Cotton Catchment Communities CRC

FINAL REPORT

(due within 3 months on completion of project)

Part 1 - Summary Details

Cotton CRC Project Number: 1.03.20

Project Title: Variety development and tillage systems for cotton production in the Ord Stage 2 development

Project Commencement Date: 1/07/06 **Project Completion Date:** 30/06/08

Cotton CRC Program: The Farm

Part 2 – Contact Details

Administrator:	Ms Annette Long		
Organisation:	WA Department of Agriculture and Food		
Postal Address:	Baron-Hay Court, South Perth, WA 6151		
Ph: 08 93683414	**Fax:** 08 93682186	**E-mail:**	along@agric.wa.gov.au
Principal Researcher:	John Moulden		
Organisation:	WA Department of Agriculture and Food		
Postal Address:	PO Box 19, Kununurra, WA 6743		
Ph: 08 9166 4000	**Fax:** 08 91664066	**E-mail:**	jmoulden@agric.wa.gov.au
Supervisor:	**(**Previously) Geoff Strickland		
Organisation:	WA Department of Agriculture and Food		
Postal Address:	PO Box 19, Kununurra, WA 6743		
Ph: 08 91683300	**Fax:** 08 91683100	**E-mail:**	

Signature of Research Provider Representative: _____

Part 3 – Final Report Guide (due within 3 months on completion of project)

Background

Cotton industry expansion in traditional growing regions is highly unlikely due to land and water constraints. However, research in northern Australia has confirmed that new production areas are technically feasible although regulatory, political and environmental issues have constrained progress. For these reasons, development is most likely to succeed in existing and expanding agricultural production areas such as the Ord and the Burdekin where the industry can develop by crop replacement, rather than by developing new land and water resources.

On 6 October, 2005, the proposed Ord Stage 2 expansion took a significant step forward with the signing of a Native Title agreement between the traditional owners and the WA government. Since the signing, the government has expressed its determination to proceed with the project development and expressions of interest were called during 2006, although this process was terminated before its completion. Although the basics of crop husbandry and pest management for Ord Stage 2 are available to farmers, there are some production issues that require resolution before commercial production commences. The most important of these are:

a) achieving reliable fibre quality in all seasons
b) strategies for early sowing
c) nutrition on virgin soils (and following sugarcane)

Objectives

To screen Bollgard II® varieties and lines from the CSIRO breeding program to identify varieties that consistently produce commercially acceptable yields and quality in a winter cropping system. This objective has been fully realised for the 2006 and 2007 seasons.

Methods

Experimental Design:

2006 variety trial

The following varieties for 2006 were selected and supplied by Dr Greg Constable, CSIRO Narrabri.

1	Sicot 71B
2	Sicot 80B
3	Sicot 289B
4	Siokra 24B
5	Sicala 350B
6	Sicala 40B
7	Siokra V-16B
8	20458-26B
9	20458-34B
10	20458-36B

11	20458-75B
12	62401B
13	62404B

The experimental design was a randomised block design with five replicates. Plot size was 3 rows by 20 m.

REML analysis of yield data was performed by Dr Greg Constable. Quality parameters were determined by the HVI unit at ACRI Narrabri.

Planting: The trial was planted on Cununurra clay formed into 1.8 m beds. Seed was planted in 2 rows per bed to establish 8-10 plants per metre row using a cone seeder.

Fertiliser: A pre-planting basal application of DAP (250 kg/ha), zinc monohydrate (15 kg/ha) and sulphur (15 kg/ha) was placed in a band under the seed rows. Nitrogen (urea, 400 kg/ha) was side-dressed into the furrow side of the bed 35 days after planting.

Weed management: Stomp (3 L/ha) was incorporated into the soil immediately prior to water-up. The crop was inter-row cultivated once about 30 days after planting.

Irrigation: The trial was irrigated as per "Norpak", which is determined by crop growth and cumulative pan evaporation.

Yield measurements:
The variety trial was harvested using the John Deere cotton picker, which has been modified to pick small trials. The centre 15 m of the centre row of each plot was picked into hessian bags. The samples were weighed and a small sub-sample (300-600 grams) was taken for ginning. The sub-sample was hand ginned and a turnout and lint yield in bales/ha calculated. A sample from each plot was forwarded to Narrabri for quality assessment through the HVI equipment.

Yields were subjected to REML analysis.

2007 variety trial

The following varieties for 2007 were supplied by Dr Greg Constable, ACRI, Narrabri, and Richard Leske, Deltapine.

1	24B
2	71B
3	80B
4	350B
5	40B
6	V16B
7	289B
8	62401-24
9	62413-80

10	62404-28
11	62404-103
12	20458-26
13	62401-99
14	62401-2
15	62401-49
16	62404-110
17	08Q532D
18	DP408BGII
19	09Q90809DF
20	09Q91620DF

Experimental design: Randomised block with 5 replications. Plot size 3 x 20m rows. The trial was planted on 18 April 2007 on field 4B.

Analysis of yield data was performed by Dr Greg Constable. Quality parameters were determined by the HVI unit at ACRI Narrabri.

