FastStart Cotton R&D Project 2016-17

Optimising Planting Rates for Dryland Cotton Production

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Summary

Dryland cotton plant stand yield response trials were conducted at two sites on the Darling Downs during the 2016-17 season. At both sites, there was no statistically significant difference in yield across a plant stand range of 4 plants/m -12 plants/m. Both sites experienced well below average rainfall during flowering - boll filling, and were severely affected by a 40 day long spell of above average heat from mid January - mid February which eventually led to premature cracking of immature bolls. Commercial yields were very poor. Heavy mirid pressure during December resulted in tipping out and low retention levels of early set squares which had an influence on the relative yield between the different plant stands. While this very flat yield response result differs from previously conducted trial work, these trials do show that even under the most extreme growing conditions, low density ie 4-6 plant/m stands have not improved yield or quality compared with the more generally recommended 8-10 plant/m stands.

Introduction

Seven trials were conducted over a 13 year time span in dryland cotton fields on the Darling Downs, looking specifically at yield response to varying plant stands of cotton grown in skip row. All trials involved varieties containing either Bollgard 11 or Bollgard 3. The sites covered a range of soil types, and a wide range of growing conditions were experienced across the sites/years. All trials were conducted in replicated, randomised small plots with harvesting carried out using either CSD or CSIRO plot pickers. While yield differences were not statistically significant in most cases, there was a common relative yield trend across most of these trials, that the highest yielding treatment came from a plant stand of 9 plants/m or higher.

The aim of the project this season was to document differences in plant structure and fruiting characteristics, final yield and quality across the plant stand range likely to be encountered in skip row dryland cotton, grown on soils representative of much of the dryland cotton production region.

Trial Site Details, Planting and Establishment

Two sites were selected for the trial, both south-west of Dalby. Site 1 was on Mark Schuur's property at Kupunn. Site 2 was located approximately 14 km east, on Chris Arthur's property at Nandi. The soil type at the Kupunn site is a grey-brown clay, formerly under brigalow forest, while the Nandi soil is a grey clay, formerly under Poplar Box Eucalypt vegetation. Both are very representative of major soil types used for growing dryland cotton in southern Queensland. They have similar water holding capacity but are inferior to the black earths/vertisols of the Darling Downs floodplains in this characteristic.

The Kupunn site was on long fallow from a 2015 chickpea crop which had been double cropped into 2014/15 sorghum. Cotton had not been grown in this field for approximately ten years. Ground cover level was low (10-15%) but the soil surface characteristics were excellent for establishment. Nitrogen @ 120 kg/ha had been applied pre-plant, and a starter blend, which included P, K, S and Zn was applied, just offset from the planted rows, immediately after planting.

The Nandi site was on long fallow from 2015 wheat, and had high stubble levels (70-80% cover). Starter fertiliser @ 12 kg/ha went down with the seed. Urea @ 100 kg/ha was spread incrop ahead of a rain event in early January. Details of the two sites are evident in photos in Appendix 1.

The variety Sicot 748B3F was planted at both sites. A double skip planting configuration was used in each instance. As Table 1 indicates, starting soil moisture in the profile was identical at both sites, very close to maximum capacity. A major contributor to this was rainfall of 160 mm approximately recorded at both sites in the six weeks leading up to planting. However, the rain turned off after planting and incrop rainfall was a long way below average, especially at the Kupunn site. In this case, only one rainfall event, a 20mm fall on 20th December, could be classed as contributing to the soil moisture profile. Dalby BOM site rainfall average (145 year record) for early October -mid February is 345 mm. As Table 2 shows, the Kupunn site recorded approximately 10% of this for the growing season, the Nandi site 40%.

Two good rainfall events occurred post maturity across both sites. However, the first, of approximately 30 mm on 18-19th February contributed to tight locking of prematurely cracked bolls and the second, the remnants of Cyclone Debbie, brought 100 mm on 30-31st March. This promoted excessive regrowth at both sites.

