SPINNING PERFORMANCE OF AUSTRALIAN LONG STAPLE COTTON SICALA 340BRF

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Abstract

Spinning trials of a new CSIRO bred Australian Upland cultivar with improved staple length called Sicala 340BRF have been carried out in collaboration with leading Chinese spinning mills. The staple length of this cultivar approaches that of extra long staple (ELS) type cotton and is marketed as Australian long staple (ALS) cotton. One container (24 tons) of 2010 season Sicala 340BRF cotton was shipped to China and distributed to six leading Chinese cotton spinning mills. At each mill the cotton was ring spun into Ne 40, Ne 50 and Ne 60 yarn with metric twist factors of 117, 120 and 123 for the three yarn counts respectively. Results of the trials showed relatively large variation in spun yarn quality across the six mills. Measured yarn properties were compared with values predicted using the yarn quality prediction program Cottonspec. The results showed Cottonspec works well in spinning mills that employ best management practice in terms of quality control.

Introduction

Spinning trials of a new CSIRO bred Australian Upland cultivar with improved staple length called Sicala 340BRF have been carried out in collaboration with six leading Chinese spinning mills. The staple length of the cultivar exceeds 1.25 inches (31.75 mm) and is being marketed as Australian long staple (ALS) cotton. The six mills included Chongqing Sanxia, Shandong Demian, Shandong Luthai, Anhui Huamao, Guangdong Esquel, and Zhejiang Bailong (a dyed cotton spinning mill). The key objective of the trial was to evaluate the spinning performance of ALS cotton particularly in the count range Ne 50 to 60 yarns. Another objective was to benchmark leading Chinese spinning mills. Results of the trials showed there was large variation in spun yarn quality across the six mills. Measured yarn properties were compared with those predicted using Cottonspec, a software program developed by CSIRO to predict yarn properties from HVI fibre properties (Yang et al, 2011).

Materials and Methods

One container of commercially grown Australian Long staple cotton Sicala 340BRF (24 tons, 112 bales) was purchased by CSIRO in October 2010. Samples of the 112 bales were tested using HVI and the test results are shown in Table 1. The cotton was shipped to China in November 2010 and evenly distributed to the six mills with 18 bales of cotton for each mill. For all mills 2 x 200 g of raw cotton samples were taken from each of the 18 bales for HVI and other fibre testing. Half of the samples were tested at the mill and half were sent to CSIRO for testing.

At each mill the cotton was ring spun into Ne 40, Ne 50 and Ne 60 count yarns with metric twist factors of 117, 120 and 123 for the three yarn counts, respectively. Mills were asked to collect semi-processed samples from the carding, combing, finisher drawing and roving stages as well as yarn samples.

Mill trials were completed in March 2011. Samples of raw cotton, sliver, roving and yarn collected by each mill were sent to CSIRO for testing. At CSIRO these samples were tested on HVI, Cottonscan and AFIS. Sliver samples (card, comb and finish draw) were tested on AFIS and Cottonscan. Roving samples were tested on Uster Evenness and AFIS and yarn samples were tested for linear density, Uster evenness and Tensorapid. All testing was conducted at CSIRO under standard testing conditions of 20 ± 2^{0}C and 65 ± 2% relative humidity.

Table 1 - CSIRO HVI testing results of the trial cotton

UHML inch	LU %	%SFI <12.7mm	Tenacity cN/tex	Elongation %	Micronaire	R	+b
1.31	83.6	7.75	32.3	5.74	3.96	81.2	6.64

Results and discussions

Results of yarn properties tested are shown in Tables 2, 3 and 4 for Ne 40, Ne 50 and Ne 60 yarns respectively.

Table 2 – Yarn properties for Ne 40 yarns

Mill	CV%	Thin places/km	Thick places/km	Neps/km	Tenacity cN/tex	Elongation %	Work-to-Break N.cm
1	12.37	0.8	21.6	54.5	20.24	6.45	4.72
2	10.78	0.1	2.4	10.9	20.9	5.51	4.44
3	11.99	0.6	12.7	34.6	18.58	5.42	3.93
4	11.17	0.1	7.3	47.5	18.07	5.04	3.57
5	/	/	/	/	19.39	5.40	4.18
6	13.33	2.7	50.6	119.4	18.82	5.38	3.91

Note: Uster evenness testing data for Mill 5 was missing due to a testing machine fault.

