by a trained cotton classer. The true colour can only be assessed under specific light conditions and via comparison to a 'standard' sample of universal standards provided by the USDA.

Also known as 'trash' is a measure of the amount of leaf material (from the cotton plant) remaining in the cotton sample. Whist the gin removes the majority of trash, some remains in the sample which is removed in the spinning process resulting in a reduction in lint yield and increases cost. Hence, cotton with high levels of trash attract a discount. Leaf grades range from 1 (lowest) to 5 (highest), with level 3 as 'base grade'.

Staple length

Length is measured on a sample of fibres known as a 'pull' when hand classing, and is measured to the nearest 1/32 inch. HVI determine length in 100ths and in 32nds of an inch or on a 'beard' or tuft of lint formed by grasping fibres with a clamp. Australian cotton is all classed using HVI measurements. Under raingrown conditions, staple length tends to range from similar to irrigated cotton (1 1/8 inches) down to very short (1 inch or less). Base grade is 36 or (1 1/8").

UPLAND LENGTH CONVERSION CHART

Length (32nds)	Length (inches)	Length (32nds)	Length (inches)
24	0.79 & shorter	36	1.11 – 1.13
26	0.80 – 0.85	37	1.14 – 1.17
28	0.86 – 0.89	38	1.18 – 1.20
29	0.90 – 0.92	39	1.21 – 1.23
30	0.93 – 0.95	40	1.24 – 1.26
31	0.96 – 0.98	41	1.27 – 1.29
32	0.99 – 1.01	42	1.30 – 1.32
33	1.02 – 1.04	43	1.33 – 1.35
34	1.05 – 1.07	44 & +	1.36 & +
35	1.08 – 1.10		

Micronaire

Micronaire is measured by placing lint in a chamber, compressing it to a set volume and subjecting it to a set pressure. The reading, when related to a variety, is an approximate guide to fibre thickness and has been used as a measure of fibre maturity. Other, more accurate, fibre maturity testing methods and devices are being tested and may soon be introduced but for now the general guidelines below still apply:

- Low (<3.5) Micronaire indicates fine (immature) lint.
- High (>4.9) Micronaire indicates coarse lint.

The desired range is 3.5 to 4.9 (G5) and discounts apply for micronaires outside that range. Discounts for low Micronaire can be substantial. Micronaire results are grouped on the schedule for premiums and discounts.

Common causes of low Micronaire include:

- Cool temperatures during fibre wall development;
- Potassium deficiency;
- Dense plant stands;
- High nitrogen;
- Excess irrigation/rainfall;
- Favourable fruit set and high boll retention; and,
- Early cut-out due to frost, hail, disease or early defoliation.

The most common causes of high Micronaire include:

- Poor boll set;
- Small boll size due to hot weather or water stress; and,
- Variety.

Ginning has little or no effect on Micronaire although low Micronaire cotton is more susceptible to buckling and entanglement which creates neps which can effect preparation and subsequently grade.

Raingrown cotton normally falls into the acceptable Micronaire range, however under hot, dry conditions some varieties are prone to produce high Micronaire. Late planted crops are susceptible to low Micronaire and heavy discounts sometimes apply.

Management practices that open immature bolls such as pre-mature defoliation can contribute to the inclusion of immature fibres and an increase in neps. Experiments conducted at the Australian Cotton Research Institute confirmed that defoliating before 60% bolls open lowers micronaire (reduced fibre maturity) and increases neps. (Bange et al. 2009)

Fibre strength

Fibre strength is highly dependant by variety although environmental conditions can have a small effect. Raingrown cotton strength is usually not adversely affected by growing conditions. Most Australian varieties are of high strength and local plant breeders have agreed to eliminate varieties that do not meet a minimum standard, thus keeping Australian cotton highly competitive in the world market. Fibre strength is measured by clamping a bundle of fibres between a pair of jaws and increasing the separation force until the bundle breaks.

Strength is expressed in terms of grams force per tex with the following classifications:

- ≤ 23, weak;
- 24 – 25, medium strong;
- 26 – 28, average
- 29 -30, strong (most current Australian varieties); and,
- ≥31, very strong.

Preparation

Preparation (often referred to as 'prep') relates to the evenness and orientation of the lint in the sample. Factors contributing to poor preparation include spindle twist or wrapping during picking or roping or knotting (neps) of immature or very fine fibres in the ginning process.

Other quality characteristics

Pricing adjustments (premiums or discounts) may be made for other undesirable quality characteristics including (but not limited to):

- Grass or bark in the sample;
- An un-uniform sample;
- Sugars (honeydew);
- Neps; and,
- Short fibre (fibres shorter than 0.5 inch).

A number of other fibre characteristics measured in HVI testing which, whilst of increasing importance to

spinners, currently do not have a direct impact on price , include:

- Uniformity Ratio (UR);
- Elongation (EL);
- Short Fibre Index (SFI);
- Maturity;

Cotton grade and price

The price received for cotton is dependent on the quality of each bale. Cotton prices are quoted for 'base grade' 31-3-36, G5 (see Figure 1). Premiums and discounts apply for higher and lower grades respectively.

Cotton merchants generally present actual classing results in an easy to read report displaying the AUD $/bale premiums or discounts.

These pricing adjustments are calculated using their 'Premiums and Discount (P&D) Schedules' or 'Differential Sheets'. Australian merchants P&D schedules are formatted similarly and the adjustments are generally quite similar, however there may be some differences. P&D schedules often change between seasons and sometimes within the season, the merchant will generally set the seasons P&D around ginning time. From this time they can be requested from your merchant.

Premiums or discounts may be displayed in either USD $/lb or USD points/lb. There is 100 points in a cent. For example a 300 point discount is equivalent to -$0.03. To convert from per pound to per bale, multiply by 500. To convert into Australian dollars, divide by the USD/AUD exchange rate (ask your merchant the exact exchange rate which is applicable).

For example: A total discount of 800pts/lb = -$0.08/lb

$$= \frac{-\$0.08 \times 500}{.85}$$

= AUD -$47.06/bale

Multiple adjustments may apply to one bale of cotton. One adjustment for colour – leaf – staple length, while all other characteristics have their own adjustments

For more information talk to your merchant or their classing facility look at the following websites:

Australian Cotton Shippers association:
http://www.austcottonshippers.com.au/

For more information the following resources and tools are available at https://www.mybmp.com.au/auth_user/grower_tools_and_resources.aspx

• FIBREpak