Table 1: Starting soil moisture at Kupunn and Nandi trial sites

KUPUNN (soil BD = 1.39)							
Profile section - cm	**10-30**	**30-50**	**50-70**	**70-90**	**90-110**	**110-130**	**Total avail moisture - mm**
Grav. Moisture %	34.5	34.5	34.4	34.7	30.9	28.0	230
Cotton LL Vol. Moisture %	19	20	22	24	26	28	
NANDI (soil BD = 1.30)							
Profile section - cm	**10-30**	**30-50**	**50-70**	**70-90**	**90-110**	**110-130**	**Total avail moisture - mm**
Grav. Moisture %	36.2	35.0	35.2	34.7	34.4	33.4	230
Cotton LL Vol. Moisture %	19	20	20	23	26	28	

Table 2: Incrop rainfall at Kupunn and Nandi trial sites – planting to crop maturity

KUPUNN (planted 13/10/2016)								**Total-mm**
Date	17/10/16		29/11	13/12	21/12	2/1/17		36
Rainfall-mm	6		2	5	20	3		
NANDI (planted 11/10/2016)								**Total - mm**
Date	17/10/16	10/11	29/11	13/12	21/12	2/1/17	23/1	135
Rainfall-mm	9	7	50	12	15	35	7	

Conditions for planting were ideal at Kupunn. This soil has a very soft surface structure and with low stubble levels, seed placement and trench closure were perfect. An excellent establishment of 91% was achieved. However, planting conditions were only average at Nandi, with a final establishment of 66%. The grey clay has a coarser surface structure and the surface had set after the prolonged wet conditions during the six weeks leading up to planting. Stubble balling up also created issues for the planter. Showers of 6-9 mm occurred at both sites on 17th October, bringing up a few late starters to fill gaps.

Table 3: Establishment and seedling growth at Kupunn and Nandi trial sites

(DAP = days after planting; DD = day degrees; Count = fully unfolded cotyledons + hypocotyl visible)

Site	First Count			Second Count			Final Count				
	DAP	DD	Count	DAP	DD	Count	DAP	DD	Count	Estab%	Growth stage
KUPUNN	7	24	1.1 + 4.5	11	37	14.1 + 0.5	20	119	14.6 + 0.9 (15.5)	15.5/17 (91%)	1.0 TL
NANDI	7	20	0.8 + 1.0	13	40	10.0 + 0.3	21	118	10.3 + 0.8 (11.1)	11.1/16.7 (66%)	1.5 TL

Plots were thinned to produce the various plant stand treatments on 2-3rd November (20-21 DAP) once all late emergers were through. Four reps of each of 4 ,6, 8, 10 and 12 plants/m were laid out, with each plot approximately 25 m in length to provide plenty of sampling space during the season. In each double skip row pair, one row was designated as treated, while its pair was thinned down to the same plant stand.

Early Season Growth

There were two noteworthy aspects of the early crop growth at both sites. One was the impact of very heavy thrip levels throughout November which made accurate early season true leaf measurement difficult. Growth at both sites during November was slow, and an average vegetative branch (VB) count of 8.5 is symptomatic of this slow growth. Some plants had 10 vegetative branches before they started squaring. First square at Kupunn occurred 46 DAP (394 DD), and 48 DAP (397 DD) at Nandi. The other very notable early season feature was the sustained mirid pressure during December. This resulted in high levels of tipping out and significant loss of early squares. Values in Table 4 indicate this for both sites, but especially at Nandi, with the drop off and overall low values for retention, especially across the bottom four fruiting branches. As the season turned out, with low soil moisture and excessive heat, the high VB count and low early season retention were major contributors to the poor yield, and flat yield response across the treatments.