Planting and crop management was the same as in 2006.

The trial was harvested on 31 October 2007. A 15m section was mechanically harvested from the middle row of each plot. Seed cotton was collected into hessian sacks for weighing. A small sub-sample was ginned and lint yield calculated. A sample from each plot was forwarded to Narrabri for quality assessment.

Results

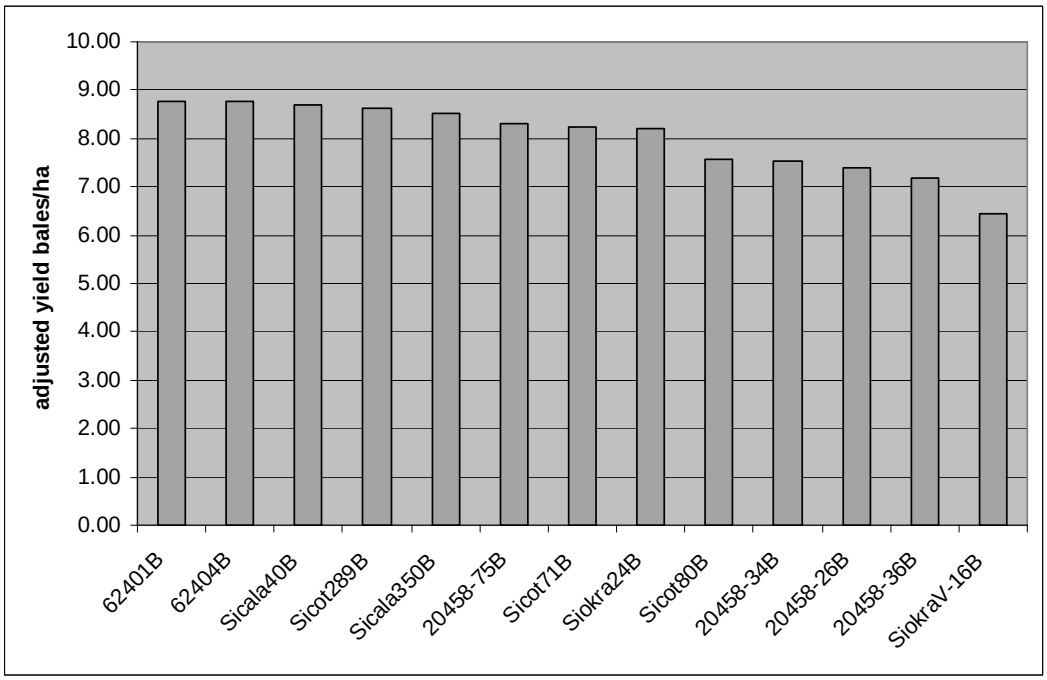
2006 variety trial

Yield data for the 2006 variety trial are shown below.

GENO	Gin turnout	Yield kg lint/ha	adjYld	bales/ha
62401B	40.7	2075	1991	8.77
62404B	41.8	1996	1988	8.76
Sicala40B	40.1	1869	1977	8.71
Sicot289B	40.5	2028	1962	8.64
Sicala350B	39.8	1899	1936	8.53
20458-75B	39.6	1889	1887	8.31
Sicot71B	40.6	1923	1873	8.25
Siokra24B	39.7	1846	1863	8.21
Sicot80B	39.3	1701	1715	7.56
20458-34B	37.3	1744	1710	7.53
20458-26B	37.1	1663	1679	7.40
20458-36B	36.2	1609	1633	7.19
SiokraV-16B	37.1	1439	1465	6.45
sed	0.54	120	78	

These yields are represented graphically in Figure 1 below.

Figure 1: Yields in the 2006 variety trial, Kununurra



Quality data for the 2006 variety trial is shown below in Table 1.

Table 1: Quality parameters for the 2006 variety trial, Kununurra.

	len	uni	sfi	str	el	mic
350B	1.206	84.06	8.00	30.62	4.76	4.68
20458-26B	1.134	82.78	8.80	29.18	4.16	5.00
80B	1.134	82.56	9.78	28.98	6.36	5.08
289B	1.128	82.48	9.24	28.88	5.36	4.74
62404B	1.126	81.66	9.64	27.94	5.80	5.00
24B	1.124	82.14	10.48	27.20	5.16	5.26
62401B	1.108	81.48	8.42	28.28	5.50	5.10
40B	1.096	82.48	10.60	27.76	4.88	4.80
71B	1.092	81.72	11.42	26.02	5.60	5.08
20458-36B	1.088	83.02	8.30	27.90	4.54	5.14
20458-34B	1.082	82.36	9.92	27.44	5.04	5.00
20458-75B	1.060	82.56	9.48	28.30	5.56	5.16
V16B	1.060	82.72	8.56	25.80	6.00	5.48