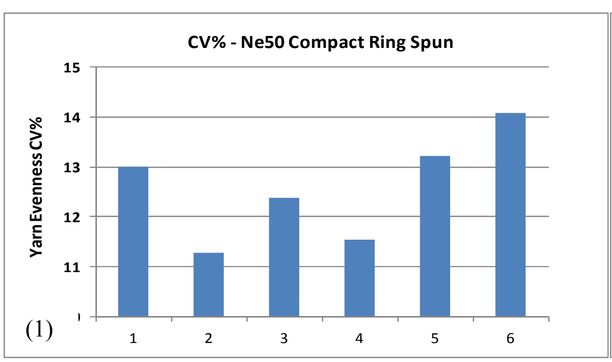
Table 3 – Yarn properties for Ne 50 yarns

Mill	CV%	Thin places/km	Thick places/km	Neps/km	Tenacity cN/tex	Elongation %	Work-to-Break N.cm
1	13.01	3.6	27.2	71.7	20.51	6.20	3.74
2	11.27	0.1	2.0	14.4	21.87	5.35	3.74
3	12.38	2.1	14.5	52	21.22	5.12	3.46
4	11.55	0.3	7.9	46.7	21.45	5.39	3.67
5	13.21	5.2	36.7	28.6	20.36	5.93	3.74
6	14.08	4.5	63.7	117.8	17.33	4.9	2.74

Table 4 – Yarn properties for Ne 60 yarns

Mill	CV%	Thin places/km	Thick places/km	Neps/km	Tenacity cN/tex	Elongation %	Work-to-Break N.cm
1	14.58	74.8	71.8	136.8	20.83	6.08	2.99
2	12.10	0.6	6.4	23.8	21.87	5.20	2.98
3	13.17	9.0	24.3	72.0	22.19	5.14	2.86
4	12.15	2.4	15.4	65.5	21.21	5.73	3.15
5	13.94	11.7	44.1	43.3	21.52	5.22	2.85
6	17.49	181.5	366.8	271.0	13.49	4.36	1.65

The results show there is large variation in spun yarn quality across the six mills. Comparison of yarn evenness, thin and thick places, neps and tenacity for Ne 50 and Ne 60 yarns are shown graphically in Figures 1 to 12. Note that Mill 6 is a dyed cotton spinning mill where the raw cotton fibre was dyed prior to spinning. As a result, yarn quality is significantly adversely affected by the dyeing process.



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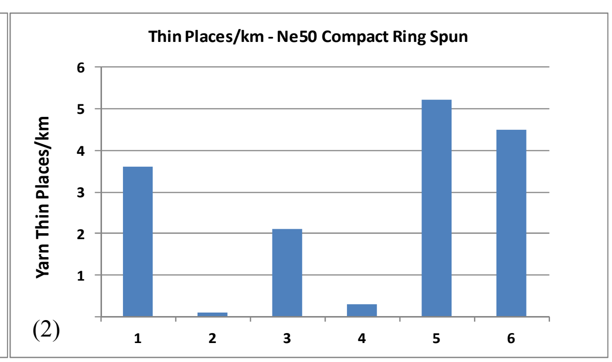

