MIA Final Irrigation Cotton Trial, 2018-19

Steve Buster (RivCott Ltd / Summit Ag, Griffith. June 2019)

Summary

- All fields that had a mid-March irrigation did not have a corresponding yield increase. As this irrigation is typically 0.6 to 0.8Ml/ha this water could have been saved and/or sold.
- Final irrigation at the end of February had the same yield as that in March.
- Final irrigation in the 3rd week of February had between 0% and 25% yield loss compared to March irrigations. The field yielding 10 b/ha had a yield loss of 10% by terminating at this irrigation. Thus if 0.8 Ml/ha water is applied at a cost of $500/Ml, this equates to a cost of $400/Ml to gain an extra bale per ha making the purchase of water cost effective at $500/bale.
- Terminating irrigations in early February had the greatest negative effect on yield in three of the four fields. Yield loss was between 8% and 44% depending upon final yield. Terminating the crop with this irrigation has significant yield penalties but did not seem to affect quality into the discount range.

Introduction

The MIA is considered one of the most reliable irrigation regions in Australia. As cotton production is relatively new in the region, growers have not needed to determine the marginal utility of the last or terminal irrigation. This year was different, with reduced water allocation and high prices of water on the temporary market reaching $600+ per Ml in late January. Very little research appears to have been undertaken looking at the benefit of additional yield compared to paying a high price for water for final irrigations if short in allocation. Four farms were approached in Coleambally, Carrathool and Hay. The trial proposed was for all farms to apply water in the first week of February and then not irrigate 24 rows with each successive irrigation. This would result in four fields having full irrigations, 24 rows with one irrigation less, 24 rows with two irrigation less and 24 rows with 3 irrigation less. As the yield impact was uncertain, the decision was made not to replicate the irrigation deficits within a field, thus using the four fields as an indication of the expected result when applying terminal irrigations in February or March.

Field Attributes and Irrigation Dates

Field attributes are shown in Table 6.1. All field rotations were back to back cotton except field 4 which was a cereal/fallow. Variety across all fields was 746B3F. Of the 24 rows per treatment, the middle 12 rows were picked with modules being weighed individually using the CGA bales weigh trailer. This harvested subset was to avoid including rows that may have had subbing of irrigation water from subsequent irrigations. Similarly, if water was backed up from the tail drain, picking was cut short so as to avoid picking rows that had additional water. From each module, four sub-samples were taken and hand ginned. Four samples per ginned treatment were classed by Pro-Class using their commercial classing High Volume Instrument (HVI).

Table 6.1 Field attributes and sowing date of four last irrigation date trials 2018-19.

	Soil Type	Rotation	Variety	Sowing Date
Field 1	Med-heavy clay	Back to Back	746B3F	15-Oct
Field 2	Medium clay	Back to Back	746B3F	13-Oct
Field 3	Med-heavy clay	Back to Back	746B3F	26-Oct
Field 4	Heavy clay	Cereal/Fallow	746B3F	3-Oct

There was a wide variety of irrigation dates between the four fields as shown in Table 6.3. However, the final three irrigations were similar except for Field 2 whose last irrigation was at the end of February. The grower considered they were one irrigation short as they ran out of water. The last three irrigation dates are shown in Table 6.2.

Table 6.2 Final irrigation dates for each treatment of the four last irrigation date trial fields 2018-19.

	Early Feb (T3)	Mid Feb (T2)	Late Feb (T1)	March (T0)
Field 1	9-Feb	16-Feb	28-Feb	11-Mar
Field 2	35mm rain 8-Feb	14-Feb	26-Feb	
Field 3	50mm rain 8-Feb	17-Feb	28-Feb	11-Mar
Field 4	4-Feb[a]	18-Feb	28-Feb	11-Mar

Table 6.3. Irrigation dates for each of the four fields in the last irrigation date trial 2018-19.