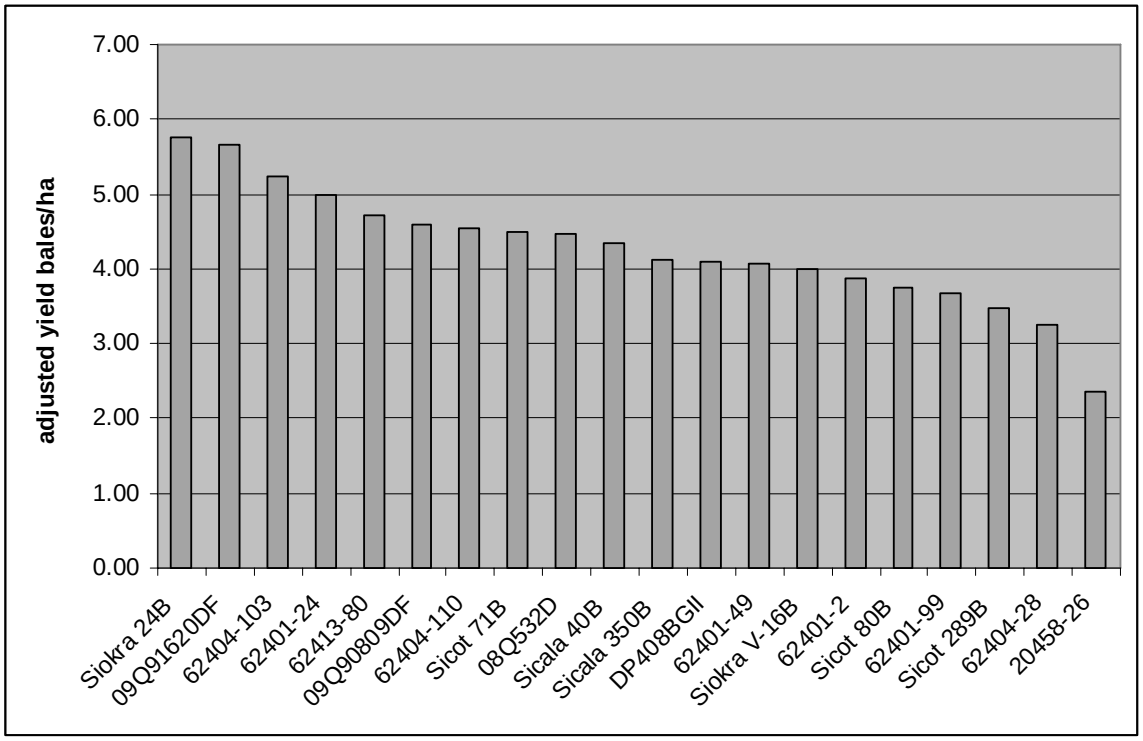
2007 variety trial

Yield and quality data for the 2007 variety trial are shown below.

geno	name	GIN	YLD	adjYld	RY	LEN	UNI	SFI	STR	EL	MIC
1	Siokra 24B	0.374	5.77	5.75	135	1.13	83.2	8.0	28.1	3.76	4.66
20	09Q91620DF	0.374	5.42	5.66	132	1.07	81.5	10.5	24.3	3.44	3.78
11	62404-103	0.394	5.31	5.23	122	1.09	81.3	10.3	25.3	3.24	3.94
8	62401-24	0.394	4.93	5.00	117	1.11	81.9	9.2	27.4	3.34	3.74
9	62413-80	0.376	4.58	4.72	110	1.15	82.8	8.4	27.0	2.86	3.98
19	09Q90809DF	0.354	4.50	4.59	108	1.13	82.5	8.4	24.6	3.40	3.54
16	62404-110	0.390	4.72	4.55	106	1.11	81.6	9.5	25.5	3.14	3.86
2	Sicot 71B	0.402	4.71	4.49	105	1.08	81.3	10.2	24.3	3.38	3.94
17	08Q532D	0.396	4.48	4.47	105	1.09	81.1	10.2	23.7	3.22	3.98
5	Sicala 40B	0.396	4.14	4.34	102	1.10	82.4	9.0	25.7	2.54	4.02
4	Sicala 350B	0.364	3.96	4.12	96	1.18	82.3	7.9	29.5	2.94	3.38
18	DP408BGII	0.380	4.18	4.09	96	1.09	81.1	10.0	24.7	3.22	3.72
15	62401-49	0.372	4.12	4.06	95	1.16	82.1	8.5	26.6	3.22	3.74
6	Siokra V-16B	0.344	4.17	3.99	93	1.06	81.7	9.9	23.2	3.52	4.44
14	62401-2	0.362	3.64	3.86	90	1.15	82.1	8.6	25.7	2.14	3.96
3	Sicot 80B	0.358	3.82	3.76	88	1.11	83.3	8.1	29.1	3.87	4.11
13	62401-99	0.396	3.66	3.67	86	1.10	81.9	8.8	26.4	3.04	4.02
7	Sicot 289B	0.372	3.45	3.47	81	1.13	82.4	8.2	27.0	3.16	4.16
10	62404-28	0.358	3.30	3.26	76	1.11	80.6	10.2	25.4	3.58	3.60
12	20458-26	0.346	2.55	2.36	55	1.13	82.7	8.7	24.4	1.92	3.68
sed		0.010	0.71	0.58	14	0.015	0.73	0.94	1.12	0.27	0.26

Yields are represented graphically in Figure 2 below.