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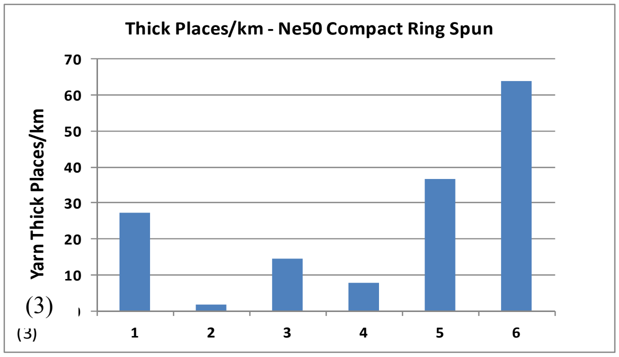
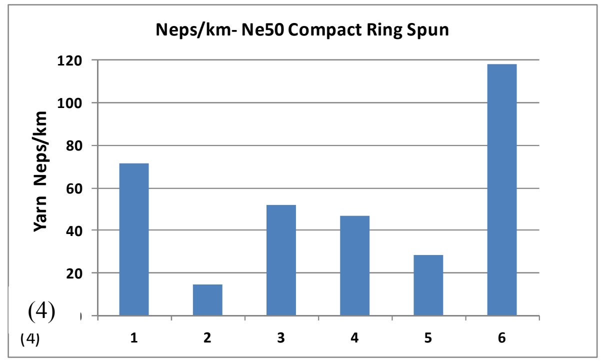
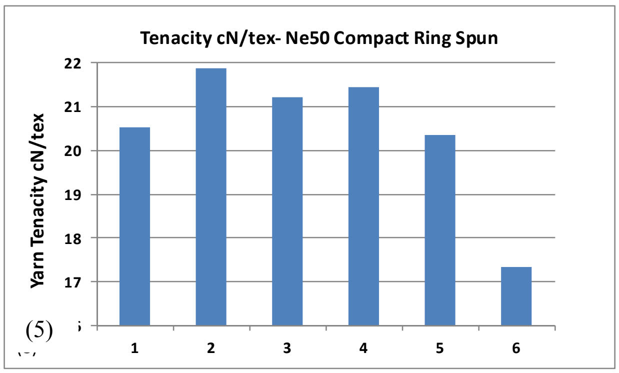
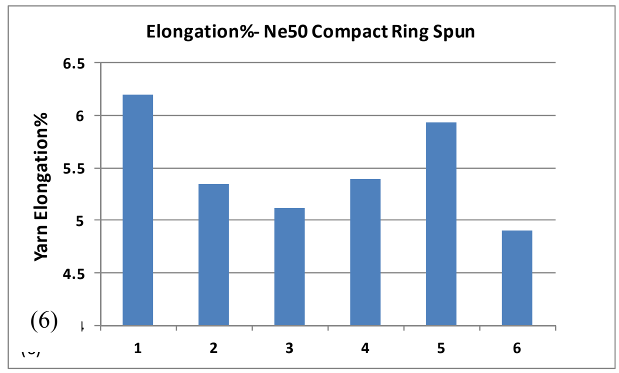
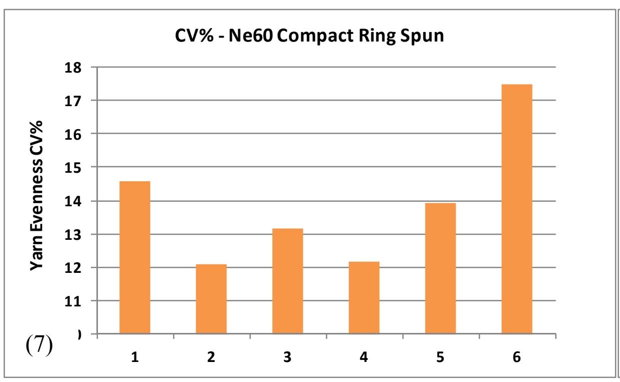