Table 4 - Early Season Growth Characteristics in Kupunn, Nandi Trials (measurements in 8 plants/m stands)

KUPUNN											
Height (*DAP* – cm)				**Retn - Bottom 4 FB (*DAP* - %)**			**Retn - All**	**VGR (*DAP*)**			
47	*62*	*71*	*78*	*62*	*71*	*78*	*78*	*47-62*	*62-71*	*71-78*	*78-90*
13.5	30.0	39.5	51.0	69	40	43	84	3.8	5.6	5.2	3.4
NANDI											
Height (*DAP* – cm)				**Retn - Bottom 4 FB (*DAP* - %)**			**Retn - All**	**VGR (*DAP*)**			
49	*63*	*73*	*80*	*63*	*73*	*80*	*80*	*49-63*	*63-73*	*73-80*	*80-92*
14.0	33.0	50.5	67.5	33	24	33	66	4.3	5.2	6.0	6.6

Crop Flowering and Boll Set

Detailed measurements were made on the 4, 8 and 12 plants/m treatments in all four reps from flowering through to crop maturity at both sites. Because of the high level of tipping out and very low retention on the lower fruiting branches, first flower determination was very difficult. At Kupunn, first flower was assessed as being 76 DAP (806 DD). VGR measurements were made across all the treatments from this stage on. At Kupunn, there was a relatively uniform drop off initially after flowering (3.4-3.8 range) but the 12/m treatment fell away more quickly as flowering progressed. A similar pattern was evident in NAWF measurements, with the rate of NAWF decline quicker in the denser plant stand. Cutout occurred 102 DAP (1216 DD), flowering only lasting 26 days. In comparison, a high yielding dryland crop of Sicot 748B3F in 2015-16 flowered for 38 days.

The picture at the Nandi site was somewhat different. First flower date here was 77 DAP (795 DD) on 27th December. Because of a better soil moisture profile in January, the VGR values were higher for longer, and NAWF decline was slower across all treatments during January. In fact, there was very little treatment difference in NAWF measurements at any of the three January measurements. Cutout in 4 plants/m treatment occurred 106 DAP (1250 DD), flowering lasting for 29 days.

The two crops followed quite different pathways of fruit accumulation during January. At Kupunn, the higher density stands accumulated bolls at a significantly higher rate for the first three weeks of flowering. This started to even out in late January as low soil moisture availability impacted. The NAWF values in Table 5 show that the higher density stand cut out a few days earlier, but there was a continuing higher level of loss from the denser stands beyond cutout. The bolls on the vegetative branches in 4/m treatment were less subject to loss than those in the denser stands. A good rainfall event on this trial in mid January, before cutout, when the 12/m treatment had 120 bolls/m would most likely have produced a quite different treatment yield result. As it turned out, from 97 DAP to harvest, the 12/m treatment lost 30 bolls/m, the 4/m gained at extra 30 bolls/m.

The Nandi site received more rainfall in the period leading up to and around flowering. This crop was showing excellent potential in mid January, as demonstrated in Table 6, with boll counts > 200/m in the 12/m stand. From this high, just after cutout, boll numbers dropped by 27% in 4/m, by 30 % in 8/m and 37% in 12/m by harvest. Part of the explanation for this lies in the boll accumulation pattern during the first half of January. In the week 92-99 DAP, the boll count only increased by about 60% across all treatments. In the following week 99-106 DAP, it jumped to almost 300%. The relatively low increase of 60% was a result of the poor retention in the lower crop. The surge in the 99-106 DAP period produced a big cohort of bolls of relatively similar age which were then very susceptible to shedding under the tough conditions towards the end of the month.

For both sites, the temperature regime for the 40 day period 10/1/17 - 18/2/17 where an average max of 37°C was experienced with absolutely no respite, on a dry soil profile, was like being in a saucepan on a gas stove, steadily boiling dry.

