

By Robert Baird, Queensland Cotton

**R**aingrown cotton is ginned and classed in exactly the same way as irrigated cotton, and under average to good growing conditions, the quality of each is similar. When seasonal conditions are more extreme, however, raingrown cotton lint quality can be inferior and can receive a range of discounts, some heavy. This is particularly so in very dry seasons and in situations where raingrown cotton has been planted late. The main quality characteristics of raingrown cotton affected by adverse conditions include: staple length, micronaire and grade, which are discussed in the relevant sections below.

## GINNING

Cotton ginning is the process of removing the fibre from the seed and baling it into 227kg bales – thus making it a saleable commodity to spinning mills. The process includes cleaning both seed cotton and lint to remove trash collected during mechanical harvesting. The gin cannot perform miracles. It cannot improve quality; it can only preserve it. To do this task, a ginner's options are limited to moisture control, the amount of cotton in the cleaning machinery at a given time, bypassing certain machinery and adding moisture at the press. The importance of good agronomy, the best conditioning possible, clean and efficient picking and careful placement of modules are of the utmost importance in obtaining good grades. In effect, the grower to a large degree is setting his grades in the field.

## QUALITY AND CLASSING

The role that quality plays in the marketing of cotton is unique among all other field and fruit crops. Cotton quality alone can be expressed by a multitude of measurements performed by cotton classers and described in the wide range of grades set out in **Table 45**.

The price received for cotton is dependent on these quality gradings and can vary substantially from quoted prices accordingly. Base cotton prices are quoted for 31-3, 1 $\frac{3}{32}$  inch length, 3.5 to 4.9 micronaire. Premiums and discounts apply for higher and lower grades respectively. Discounts are also applied for either very coarse (high micronaire) or very fine (low micronaire and immature cotton).

### KEY POINTS:

- The crucial stress period, particularly for fibre length, strength, and to some extent, micronaire occurs during the 20 day period following peak flowering. Stress during this time can adversely affect quality.

Historically, the cotton industry has employed both visual and mechanical methods to determine quality. Most aspects of visual cotton classing are gradually being replaced by the HVI (High Volume Instrument) system which determines most quality specifications by instrument.

Visual methods based on definite and specific grades established by the USDA for upland cotton determine the differing qualities and describe cotton for buying and selling when samples are not available. Cotton classers are skilled in determining those grades visually but now also use HVI systems. A classer's grade is composed of three components: trash, preparation, and colour.

Greater detail on cotton quality and grade is available from cotton classers, and only the most important points are included in this section. The characteristics of quality which directly influence price, are:

- Colour
- Trash
- Preparation
- Staple Length
- Micronaire
- Strength
- Extraneous Matter

### Colour

The colour groups reflect the varying amount of colour from white through spotted and yellow to gray. True colour can only be assessed under light conditions which are set for universal testing.

Colour difference can only be observed when compared with universal standards.

Colour refers to the graduations of whiteness and yellowness in the cotton. The official USDA colour grades are listed in **Table 45** on the following page.

**Table 45: Cotton grades, and codes.**

GRADE	CODE	GRADE	CODE
Good Middling	.11	Good Middling Spotted	.13*
Strict Middling	.21	Strict Middling Spotted	.23
Middling	.31	Middling Spotted	.33
Strict Low Middling	.41	Strict Low Middling Spotted	.43
Low Middling	.51	Low Middling Spotted	.53
Strict Good Ordinary	.61	Strict Good Ordinary Spotted	.63
Good Ordinary	.71	Strict Middling Tinged	.24*
Good Middling Light Spotted	.12*	Middling Tinged	.34
Strict Middling Light Spotted	.22*	Strict Low Middling Tinged	.44
Middling Light Spotted	.32*	Low Middling Tinged	.54
Strict Low Middling Light Spotted	.42*	Strict Middling Yellow Stained	.25*
Low Middling Light Spotted	.52*	Middling Yellow Stained	.35*
Strict Good Ordinary Light Spotted	.62*		

\*Denotes descriptive grades. All other grades are represented by physical standards.

Leaf grades are identified by numbers 1 through 7, all represented by physical USDA standards.