Irrigation Date	Field 1	Field 2	Field 3	Field 4
Flush up	15-Oct	13-Oct	26-Oct	3-Oct
1st Irr	29-Nov	1-Dec	17-Nov	7-Dec
2nd Irr	23-Dec	26-Dec	8-Dec	26-Dec
3rd Irr	4-Jan	9-Jan	20-Dec	5-Jan
4th Irr	14-Jan	18-Jan	30-Dec	15-Jan
5th Irr	23-Jan	8-Feb	5-Jan	24-Jan
6th Irr	31-Jan	14-Feb	14-Jan	4-Feb
7th Irr	9-Feb	26-Feb	19-Jan	18-Feb
8th Irr	16-Feb		26-Jan	28-Feb
9th Irr	28-Feb		3-Feb	11-Mar
10th Irr	11-Mar		8-Feb 50mm rain	
11th Irr			17-Feb	
12th Irr			28-Feb	
13th Irr			11-Mar	

Note[a]. Field four had a mishap in the last irrigation of treatment 3 (early Feb). T3 was irrigated on the 4th February and missed the irrigation on the 18th February and then rewatered on the 28th February. T2 (mid Feb) last irrigation was on the 18th February. Thus, both T2 an T3 missed two irrigation but at different times. They both missed the 11th March irrigation.

Rain was inconsequential on the field sites except for field 3 which received 50mm rain at mid irrigation on the 8th February. Both Fields' 1 and 2 had 10mm and 35mm rain on 8th February respectively but this coincided with an irrigation, so the rains impact is effectively nullified by the irrigation.

Probe graphs for each field or its associated irrigation management unit field are shown in Appendix 6.1

Results and Discussion

Basic plant measurements of total nodes, plant height and NAWF were taken from each plot in early February just before the irrigation (Table 6.4). Bolls per meter measurements were taken in late March before defoliation. As expected, reduced irrigations at these times did not affect crop height or final nodes as these parameters were set before the stress was imposed. The effect of stress on boll number was more pronounced with most crops showing a decline in boll number with the terminal irrigation in early-February. In some fields, there appears to be an effect of reduced boll number with last irrigation in mid-February compared to the March irrigation as well, but this is not consistent across all fields.

Hand ginning turnouts are higher than commercial ginning due to no lint cleaning in the ginning process. As shown in Table 6.4 there is little difference between treatments within a field with the

major difference being between fields. Final yields of the whole fields based upon module numbers and average weights are included for reference.

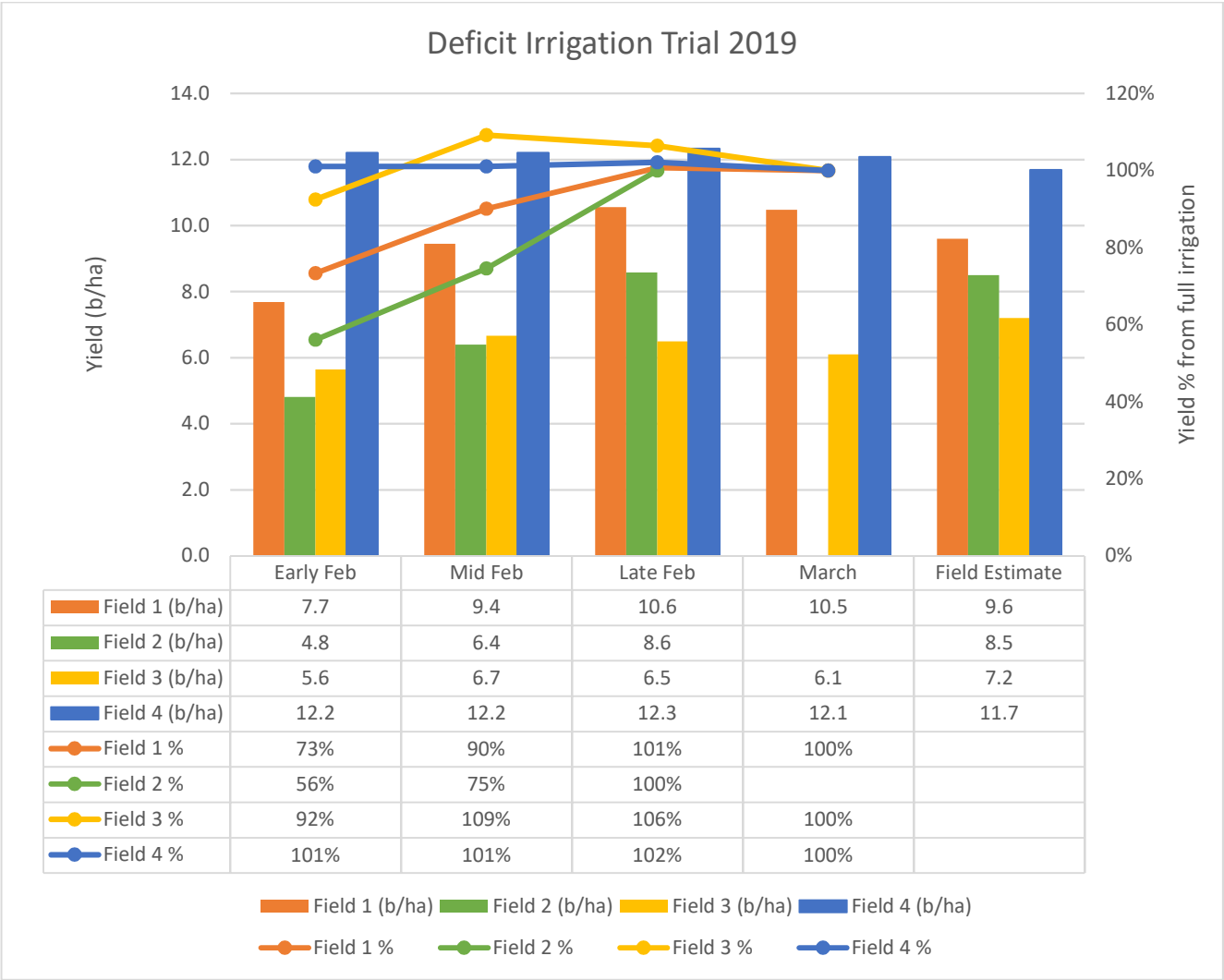
Table 6.4 Crop measurements for each treatment within each field