Table 5 – Growth characteristics during peak flowering at Kupunn and Nandi (across three plant stands)

KUPUNN												
Treatment	**Height (*DAP* - cm)**			**VB No**	**FB No progression (*DAP*)**			**VGR (*DAP*)**	**Total nodes**	**NAWF (*DAP*)**		
	90	*97*	*102*	*102*	*90*	*97*	*102*	*90-97*	*102*	*90*	*97*	*102*
4/m	67.4	70.9	72.2	8.4	14.3	15.6	16.3	2.7	24.7	7.0	5.2	4.0
8/m	64.2	67.0	67.5	8.5	14.2	15.2	15.7	2.8	24.2	6.7	4.9	3.8
12/m	61.6	63.7	64.5	8.4	12.3	13.4	13.4	1.9	21.8	6.3	4.5	3.2
NANDI												
Treatment	**Height (*DAP* - cm)**			**VB No**	**FB No progression (*DAP*)**			**VGR**	**Total nodes**	**NAWF (*DAP*)**		
	92	*99*	*106*	*106*	*92*	*99*	*106*	*92-99*	*106*	*92*	*99*	*106*
4/m	88.9	93.7	94.5	8.4	15.8	17.0	17.6	4.0	26.0	8.1	5.7	3.0
8/m	84	88.2	89.4	8.5	14.5	15.8	16.1	3.2	24.6	7.6	5.4	3.0
12/m	86.2	91.3	92.3	8.7	14.2	15.4	15.9	4.3	24.6	7.6	5.5	3.2

Table 6: Boll accumulation at Kupunn and Nandi trial sites (on FB + VB)

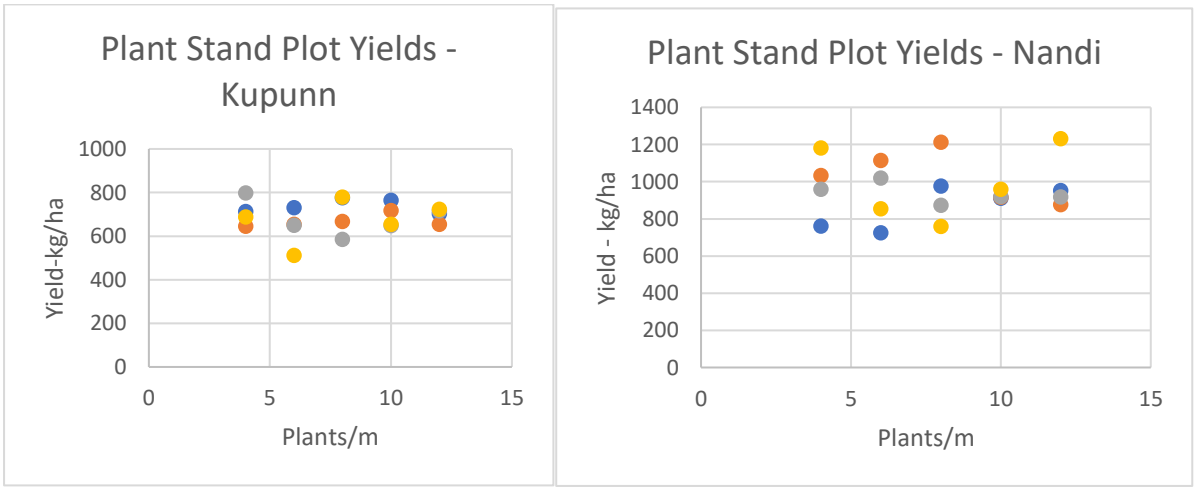
KUPUNN										
	Bolls/plant	Bolls/m	Bolls/plant	Bolls/m	Bolls/plant	Bolls/m	Bolls/plant	Bolls/m	Bolls/plant	Bolls/m
	90 DAP		*97 DAP*		*102 DAP*		*118 DAP*		*Harvest*	
4/m	5.5 + 1.5	28	11.2 + 6.4	70	16.0 + 11.5	110	14.5 + 9.6	96	14.5 + 10.3	99
8/m	5.5 + 0.5	48	9.1 + 2.3	91	12.1 + 3.0	121	9.3 + 2.7	96	8.8 + 2.7	93
12/m	4.1 + 0.1	50	9.1 + 1.0	121	9.8 + 2.0	140	7.4 + 1.8	110	7.0 + 0.7	93