Other criteria will be reported as Level 1 (light) and Level 2 (heavy).

This includes poor preparation, excessive neppiness, presence of any substance other than fibre or leaf, such as grass, bark, stickiness and contaminants.

Mature cotton, when the bolls first open, is white and clean. Yellow colour may be a consequence of premature cessation of development by frost, drought or early harvest aid application. Gray is largely a result of exposure to moisture and field weathering. Weathering can be controlled, but the risk of weathering damage can be reduced by minimising the time between first and last boll opening. Fungal development, or sugars on the lint due to honeydew from aphids, can also produce gray cotton, but this can be managed by controlling aphids before they produce significant honeydew. Under certain circumstances, e.g. drought stress, raingrown cotton can produce more light spotted grades than irrigated cotton. Otherwise colour tends to be similar.

### Trash

Trash represents the non lint particles such as leaf, bracts, bark and grass, most of which can be removed by lint cleaners during ginning. However, any major adjustments during ginning or milling to remove trash also removes lint and reduces gin out turn. Bark and grass can be more difficult to remove because they align with the fibres, and are a major problem in milling. Grass and/or bark or honeydew in the sample will

result in a discount of the order of US\$10–\$50/bale. High trash levels are due to poor defoliation, inadequate harvest management, excessive weed infestations and, to a lesser degree, inadequate gin cleaning. Certain factors decrease leaf drop and thus the harvest of clean, dry seed cotton, which can be ginned for high quality. These include:

- Hairy leaves (not present in current varieties)
- High residual nitrogen (not usually a problem in raingrown)
- Rapidly growing juvenile plants (poor boll set or late cotton)
- Ample soil moisture
- Disease free plants
- Regrowth (due to rainfall at defoliation or just prior to harvest)
- Cool temperatures for five days following crop conditioning
- How much humidity before and during crop conditioning
- Water stress before crop conditioning (common problem in raingrown)
- Excessive conditioner or desiccant application
- Inadequate conditioner or desiccant rates

Many picking problems can be avoided if:

- Spindles are sharp and turning
- Excess oil and grease are cleaned from picking heads
- Moistener pads and doffer columns are in good condition and properly adjusted
- Doffer lugs barely clear each spindle
- Pressure plates are adjusted according to crop condition
- Spindle cleaner used in moistening system where green leaves are present

- Picking units and baskets are cleaned and inspected at every dump
- Picking wet cotton or adding too much water is avoided
- Harvesting should be delayed until dew has dried, humidity is below 50%
- Seed cotton moisture is less than 12% (use a moisture meter or bite the seed, they should crack. This often means starting to pick around 10am or later)
- Seed cotton is kept dry during handling and storage. If cotton is wet, keep it separate from dry cotton and advise the ginner to see if it can be ginned early.

For stripper harvest, the last four points above also apply along with the following:

- Ensure that the crop is adequately defoliated/desiccated
- The stripper is fitted with an efficient pre-cleaner

### Preparation

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

### Staple Length

Length is measured on a sample of fibres known as a “pull” when hand classing, and is measured to the nearest ½ inch. HVI determine length in 100ths of an inch on a “beard” or tuft of lint formed by grasping fibres with a clamp. Fibre length is controlled to a large degree by variety, although weather and management can also influence it. Maximum fibre length is determined during the fibre elongation phase in the first 20 days after flowering.

During elongation length is decreased by high temperatures, very severe water stress and potassium deficiency. It is increased by moderate temperatures during that same period. Under raingrown conditions, staple length tends to range from similar to irrigated cotton (1 ¾ inches) down to very short (1 inch or less). It is wise to apply a staple discount of up to ¼ inch for budgeting purposes in raingrown cotton. Ginning and lint cleaning can also reduce length if lint moisture is below 5%, but this seldom occurs because moisture is usually added to seed cotton in this condition to allow better flow through the gin.

### 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 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 and discounts apply for micronaires outside that range. Discounts for low micronaire can be heavy. Micronaire results are grouped on the schedule for premiums and discounts as shown in **Table 46**.