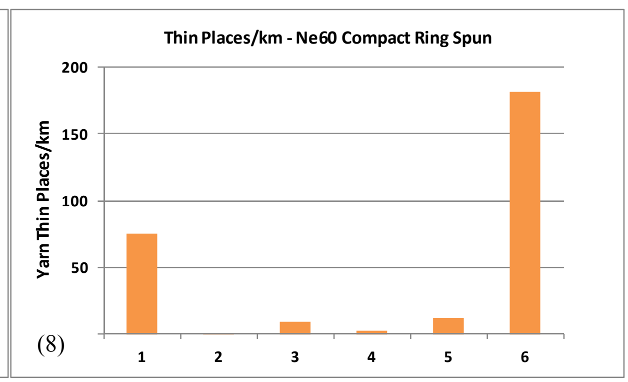


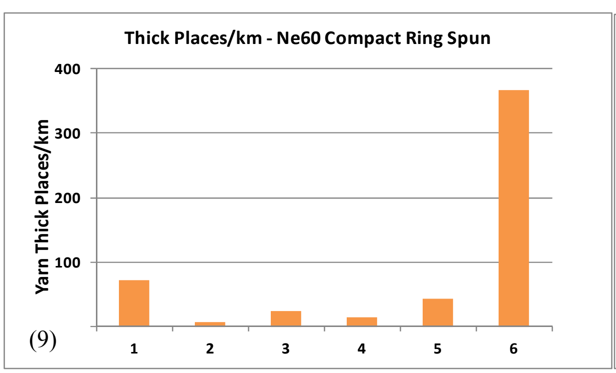


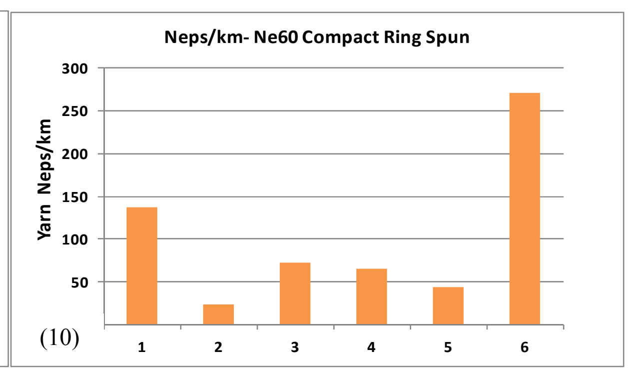


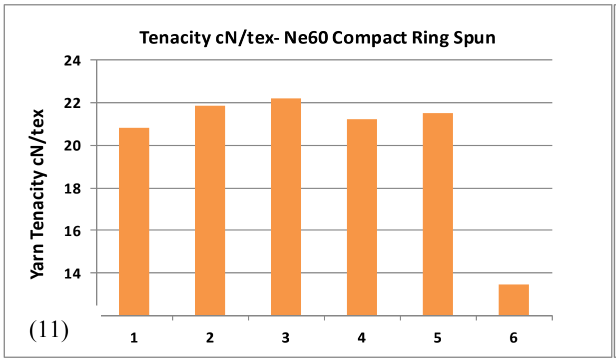
Figures 1 to 6 – Comparisons of yarn evenness (CV%), thin and thick places, neps, tenacity and elongation for Ne 50 yarns for the six mills

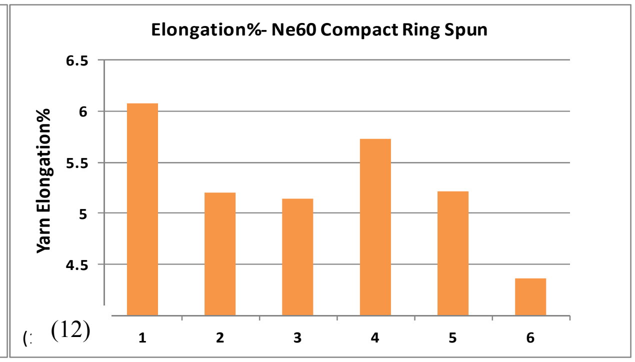












Figures 7 to 12 – Comparisons of yarn evenness (CV%), thin and thick places, neps, tenacity and elongation for Ne 60 yarns for the six mills

As seen from these Figures there is large variation in spun yarn quality across the six mills. Clearly, Mills 2, 3, and 4 are the top performers, particularly with regards to yarn evenness and imperfections.

Comparison of measured and predicted yarn evenness and tenacity values using Cottonspec (Yang et al, 2011) for Ne 50 and Ne 60 yarns spun by the 3 Mills are shown in Table 5. It is seen that for Mill 4 the prediction error is less than 2% for yarn evenness and zero for yarn tenacity for both Ne 50 and Ne 60 yarns. For Mill 2 the prediction error is slightly higher with less than 3% for yarn evenness and 1% for yarn tenacity and for Mill 3 the prediction errors are a bit higher again for yarn evenness, about 5%, but still quite good for yarn tenacity; at 3.9% for Ne 50 yarn and 1.4% for Ne 60 yarn. The results demonstrate Cottonspec works very well for spinning mills where good quality control is applied throughout the spinning process. These results reflect the basic underpinning of Cottonspec, that is, best commercial practice produces the best (griege) yarns. The Cottonspec software predicts very well what a good modern mill can expect in terms of yarn quality using particular quality cotton for a given yarn under specified spinning conditions.

Table 5 – Measured and predicted yarn evenness and tenacity for Ne 50 and Ne 60 yarns for Mills 2, 3 and 4

Ne	Mill	Evenness CV%			Tenacity cN/tex		
		Meas.	Pred.	Error%	Meas.	Pred.	Error%
50	2	11.27	11.60	2.9	21.87	22.05	0.8
	3	12.38	11.69	5.6	21.22	22.06	3.9
	4	11.55	11.68	1.1	21.45	21.43	0.0
60	2	12.10	12.40	2.5	21.87	21.84	0.1
	3	13.17	12.57	4.5	22.19	21.88	1.4
	4	12.15	12.36	1.7	21.21	21.20	0.0

Conclusion

Spinning trials of a new CSIRO bred Australian Upland cultivar with improved staple length called Sicala 340BRF have been carried out in collaboration with Chinese spinning mills. The results demonstrate ALS can be used for production of high quality fine count yarns Ne 50 and above, and demonstrate also very clearly that Cottonspec works well for good spinning mills.

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References

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