NANDI											
	Bolls/plant	Bolls/m	Bolls/plant	Bolls/m	Bolls/plant	Bolls/m	Bolls/plant	Bolls/m	Bolls/plant		Bolls/m
	92 DAP		*99 DAP*		*106 DAP*		*121 DAP*		*Harvest*		
4/m	7.1 + 0	28	10.4 + 2.2	50	22.9 + 18.2	164	16.6 + 12.1	131	15.9	14.8	119
8/m	4.5 + 0	36	7.4 + 0.1	60	16.2 + 5.1	170	11.5 + 3.5	120	11.4	3.3	118
12/m	3.5 + 0	42	5.8 + 0	70	14.3 + 2.5	202	10.2 + 1.8	144	12.3	3.8	128

Yield, Fibre Quality and Segmented Pick Data

Picking the trial plots turned out to be a very time consuming operation. Because of the geographic location of the trials, it was never going to be possible to obtain the services of a small plot picker – hence hand picking of the plots was always the plan. The combination of premature cracking of mid - late season bolls brought on by the extreme heat over the period 10-13th February in particular and subsequent tight locking of many of these bolls aggravated by a 30 mm rain event on 18-19th February made field hand picking very difficult. With the threat of seed cotton losses from early set open bolls due to forecast heavy wind/rain associated with the passage of Cyclone Debbie, a strategy was implemented which involved cutting plants from 1.0 m plots in the treatments/reps, conveying them to a shed in town, and laying them out to allow a full segmented boll harvest. This type of hand harvest meant that the final plot yields were significantly higher than what would have been obtained with a spindle picker, due to the significant number of tight lock bolls present. Both sites were similarly affected. The commercial yield from the Kupunn site was 1.4 bale/ha while the Nandi site yielded 2.0 bale/ha. On both these farms, this is the poorest dryland cotton yield ever.

Figure 1: Plant Stand Trials Plot Yields



Dr Warwick Stiller made the following comments after analysing the yield data. 'While the data is reasonably good, the bad news is that there is not a hint of difference between the population treatments. This becomes obvious when you look at the individual plot data shown in Figure 1. If there was a chance that treatment differences could be resolved, I would run some spatial statistics, but I think that this would be pointless. It is a function of the season, that with the low yields, it didn't make any difference what the plant stand was, seasonal conditions were the main constraint'

Looking at the Kupunn site data in Table 7, there is basically no difference across the average yield in all treatments with the exception of 6 plants/m. However, one plot in this treatment has yielded nearly 200 kg/ha below the trial average which has impacted on its average. Turnouts are quite uniform across all treatments with no obvious pattern. Average boll count doesn't provide much information, with a spread on about 20/m between lowest and highest in the reps of each treatment. Boll size doesn't follow any trend and goes a long way to explaining the low yields from these trials. In a high yielding dryland plant population trial on the Downs last season, average boll size ranged from 2.6 g/boll for 4 plants/m down to 2.4 g/boll for 12 plants/m. At this site, the average range is 1.5-1.4 g/boll.

From a quality consideration, there appears to be a slight improvement in fibre length at the higher plant stands. Micronaire has been relatively non responsive, and there is no pattern in the strength results. The commercial picked cotton from this field (average stand 10/m) has produced mainly 33-34's length (1.02 - 1.07), which is considerably shorter than that coming from the trial (hand picked, 20 saw research gin). As well, a lot of the tight lock bolls, contributing the poorer quality cotton were missed in the commercial picking. For the other key fibre quality parameters, the commercial picked cotton has stayed above the penalty range ie micronaire (>3.5) and strength (>28 g/tex)