	Treatment	Nodes	Plant Height	NAWF	Bolls/m	Turnout %
Field 1	Early Feb	24	85	5.2	117	45.2%
	Mid Feb	24	85	5.2	130	45.6%
	Late Feb	24	85	5.2	139	45.5%
	March	24	85	5.2	147	45.6%
						45.5%
Field 2	Early Feb	26	98	5	99	45.7%
	Mid Feb	27	95	5	112	46.0%
	Late Feb	27	96	5	143	46.3%
						46.0%
Field 3	Early Feb	23	69		110	44.8%
	Mid Feb	23	70		98	45.3%
	Late Feb	24	69		100	45.2%
	March	24	70		125	44.8%
						45.0%
Field 4	Early Feb	24	85	3	117	46.4%
	Mid Feb	23	94	3	146	46.2%
	Late Feb	24	97	3	138	46.3%
	March	24	96	3	142	46.3%
						46.3%

Field treatment yields and percentage of yield from full irrigation is shown in Figure 6.1. Yields were calculated equating a hand-gin turnout percentage of 45.5% being equal to a commercial gin turnout percentage of 40.25% (approximately the average for the variety this year). The hand gin variation for each treatment was then applied to the weighed module weight for each respective treatment.

There was a wide range of yield response between fields with each irrigation treatment imposed. Field 1 yield is the most typical of the average yield across the MIA for the 1018-19 season. Fields 3 and 4 yields are towards either end of the yield range for this season. Field 2 shows similar trend to field 1 but at lower yields. Field 2 did have some hail damage in mid-December which was considered minor to moderate.

Taking the percentage yield graphs for fields 1 and 2, the last irrigation periods show a similar trend with yields being reduced between 27% and 44% respectively when the last irrigation was applied in early February. Mid-February irrigations resulted in 10% to 25% yield reductions compared to final irrigation yields. Late -February final irrigation for all treatments were not very different from March irrigations.



	Early Feb	Mid Feb	Late Feb	March	Field Estimate
Field 1 (b/ha)	7.7	9.4	10.6	10.5	9.6
Field 2 (b/ha)	4.8	6.4	8.6		8.5
Field 3 (b/ha)	5.6	6.7	6.5	6.1	7.2
Field 4 (b/ha)	12.2	12.2	12.3	12.1	11.7
Field 1 %	73%	90%	101%	100%	
Field 2 %	56%	75%	100%		
Field 3 %	92%	109%	106%	100%	
Field 4 %	101%	101%	102%	100%	

Figure 6.1 Calculated treatment yields and percentage yield of full irrigation for each field and respective last irrigation period 2019.

Field 3 had a much lower yield. It appears the only impact on yield was in the early-February irrigation. With reduced boll number (100/m) it would seem this yield was set by mid- February and no further irrigations had the ability to change the final yield. The apparent yield decline with the March irrigation plot did not carryover to the whole field so reflects variation within the field.

Field 4, being fallow and on a deep clay soil showed no yield decline with reduced irrigations. This would imply that the soil water holding capacity was so great the plant did not appear to go into stress enough to affect yield. It is arguable whether fibre qualities were affected but none to the extent that discounts would apply (Figures 6.2, 6.3, 6.4).