Figure 2: Yields from the 2007 variety trial, Kununurra.



Outcomes

The 2006 growing season in the Ord was characterised by low maximum temperatures and mild nights, and yields were generally below those of the previous three years. Almost all varieties in this trial yielded above the 7.2 bales per hectare recorded from the Bollgard II demonstration block, which was the lowest yield from this demonstration in the past four years. The cone seeder-planted variety trial usually yields less than the other cotton grown in the same year, and this further highlights the good yields obtained here.

Short fibre length and high micronaire have often been responsible for downgrades in Ord cotton in the past. Seven of the varieties in this trial produced above-grade fibre length. Sicala 350B produced significantly greater length than any other variety; this is an important result as it confirms the good length of 350B in last year's variety trial.

Most varieties exhibited excessive micronaire. This is difficult to explain as almost all samples taken from cotton from other trials had micronaire values in the range 3.5 to 4.9.

2006 was a relatively difficult year for cotton in the Ord with lower than normal maxima and below average day degree accumulation. Tight locks were common, picking efficiencies were lower than normal and yields were down. If we accept that the high micronaire values recorded from the variety trial are anomalies, and that

the true value lies in the range 3.5 to 4.9, the overall result is positive. In particular, Sicala 350B is an exciting development for the Ord, with its exceptional fibre length.

Yields obtained in the 2007 season were the lowest recorded from experimental crops in the Ord since the commencement of the current research program. The mean yield recorded in this variety trial was 4.27 bales/ha, compared with 8.02 from the year before. Heavy and sustained rain (100mm) fell over a two week period coinciding with the start of flowering. The resultant waterlogging caused fruit to abort and the crop to become yellow and rank. The adverse affects on yield were not restricted to cotton, with many other crops in the district also yielding poorly and being of poor quality.

Despite yielding poorly, several varieties again exhibited good fibre length. In particular, Sicala 350B, with a length of 1.18 in. performed well under adverse conditions.

Micronaire values were generally acceptable. The mean value of 3.9 compares favourably with the mean of 5.0 obtained the year before.

In-season rainfall such as experienced in 2007 is clearly disastrous for cotton. Fortunately, it is a rare occurrence.

Conclusion

Cotton remains an unfulfilled opportunity for the Ord, with insufficient available land and a continuing moratorium prohibiting the cultivation of GM crops in Western Australia. The land available in Ord Stage 1 is being increasingly developed for permanent plantations of Indian sandalwood with cropping cycles of 15 years or more. Without the release of significant areas of new land and the lifting of the moratorium the prospects of a cotton industry are remote. There is some optimism that the new Liberal/National government, elected in September 2008, will place a higher priority on both issues than the previous Labor government.

In the event that developments favour cotton in the Ord, we have identified varieties that consistently yield well and produce lint of adequate quality. In particular, the variety Sicala 350B is an outstanding prospect, yielding well and producing exceptional fibre length.

Extension Opportunities

Limited in the absence of a local industry.

Publications

Cotton Catchment Communities Cooperative Research Centre (2007). NORpak Ord River Irrigation Area: Cotton production and management guidelines for the Ord River Irrigation Area.

Part 4 – Final Report Executive Summary

A robust dry season production package for cotton in the Ord River region has been developed over the past 12 years, based on research conducted in Kununurra and supported by the Cotton CRC, CRDC, the WA Department of Agriculture and Food, as well as many other industry and farmer collaborators. Yields comparable to the Australian average are reliably achieved using production systems based on Integrated Pest Management (IPM). The production package has been published by the Cotton CRC as "NORpak – production and management guidelines for the Ord River Irrigation Area".

Historically, Ord River cotton has been subject to price penalties due mainly to short fibre length. The objective of the current series of variety trials has been to identify varieties, particularly from the CSIRO breeding program, that are particularly well suited to tropical growing conditions, as measured by yield and fibre quality.

Varieties that perform exceptionally well in an eastern Australian production system do not always stand out in the tropics. The variety Sicot 71B, a standout variety at Narrabri, does not yield particularly well in the Ord. Sicala 350B, which exhibits very good fibre length in the east does not yield very well there; by contrast, in the Ord Sicala 350B yields better than most varieties and also produces good fibre length.

A critical shortage of land and a continuing moratorium prohibiting the cultivation of GM crops in Western Australia has prevented the establishment of a cotton industry in the Ord. There is the hope that the newly elected State government will address both these issues, but for now cotton is not a commercially viable cropping option in the Ord.

For further information contact John Moulden, WA Department of Agriculture and Food, Kununurra.

Phone: 08 9166 4000
Mob: 0418 931 905
Email: jmoulden@agric.wa.gov.au

Project 1.03.20

Cotton nutrition following a long sugarcane rotation.

