At a glance – spindle versus stripper harvesting

By René van der Sluijs[1]

TRADITIONALLY, seed cotton was harvested (picked or removed from opened bolls on the cotton plant) by hand, with mechanical harvesters developed and implemented in the early 1940s. Although only 30 per cent of the cotton produced worldwide is harvested mechanically, some of the largest producers and exporters of cotton lint, such as the US, Australia and Brazil, harvest 100 per cent of their seed cotton mechanically. The adoption of mechanical cotton harvesters was mainly due to an increase in cotton acreage and yield, which resulted in dramatic increases in production, as well as due to the shortage, inefficiency and cost of labour.

The introduction of mechanical harvesting, and the resultant practice of once over harvesting with the aid of chemical boll openers and defoliants, has led to trashier, more variable and sometimes cotton with higher moisture content being delivered to the gin.

Therefore, harvesting plays an important role in determining fibre and seed quality, as the quality of ginned cotton is directly related to the quality of seed cotton prior to ginning. Irrespective of which mechanical harvesting method is used, the setup and adjustment, training and skill of the operators, as well as the timing of defoliation and harvesting play a major role in the amount of trash and moisture present in the seed cotton.

There are basically two ways in which cotton can be mechanically harvested:

The spindle harvester

This selective type harvester (picker) uses rotating tapered, barbed spindles (see Photo 1), to pull seed cotton from opened bolls into the machine. Spindle harvesters are large and complex machines, which are expensive to purchase, costly to maintain and require precise setup and adjustment, as well as trained and skilful operators to obtain the maximum yield and value per hectare. Compared to the stripper harvester, spindle harvesters are generally more expensive to operate and maintain, can handle higher yielding crops more efficiently, have higher harvesting efficiencies and higher lint turnout, since the seed cotton contains less trash.

Photo 1: Spindle type harvester.

The stripper harvester

This is a non-selective harvester that uses brushes and bats to strip seed cotton from bolls (see Photo 2). These harvesters are predominately used to harvest seed cotton from rain-fed cotton crops which have relatively short plant heights and lower yields. They remove not only the well opened bolls but also the cracked, immature and unopened bolls, along with burrs, plant sticks, bark and other foreign matter. Strippers are not very popular in many countries, since the seed cotton harvested often increases ginning costs and results in lower turnout and lower grades.

Photo 2: Stripper type harvester.

Currently the spindle harvester accounts for the bulk of all the cotton harvested in Australia, but as the industry looks at increased rain-fed and semi irrigated cotton production, with the anticipated increase in strippers, especially with the introduction by John Deere of the CS690 round module harvester, a preliminary study was conducted with the aim of investigating the impact of increased number of strippers on yield, gin turn out and quality.

Methods and materials

The study was conducted in a field at The University of Sydney farm in Narrabri. The cotton variety was Sicot 748B3F which was planted as single skip. It was an extremely dry year and the crop received virtually no in season rainfall. Only part of the field was utilised for this trial, using a randomized complete block design, with three replications.

Each treatment replicate consisted of eight rows of cotton plants, which resulted in one round module per treatment replicate, with harvesting taking place during the day to ensure that harvested cotton did not have a surface moisture level greater than the recommended level of 12 per cent. A total 27.4 hectares (13.7 ha x 2) and 17 round modules (7 x spindle and 10 x stripper) were harvested and staged in the sequence that they were harvested. All modules were ginned, in sequence, within the same timeframe and under similar standard commercial conditions, at the LDC gin in Moree.

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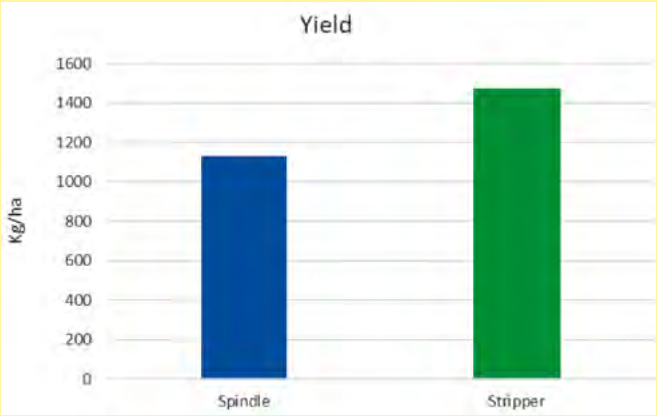
Results

Yield

Photo 3 shows that the stripper removed everything from the plant except the plant itself, whereas the spindle picker was more selective and only removed cotton from open bolls. The stripper therefore harvested 341 kg per hectare or 30 per cent more cotton than the spindle harvester – see Figure 1.

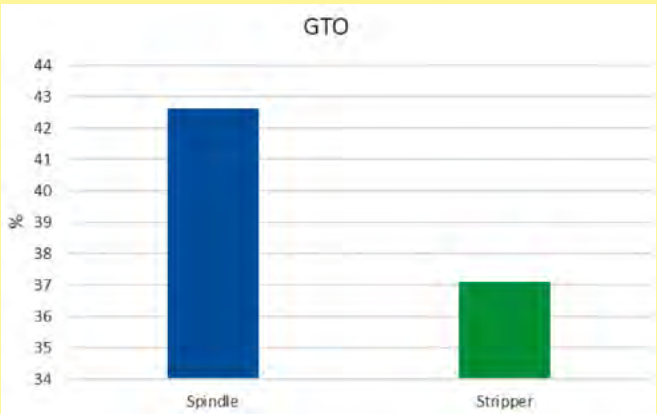
FIGURE 1: Yield



Gin turn out

The purpose of ginning is to separate the cotton fibre from the seed and produce cotton lint which is a saleable and processable commodity. During the ginning process the cotton needs to be cleaned to remove any foreign matter to achieve base grade. Gin turn out is the percentage of the weight of usable fibre per the weight of un-ginned seed cotton. Figure 2 shows the average gin turn out for the stripper harvested cotton was 37.1 per cent and 42.6 per cent for spindle harvested cotton, with the difference of 5.5 per cent significant for a grower in terms of economical return – Figure 2.

FIGURE 2: Gin turn out



Quality

As can be seen in Table 1, there were some significant differences, in terms of average fibre quality, from the two harvesting methods. Harvesting method had negative effects on colour in terms of Rd and +b and fibrous neps and no effect on fibre length, length uniformity, short fibre content, strength, micronaire, fineness and maturity and grade.

Although the fibre length, strength and uniformity were

Photo 3: Picking efficiency (spindle LHS, stripper RHS).

below base grade, and hence resulted in a discount, this was not due to the harvesting method but rather due to the hot and dry conditions experienced during the season. Although there was a significant difference in the Rd and +b values this did not influence the colour grade which at 11-1 (Good Middling) is better than the Australian base grade for Upland cotton and resulted in a premium.

There was no significant difference, in terms of seed quality, from the two harvesting methods, with the harvesting method having no effect on residual lint and mechanical damage.

TABLE 1: Fibre quality (green = no significant difference; red = significant difference)

Parameter	Spindle	Stripper
Length (3nds)	34	34
Uniformity	79	79
Strength	28.3	28.2
Micronaire	4.65	4.60
Reflectance (Rd)	82.3	83.0
Yellowness (+b)	9.0	9.6
Colour Grade	11-1	11-1
Fineness	205	206
Maturity	0.85	0.85
Fibrous Neps	208	233
SFC	13.0	13.5

Future work

It is envisaged that larger in-depth trials will be conducted during the following seasons that will incorporate determination of in-field efficiency and economic studies, as well as further fibre and seed quality comparisons.

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