**Table 46: Micronaire Discounts.**

Group	Micronaire	Discount US\$/Bale	Price US\$/Bale
G7	5.3 and above	-20.00 - 35.00	315.00 - 330.00
G6	5.0 - 5.2	-12.00 - 30.00	320.00 - 337.00
G5	3.5 - 4.9	Base	350.00
G4	3.3 - 3.4	-20.00 - 35.00	315.00 - 330.00
G3	3.0 - 3.2	-50.00 - 63.00	287.00 - 300.00
G2	2.7 - 2.9	-73.00 - 100.00	250.00 - 277.00
G1	2.5 - 2.6	-95.00 - 115.00	235.00 - 255.00
G0	2.4 and below	-140.00 - 175.00	175.00 - 210.00

Fibre thickening develops after the elongation phase and continues until mature according to carbohydrate supply. Hence, growing conditions which influence growth and maturity in the finishing stages of the crop will affect fibre thickening and micronaire. Insufficient carbohydrate to meet boll demand results in low micronaire whilst ample carbohydrate to mature bolls results in high micronaire.

Common causes of low micronaire include:

- cool temperature during fibre wall development
- potassium deficiency
- dense plant stands
- high nitrogen
- excess irrigation/rainfall
- favourable fruit set and high boll retention
- 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
- Variety

Ginning has little or no effect on micronaire although low micronaire cotton is more susceptible to entanglement and nepping which can affect 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. Boll filling ceases within 5 days of defoliation, so early defoliation must be avoided.

Fibre strength is important in determining price if it is below 24GMS/TEX when a discount of the order of US\$15.00/bale will apply and US\$5.00/bale for strength between 25 to 27g/tex. There is no premium for high strength although it is an important element in marketing.

### **Fibre Strength**

Fibre strength is highly controlled 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.

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

**Less than 17 very weak**

**18 - 21 weak**

**22 - 25 medium strong**

**26 - 29 strong (most current Australian varieties)**

**More than 30 very strong**

### **Other Quality Characteristics**

A number of other fibre characteristics measured in HVI testing which, whilst of increasing importance to spinners, does not have a direct impact on price at present. Further detail on these is available from cotton classers and they include:

- Upper Half Mean Length (UHM)
- Span Length
- Uniformity Index (UI)
- Uniformity Ratio (UR)
- Elongation (EL)
- Short Fibre Index (SFI)
- Maturity
- Fineness
- Sugars (honeydew)
- Nep

### **COTTON GRADE AND PRICE**

The effect of a range of grades on the price of a bale of cotton (quoted in US\$) is set out in **Table 47** for G5 micronaire. Note that the premiums and discounts do fluctuate throughout the season due to supply and demand and this is reflected in the price ranges given below.

### **SUMMARY**

Although always classed on its merits, the price of raingrown cotton is more likely to be discounted than irrigated cotton. A number of the reasons for this have been given in this chapter such as: short staple, spotted grades and high micronaire from hot dry conditions; low micronaire from development of late bolls under cool conditions (i.e. late planting); and lower grades from extra trash gathered by stripper harvest. When setting budgets, raingrown growers should consider reducing quoted prices for base grades by US\$20-50/bale to provide a more realistic estimate of their likely returns.

**Table 47: Premiums and discounts for a range of grades and staple lengths.**

Grade	Premium/Discount US\$/bale	Price US\$/bale	Comment
21-2 35	+3.00 - 7.00	353.00 - 357.00	Higher grade
31-3 35	Base Grade	\$350-00	Base price
21-2 33	-37.00 - 60.00	290.00 - 313.00	Higher grade, shorter staple
31-4 35	-10.00 - 20.00	330.00 - 340.00	Lower leaf
31-4 33	-37.00 - 60.00	290.00 - 313.00	Lower leaf, short staple
41-2 35	-27.00 - 55.00	295.00 - 323.00	Discoloured
41-2 33	-55.00 - 75.00	275.00 - 295.00	Discoloured, short staple
51-5 35	-55.00 - 80.00	270.00 - 295.00	Low grade
51-5 33	-75.00 - 140.00	210.00 - 295.00	Low grade, short staple