Lint grades for micronaire, length and strength for each treatment are shown in Figures 6.2, 6.3 and 6.4 respectively. It could be argued that the early- February terminal irrigation resulted in reduced micronaire and fibre length but neither of these final irrigations resulted in discounts. Only Field 2 approached micronaire discounts and this relates more to the field than to the irrigation treatments. As this field was hail affected, the hail may have resulted in reducing micronaire by reducing leaf area and thus accentuated the yield decline with the early and mid-February terminal irrigations.

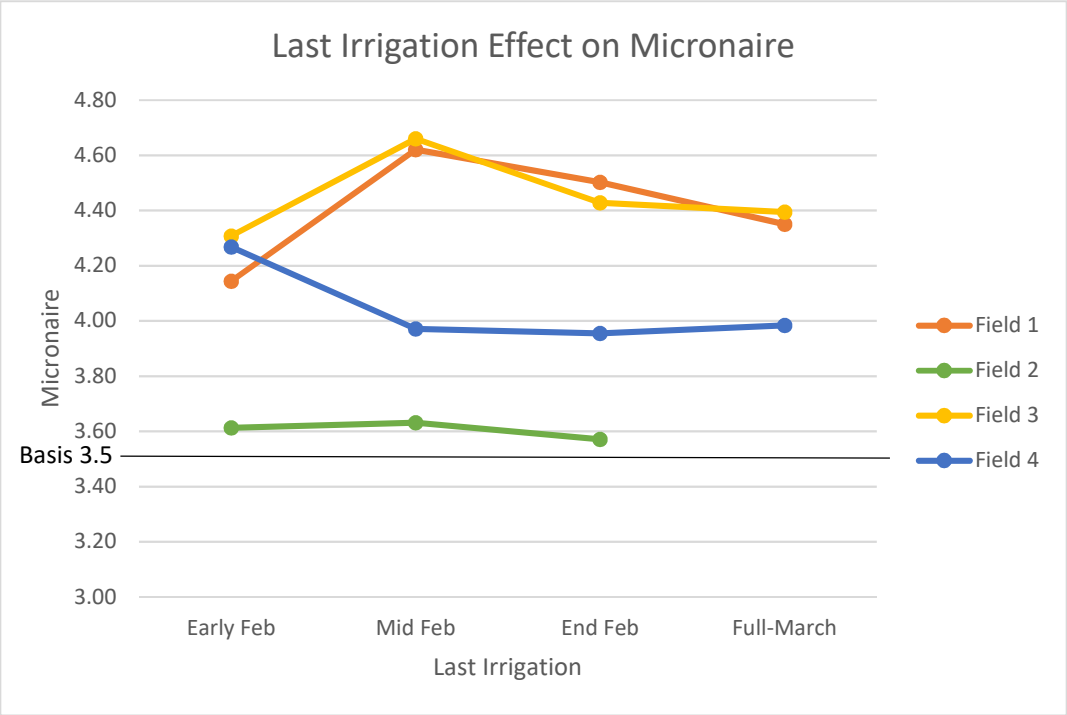


Figure 6.2 Last irrigation effect on lint micronaire in 2019.