Background:

Until the closure of the sugar industry in 2007, sugarcane was the single largest horticultural crop by area planted in the ORIA. Sugarcane remains a broadacre cropping option in the Ord Stage 2 development. Cotton is seen as an ideal crop to grow in rotation with sugar. Sugarcane plantings typically last for five to six years before the crop is destroyed. Land which has come out of a long sugar planting can be compacted and be deficient in nutrients. There is at present no experience of growing cotton on land which is coming out of a long sugarcane history.

Aim:

To evaluate the nutritional response and performance of cotton following a long sugarcane cycle on furrow irrigated Cununurra clay soils.

Experimental Design:

Randomised block, eight fertiliser treatments replicated five times. Each plot was three beds wide running the length of the field. Refer to Figure 1 for experimental layout. Treatments were:

1	LN LP LK	300kg/ha urea
2	LN LP HK	300kg/ha urea + 240kg/ha K_2SO_4
3	HN LP LK	500kg/ha urea
4	HN LP HK	500kg/ha urea + 240kg/ha K_2SO_4
5	LN HP LK	100kg/ha DAP + 265kg/ha urea
6	LN HP HK	100kg/ha DAP + 265kg/ha urea + 240 K_2SO_4
7	HN HP LK	100kg/ha DAP + 460kg/ha urea
8	HN HP HK	100kg/ha DAP + 460kg/ha urea + 240kg/ha K_2SO_4

All treatments received a sidedressing of 250kg/ha DAP + 15kg/ha $ZnSO_4$ on 18 April 2007 (14 days post sowing).

The treatments were designed to supply a total of the following nutrients: (NPK, kg/ha)

1	LN LP LK	185:50:0
2	LN LP HK	185:50:100
3	HN LP LK	275:50:0
4	HN LP HK	275:50:100
5	LN HP LK	185:70:0
6	LN HP HK	185:70:100
7	HN HP LK	275:70:0
8	HN HP HK	275:70:100

Methods

The field had been continuously cropped with sugarcane for the previous 11 years. After each year's cane cut fertiliser was applied to replace nutrients removed at harvest. Following the final cane harvest in October 2006 the crop was destroyed by cultivation and spraying. The field was left as a bare fallow over the 2006/2007 wet season.

As soon as the field had dried sufficiently to allow tractor access after the wet season, cotton (variety Sicala 43BRF) was sown directly into the beds on 4 April 2007. Seed was sown in 2 rows per 1.8m wide bed at a rate of approximately 11kg/ha, to establish a plant density of about 10 plants/m. Cotton is routinely planted into moisture in the cotton growing areas of eastern Australia; soil moisture is sufficient to promote germination and establishment in these areas. Pre-emergent herbicide was not applied.

Weed control: Glyphosate (Powermax) 3L/ha was applied over the top of the crop on 4 April and 7 June. No pre-emergent herbicide was used.

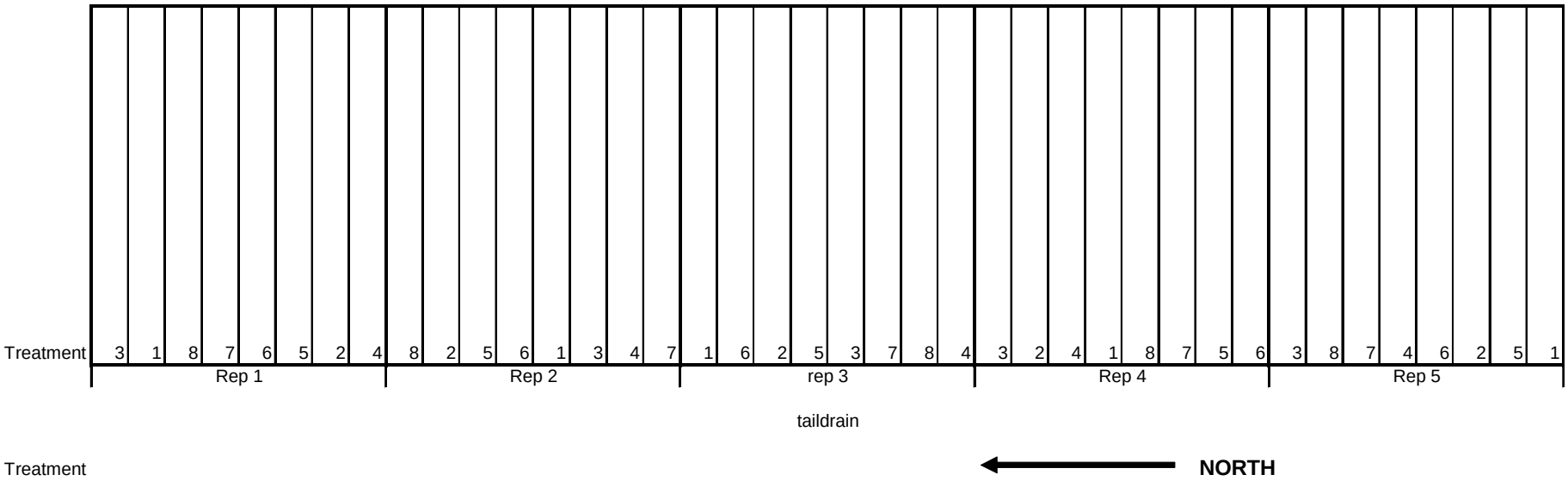
Diammonium phosphate (DAP), 250kg/ha, was applied in bands on the outside of each plant row at a depth of approximately 100mm on 17 April. This was immediately followed by furrow irrigation. The treatments were applied in a similar manner on 19 and 20 May. The furrows were swept out during application of treatments and the field was furrow irrigated on 21 May.