Table 7: Yield and quality summary for Kupunn and Nandi trial sites

KUPUNN							
Plant stand/m	**Yield (kg/ha)**	**T/O %**	**Boll Count /m**	**Av Boll Size gm**	**Length**	**Mic**	**Strength**
4	710	45.6	99	1.44	1.08	3.7	27.3
6	636	45.1	90	1.41	1.11	3.7	28.3
8	701	45.0	93	1.52	1.10	3.8	27.5
10	696	45.9	98	1.42	1.12	3.7	29.2
12	698	45.0	93	1.51	1.12	3.9	27.5
NANDI							
Plant stand/m	**Yield (kg/ha)**	**T/O %**	**Boll Count /m**	**Av Boll Size gm**	**Length**	**Mic**	**Strength**
4	984	44.8	119	1.64	1.14	3.5	29.0
6	928	43.5	115	1.62	1.15	3.5	28.4
8	955	44.6	118	1.62	1.14	3.7	27.6
10	927	43.6	120	1.54	1.12	3.6	26.4
12	994	43.7	128.5	1.55	1.13	3.3	28.0

Table 8: Segmented pick data from Kupunn plant stand trial site

Plant Stand	Segment	Bolls/m	Segm %	Lint wt -gm	Segm %	TO%	Av boll lint wt - gm	Length	Mic	Str
	1	6.8	6.8	13.5	9.5	48.4	2.00	1.15	4.8	32.3
	2	14.4	14.5	25.7	18.1	46.2	1.56	1.09	4.1	28.3
	3	16.5	16.7	21.8	15.5	46.2	1.32	1.07	3.0	26.2
4	5	9.6	9.7	14.6	10.1	46.9	1.52	1.07	3.5	26.3
	6	10.8	10.9	15.7	11.0	44.9	1.46	1.07	3.5	26.3
	8	41.0	41.4	50.8	35.7	43.9	1.24	1.07	3.6	26.5
	Av	99	100.0	142.1	100.0	45.6	1.44	1.08	3.7	27.3
	1	9.8	10.2	18.4	14.5	45.9	1.89	1.12	4.7	31.7
	2	17.4	19.4	29.9	23.5	46.0	1.72	1.11	3.9	27.7
	3	13.4	14.9	15.6	12.3	44.6	1.17	1.07	3.4	26.3
6	5	11.5	12.8	15.6	12.3	43.7	1.36	1.14	3.5	27.8
	6	8.1	9.1	10.4	8.2	46.0	1.27	1.11	3.0	25.0
	8	29.6	33.0	37.1	29.2	44.6	1.25	1.11	3.3	29.1
	Av	90	100.0	127.0	100.0	45.1	1.41	1.11	3.7	28.3
	1	14.8	15.9	30.7	21.8	46.1	2.08	1.11	4.6	29.2
	2	22.3	24.1	40.3	28.8	45.5	1.81	1.12	3.8	29.3
	3	12.5	13.5	14.2	10.1	4474	1.14	1.16	3.1	22.3
8	5	10.5	11.4	16.1	11.5	44.4	1.53	1.12	3.8	27.9
	6	10.8	11.6	12.2	8.7	41.2	1.13	1.09	3.0	26.0
	8	21.8	23.5	26.8	19.2	45.4	1.23	1.10	3.4	25.8
	Av	93	100.0	140.3	100.0	45.0	1.52	1.10	3.8	27.5
	1	16.3	16.7	30.6	22.0	47.2	1.88	1.13	4.5	31.5
	2	27.5	28.1	45.2	32.5	46.6	1.65	1.17	3.7	29.3
	3	12.7	13.0	12.8	9.2	45.5	1.01	1.11	2.8	25.6
10	5	10.5	10.7	13.6	9.8	43.4	1.31	1.14	3.6	29.9
	6	10.5	10.7	12.9	9.3	45.5	1.24	1.13	3.0	27.6
	8	20.2	20.7	23.9	17.2	46.1	1.18	1.12	3.4	28.4
	Av	98	100.0	139.0	100.0	45.9	1.42	1.12	3.7	29.2
	1	23.5	25.3	43.0	30.8	45.7	1.86	1.11	4.4	29.4
	2	29.2	31.5	51.4	36.8	46.2	1.79	1.15	3.9	26.6
	3	13.3	14.3	12.2	8.7	46.4	0.93	1.05	3.2	23.6
12	5	9.5	10/2	14.1	10.1	45.3	1.52	1.14	3.7	27.7
	6	7.8	8.4	7.7	5.5	48.4	1.01	1.09	3.4	25.6
	8	9.5	10.2	11.3	8.1	45.0	1.21	1.14	3.4	29.1
	Av	93	100.0	139.7	100.0	45.9	1.51	1.12	3.9	27.5