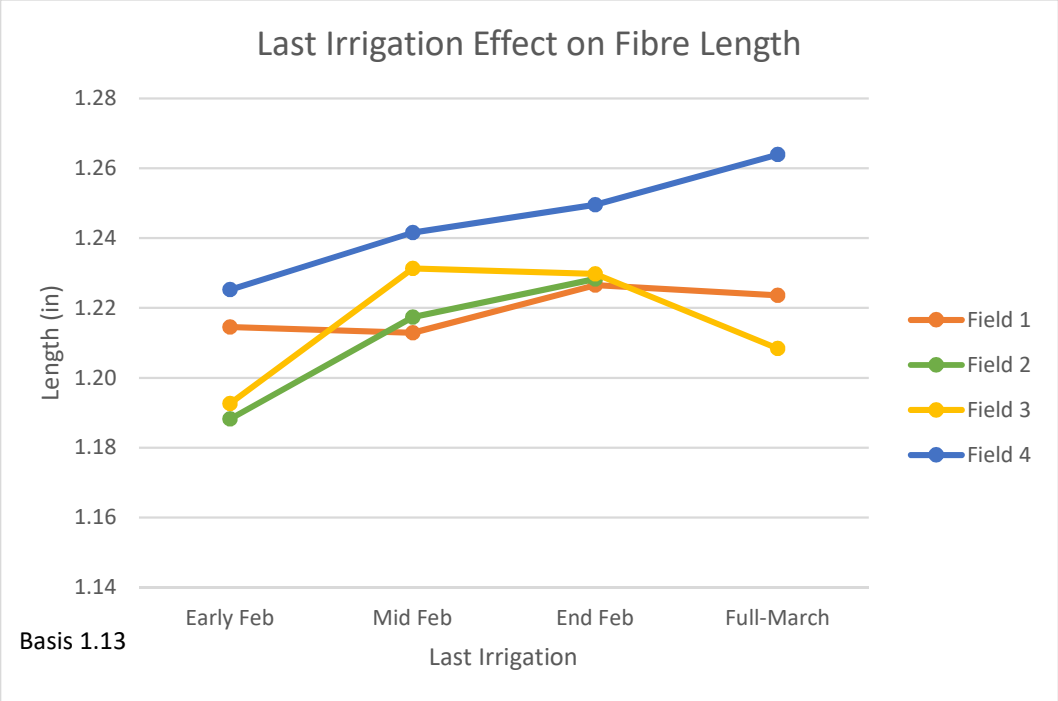


Figure 6.3 Last irrigation effect on lint fibre length in 2019.

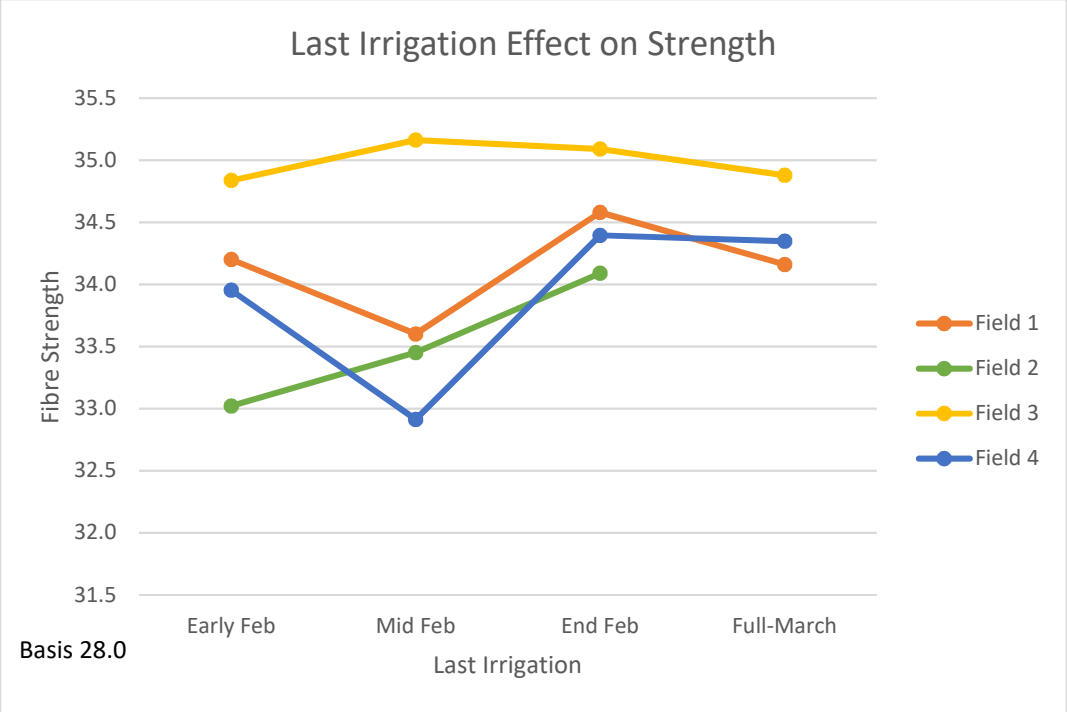


Figure 6.2 Last irrigation effect on lint fibre strength in 2019.