Datum points were established in each plot. At each datum point a 1.1m length of row (equivalent to $1m^{-2}$) was marked with flagging tape. All plants in this sub-plot were measured weekly for growth rate as indicated by height and node development. From first flower onwards fruit counts were made weekly in each sub-plot. The number of nodes above the top white flower (NAWF, an indicator of the approach of cutout) was measured weekly from first flower until cutout.

Yield was assessed using the John Deere 9010 cotton harvester. Five samples were picked from one row of each treatment (each sample 20m, a total of 200 samples) Seed cotton was collected into hessian sacks and weighed for yield calculation. Treatments were compared using analysis of variance. A sample of seed cotton was taken from each plot, combined into lots representing treatments, ginned in the laboratory and sent for quality testing at ACRI, Narrabri.

The crop was watered in accordance with guidelines in NORpak. Irrigation frequency was based on accumulated pan evaporation.

Figure 1. Layout of Field 2B, Frank Wise Institute, Kununurra 2007



Treatment		
1	LP LN LK	300 urea
2	LP LN HK	300 urea+240 K_2SO_4
3	LP HN LK	500 urea
4	LP HN HK	500 urea+240 K_2SO_4
5	HP LN LK	100 DAP+265 urea
6	HP LN HK	100 DAP+265 urea+240 K_2SO_4
7	HP HN LK	100 DAP+460 urea
8	HP HN HK	100 DAP+460 urea+240 K_2SO_4

Each plot 3 beds wide and 180m head to tail

Table 1: raw harvest data

Sample number	Plot number	b/ha	treat	rep	Sample number	Plot number	b/ha	treat	rep	Sample number	Plot number	b/ha	treat	rep	Sample number	Plot number	b/ha	treat	rep
1	1	5.86		5	51	11	3.85		4	101	21	4.24		3	151	31	4.00		2
2	1	6.29		5	52	11	2.99		4	102	21	5.38		3	152	31	4.01		2
3	1	5.15		5	53	11	4.12		4	103	21	4.29		3	153	31	4.12		2
4	1	5.21		5	54	11	5.18		4	104	21	6.18		3	154	31	4.41		2
5	1	5.89	1	5	55	11	4.64	7	4	105	21	5.52	5	3	155	31	5.39	2	2
6	2	4.12		5	56	12	5.07		4	106	22	5.58		3	156	32	4.78		2
7	2	3.56		5	57	12	5.72		4	107	22	5.48		3	157	32	4.58		2
8	2	4.09		5	58	12	4.50		4	108	22	5.49		3	158	32	4.67		2
9	2	4.25		5	59	12	4.02		4	109	22	4.09		3	159	32	5.72		2
10	2	5.02	5	5	60	12	5.47	8	4	110	22	5.86	2	3	160	32	5.49	8	2
11	3	5.35		5	61	13	5.12		4	111	23	4.29		3	161	33	4.84		1
12	3	4.79		5	62	13	4.02		4	112	23	4.91		3	162	33	5.55		1
13	3	5.28		5	63	13	2.84		4	113	23	5.20		3	163	33	3.83		1
14	3	6.01		5	64	13	5.15		4	114	23	5.43		3	164	33	4.39		1
15	3	5.88	2	5	65	13	4.83	1	4	115	23	5.09	6	3	165	33	4.44	4	1
16	4	4.61		5	66	14	4.82		4	116	24	5.38		3	166	34	3.83		1
17	4	4.97		5	67	14	5.28		4	117	24	5.25		3	167	34	4.78		1
18	4	4.61		5	68	14	4.28		4	118	24	6.44		3	168	34	5.90		1
19	4	5.16		5	69	14	4.95		4	119	24	5.55		3	169	34	5.78		1
20	4	5.72	6	5	70	14	5.40	4	4	120	24	4.77	1	3	170	34	6.46	2	1
21	5	4.37		5	71	15	4.27		4	121	25	5.86		2	171	35	4.92		1
22	5	5.05		5	72	15	3.49		4	122	25	6.14		2	172	35	5.04		1
23	5	4.23		5	73	15	4.53		4	123	25	5.58		2	173	35	5.09		1
24	5	4.66		5	74	15	3.55		4	124	25	6.51		2	174	35	4.38		1
25	5	5.54	4	5	75	15	5.27	2	4	125	25	5.42	7	2	175	35	5.76	5	1
26	6	4.12		5	76	16	5.60		4	126	26	5.83		2	176	36	5.24		1
27	6	4.20		5	77	16	5.35		4	127	26	6.56		2	177	36	5.96		1
28	6	4.16		5	78	16	6.09		4	128	26	7.04		2	178	36	6.13		1
29	6	3.80		5	79	16	4.57		4	129	26	5.97		2	179	36	6.48		1
30	6	4.83	7	5	80	16	4.40	3	4	130	26	6.00	4	2	180	36	6.91	6	1
31	7	4.22		5	81	17	3.49		3	131	27	5.56		2	181	37	6.97		1
32	7	4.93		5	82	17	3.48		3	132	27	5.84		2	182	37	6.98		1
33	7	5.04		5	83	17	3.63		3	133	27	5.57		2	183	37	5.83		1
34	7	5.33		5	84	17	3.78		3	134	27	5.09		2	184	37	4.64		1
35	7	5.24	8	5	85	17	4.82	4	3	135	27	4.80	3	2	185	37	6.08	7	1
36	8	5.36		5	86	18	5.70		3	136	28	5.17		2	186	38	5.19		1
37	8	4.78		5	87	18	5.98		3	137	28	5.43		2	187	38	5.17		1
38	8	4.85		5	88	18	5.69		3	138	28	5.80		2	188	38	5.13		1
39	8	4.84		5	89	18	6.57		3	139	28	5.11		2	189	38	5.16		1
40	8	4.51	3	5	90	18	6.74	8	3	140	28	5.16	1	2	190	38	5.52	8	1
41	9	5.67		4	91	19	3.07		3	141	29	4.19		2	191	39	4.88		1
42	9	4.92		4	92	19	4.85		3	142	29	6.45		2	192	39	6.13		1
43	9	3.69		4	93	19	4.24		3	143	29	3.68		2	193	39	4.64		1
44	9	4.65		4	94	19	5.26		3	144	29	5.24		2	194	39	4.01		1
45	9	4.39	6	4	95	19	4.88	7	3	145	29	3.98	6	2	195	39	5.85	1	1
46	10	6.39		4	96	20	6.05		3	146	30	4.22		2	196	40	5.43		1
47	10	6.49		4	97	20	5.51		3	147	30	4.27		2	197	40	5.44		1
48	10	5.52		4	98	20	4.97		3	148	30	4.13		2	198	40	5.78		1
49	10	6.65		4	99	20	4.66		3	149	30	5.69		2	199	40	5.50		1
50	10	6.53	5	4	100	20	3.75	3	3	150	30	4.31	5	2	200	40	5.09	3	1