The segmented pick data provides better insight into the various interactions at the two sites. At Kupunn, segment 1 (first position bolls, FB 1-4) boll number ranged from 7-25% of total, increasingly consistently as plant density increased. It equates to a retention of 40-52%, with no pattern evident. Segment 2 (first position bolls, FB 5-8) ranged from 15-32% of total, again increasing very consistently as plant density increased. However, in this instance, there was a noticeable decrease in retention as density increased (range 90-61%), possibly a response to the severe soil moisture stress which the crop experienced from mid flowering onwards. In these trials, segment 3 category represented any bolls from FB 9 and upwards. It ranged from 17% of bolls in the thinnest, to 14% in 12/m, very little spread. However, there was a marked drop off in average boll size moving from 4/m to 12/m (1.32 g/boll v 0.93 g/boll), a reflection of the greater stress the higher density stands experienced during filling of later set bolls. Segment 8 (bolls on VB) accounted for 41% of the total count in 4/m, down to 10% in 12/m. Retention of bolls on vegetative branches under the extreme conditions was relatively good.

As mentioned earlier, many of the bolls were tight locked and the lint could not be collected by the spindles of a conventional picker. As well, the size of many of the bolls, especially in segments 3, 6 and 8 would have meant that they would not have been collected. This is the reason for the marked discrepancy in yield between the hand picked and commercial picked. Use of a stripper for commercial picking would have improved the yield.

From a quality consideration, fibre length has improved, moving from the thinner to denser stands (1.08-1.12). The lengths in segment 8 have been the major contributor to this trend. Average micronaire is very uniform across all treatments. The only trend that is apparent is the decrease in values in segment 1, from 4.8 in the thinnest to 4.4 in 12/m.