ANOVA

Source	DF	SS	MS	Observed F		Tabular F value	
Rep	4	1.241079	0.31027	0.636542	ns	5.75	13.86
Treat	7	0.835958	0.119423	0.245004	ns	3.43	6.01
Error	28	13.64805	0.48743				
Total	39	15.72508	0.403207				

CV: 3.10 %

ns=non-significant

Figure 1: Nodes above white flower

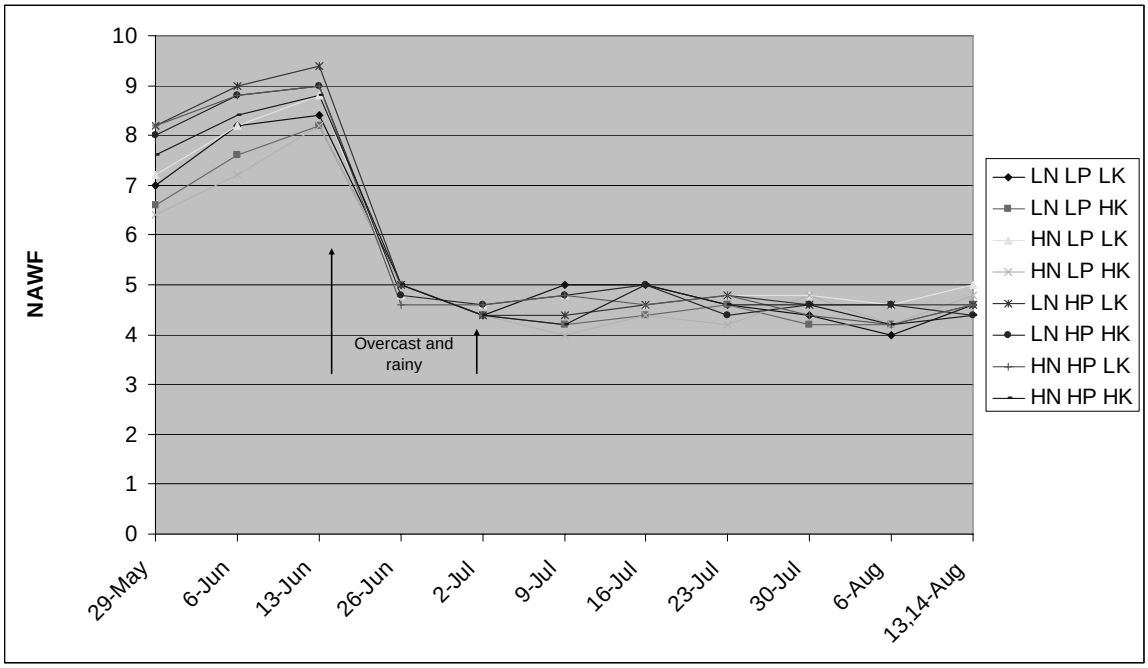


Table 1: Quality parameters

treatment no.	treatment	len	uni	sfi	str	el	mic
1	LN LP LK	1.08	83.6	6.9	24.5	3.9	4.6
2	LN LP HK	1.09	83.2	7.4	23.8	3.8	4.3
3	HN LP LK	1.09	81.8	9.3	24.9	3.7	4.2
4	HN LP HK	1.07	79.6	11.0	22.9	3.4	4.1
5	LN HP LK	1.06	83.6	8.1	23.4	3.7	4.7
6	LN HP HK	1.13	82.3	7.1	25.0	3.2	4.2
7	HN HP LK	1.09	82.5	9.3	24.2	3.2	4.1
8	HN HP HK	1.05	81.9	8.5	25.1	3.7	4.3

Figures 2 & 3: Root distortion resulting from hardpan, present across the field.

Discussion and conclusions:

Analysis of yields using ANOVA indicated that there was no effect on yield due to treatment. This was an unexpected result, and probably indicates the presence of adequate nutrient levels as a result of fertiliser applications made annually through the 11 year sugar cropping cycle. Nevertheless, the lack of response to nitrogen is puzzling. Several observations made through the growing season may explain in part the observed effects.

1. Planting into moisture. Although the seed was planted into sufficient moisture to produce germination, very hot and strong easterly winds prevailed for the first few weeks following planting. Supplementary irrigation was not applied as the field was still too wet at depth to allow access by heavy machinery for the purpose of cleaning out furrows, and the concern that this process would bury emerging seedlings. Many seedlings had wilted by mid-morning and appeared dead by late afternoon. These seedlings invariably had poorly developed and weak root systems. Most of these seedlings recovered turgor by the next day but never produced normal plants even after normal irrigation commenced**. Based on the experience of this year, planting into moisture without the ability to apply supplementary irrigation would not be recommended.**

2. Hardpan. A very dense hardpan was present throughout the field, the result of a long sugarcane rotation without seasonal drying down. Cununurra clay soils are strongly cracking when allowed to dry down under crop cover, and as a result hardpans rarely form in a normal cropping system where drying down for a month or two is allowed to occur. Root development on almost all plants was severely retarded, with right-angled bends ocurring at approximately 20 cm depth. These plants never developed a satisfactory root system, even after later drying had caused some sub-surface cracking which allowed roots to turn downwards.**The importance of allowing compacted soils to dry down to depth and self-mulch before planting other crops was amply demonstrated in this trial.**

3. Delayed fertiliser application. It has been standard practice with cotton in the Ord to make a pre-planting application of DAP or MAP, followed by supplementary urea just prior to the second irrigation. Delayed application of all fertiliser is seen as one approach to achieve the earliest possible planting date. Work in the Ord by Steve Yeates in the 1990s showed that fertiliser application could be delayed by up to 40 days following planting, with no effect on yield. This trial has neither supported or challenged this conclusion; however, in view of the demonstrated need to be able to irrigate immediately after planting, requiring heavy vehicle access, **delayed fertiliser application would seem to have little to recommend it in a cotton production system.**

4. Roundup Ready Flex technology. This trial was the first large scale demonstration of this technology in the Ord. The field was severely infested in patches with nutgrass (*Cyperus rotundus*). Two applications of glyphosate at 3L/ha effectively controlled this and all other weeds, including wild rosella, *Abelmoschus ficulneus*.

5. Seasonal conditions. The 2007 season experienced wet and overcast conditions over several weeks in June, atypical for the region. Figure 1 follows NAWF with time. It is apparent that all treatments effectively cut out at the onset of the wet weather. This

resulted in rank vegetative growth and loss of squares. The crop did not fully recover from this setback, and as a result fruit set was delayed and yield was greatly reduced. Experience has shown that the application of even low rates of Pix (400mL/ha) followed soon after by cold weather causes severe stunting and abnormal growth, so the decision was made not to attempt to control vegetative growth this way so late in the season. In hindsight, a very low rate (250mL/ha) may have been effective in reducing vegetative growth and encouraging fruiting with minimal risk.

Quality

All treatments except one were below base grade for length and strength. Micronaire was within the base grade range. Length in Ord River cotton in recent years has generally been satisfactory – this year's result reflects the adverse growing conditions experienced.

Yield

Mean yields obtained from this trial were well below the district average; similar low yields were obtained in the variety trial run the same year. The unseasonal rainy and overcast conditions experienced during squaring caused the plants to abort squares and move into a vegetative condition. While the weather conditions experienced are unusual, they are not unknown at this time of year, and this result illustrates that the possibility of an occasional poor crop must be considered in the Ord.