Table 9: Segmented picking data from Nandi plant stand trial

Plant Stand	Segment	Bolls/m	Segm %	Lint wt -gm	Segm %	TO%	Av boll wt - gm	Length	Mic	Str
	1	5.6	4.7	14.3	7.2	44.8	2.53	1.17	4.5	31.4
	2	12.9	10.8	32.5	16.5	47.9	2.53	1.16	4.4	30.5
	3	20.3	17.0	26.0	13.2	44.3	1.28	1.10	2.9	27.5
4	5	11.5	9.7	21.5	10.9	44.1	1.88	1.14	3.6	28.3
	6	13.4	11.3	22.0	11.2	45.4	1.91	1.14	3.3	27.3
	8	55.3	46.5	80.5	40.9	43.8	1.46	1.15	3.2	29.1
	Av/Total	119	100.0	196.8	100.0	44.8	1.64	1.14	3.5	29.0
	1	6.9	6.0	15.7	8.5	46.4	2.90	1.18	4.4	31.9
	2	17.0	14.8	37.3	20.1	43.8	2.19	1.18	3.5	29.8
	3	25.9	22.6	33.0	17.8	43.2	1.28	1.09	3.2	25.2
6	5	14.5	12.6	26.8	14.4	42.4	1.85	1.14	3.7	29.3
	6	12.3	10.7	20.9	11.3	43.0	1.71	1.12	3.4	27.8
	8	38.1	33.3	51.9	28.0	43.4	1.36	1.13	3.3	28.0
	Av	115	100.0	185.6	100.0	43.5	1.62	1.15	3.5	28.4
	1	16.4	13.9	32.4	17.0	46.1	1.98	1.17	4.4	30.5
	2	22.8	19.3	47.0	24.6	44.8	2.07	1.18	3.8	28.4
	3	26.0	22.0	33.5	17.6	44.7	1.29	1.03	3.2	23.8
8	5	11.6	9.8	17.4	9.1	42.5	1.50	1.17	3.7	30.5
	6	14.6	12.4	20.0	10.4	43.7	1.36	1.09	3.4	25.5
	8	26.8	22.6	40.8	21.3	44.5	1.52	1.10	3.5	25.8
	Av	118	100.0	191.1	100.0	44.6	1.62	1.14	3.7	27.6
	1	16.0	13.3	33.8	18.3	44.1	2.12	1.20	4.1	29.5
	2	29.6	24.5	52.6	28.4	43.4	1.78	1.14	3.9	27.8
	3	24.4	20.2	28.7	15.5	43.5	1.18	1.03	3.3	24.6
10	5	14.1	11.7	21.3	11.5	42.3	1.50	1.13	3.6	28.1
	6	13.0	10.8	15.9	8.6	43.2	1.22	1.10	3.1	25.2
	8	23.1	19.2	33.0	17.8	45.1	1.42	1.10	3.4	26.8
	Av	120	100.0	185.3	100.0	43.6	1.54	1.12	3.6	26.4
	1	17.6	13.7	36.8	18.6	44.2	2.09	1.17	3.8	30.2
	2	36.4	28.3	60.0	30.2	42.4	1.65	1.17	3.1	28.9
	3	22.7	17.7	24.6	12.4	43.5	1.08	1.04	2.9	24.8
12	5	10.2	7.9	17.7	8.9	46.2	1.74	1.17	3.5	30.9
	6	9.9	7.7	14.1	7.1	43.1	1.42	1.05	3.4	25.1
	8	31.7	24.7	45.5	22.9	44.2	1.44	1.09	3.4	26.5
	Av	128.5	100.0	198.7	100.0	43.7	1.55	1.13	3.3	28.0

At the Nandi site, segment 1 bolls accounted for 6-17% of total, increasing with increasing plant density. This equates to a first position retention of 29-51%, lower than the other site due to previously noted heavier early square losses due to mirids. Once again, there is no apparent pattern in retention related to plant density. Segment 2 ranges from 11-28 %, slightly lower than the other site but following the same pattern from 4/m to 12/m. The retention level in this case is remarkably consistent, 71-81%, so fruit shedding due to soil moisture constraints does not appear to have been

a factor in this segment. In this segment there has been a significant change in average boll size ranging from 2.53 g/boll in the thinnest down to 1.65 g/boll in 12/m. A very high T/O % in the 4/m treatment has partly contributed to this but moisture constraint should not have been a factor for boll size in this segment. There is no density related pattern in segment 3 boll counts, with a scattered range 17-25%. Boll size in this segment shows some decline in the 10/m and 12/m treatments (1.28 g/boll - 1.08 g/boll) , which is likely to be a reflection of late season moisture stress. Once again, there is a noticeable change in segment 8 counts with 47% of bolls in the thinnest, down to 19% in 10/m. Not much spread in boll size between the treatments for this segment.

From fibre quality considerations, length has dropped off slightly in the 10/m and 12/m treatments, due to poorer lengths in segments 3, 6 and 8 compared with the thinner stands. There is no clear trend with micronaire, although 12/m appears to have slightly lower values in segments 1 and 2 compared with the other treatments. There are no trends with strength, but 10/m is slightly lower than the others.

The commercial picked cotton at Nandi has made base grade in all key fibre quality parameters. It did however incur severe colour and leaf discount, brought on by regrowth from the end of March rain, and difficulty in getting leaf off the bush.

Appendix 1

Kupunn site – early season

Kupunn site – approaching cutout

Nandi site - early season

Nandi site – after cutout

Tight lock bolls - common to both sites