This last irrigation trials show a wide range in field responses and it is important to consider this is one years' data. The trial needs to be undertaken again in a different season and yield potential to verify these results. Putting all the field results together the following conclusions can be made;

- All fields showed very limited yield response to the terminal irrigation in mid-March. No apparent yield was gained from this irrigation. This was regardless of sowing date.
- If the crop has a low yield potential (circ 7 bale/ha) through low boll numbers and these bolls are set through the crop (ie, not late, top crop set) then it is a marginal call whether irrigations in late February are of benefit.
- Most fields with a yield potential of 8 to possibly 12 bales/ha need to be irrigated to the end of February/early March but irrigations after this needs careful consideration. It is postulated that only crops with very high yield potential (>12 b/ha) and the ability to be grown out would benefit from 2nd week of March irrigations.
- Crops in very good soil with high water holding capacity have the ability to cope with moisture stress better than other soil types. Water from last irrigation on these soils may be better used on crops with poorer soil or sold if the market is suitable.
- All crops need to have their last irrigation past mid-February to achieve close to valley average yield potential. Farmers are encouraged when budgeting water to consider irrigation frequency in hot years but also having enough water to get to the end of February without stretching irrigations.

Acknowledgements

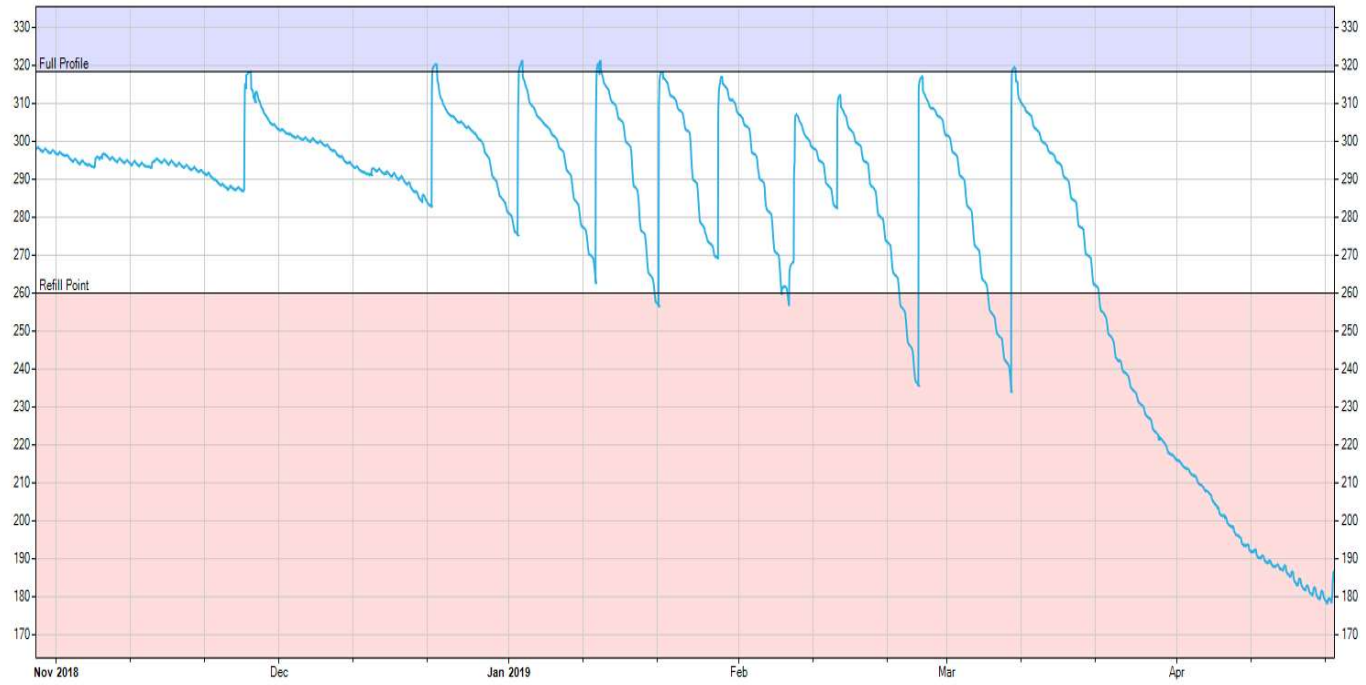
Many people have helped and contributed to this irrigation trial. I wish to thank the farms;
John Durham – Southern Cotton – Tubbo Station
Peter Tuohey – Daisy Lodge – Kulki Farm
Darren Eather – Bellevue Pastoral Company – Quindalup Farm
Bill Back – Auscott PL – Cobram Farm

Thanks to the consultants and industry personnel that helped organise and collect data;
Heath McWhirter – Summit Ag
Ella Steinfort – Auscott PL
Allan Jones – Agronomic Business Solutions
Kieran O'Keefe – CottonInfo
Patrick McDonnell – ProClass
Hayden Petty – NSW DPI

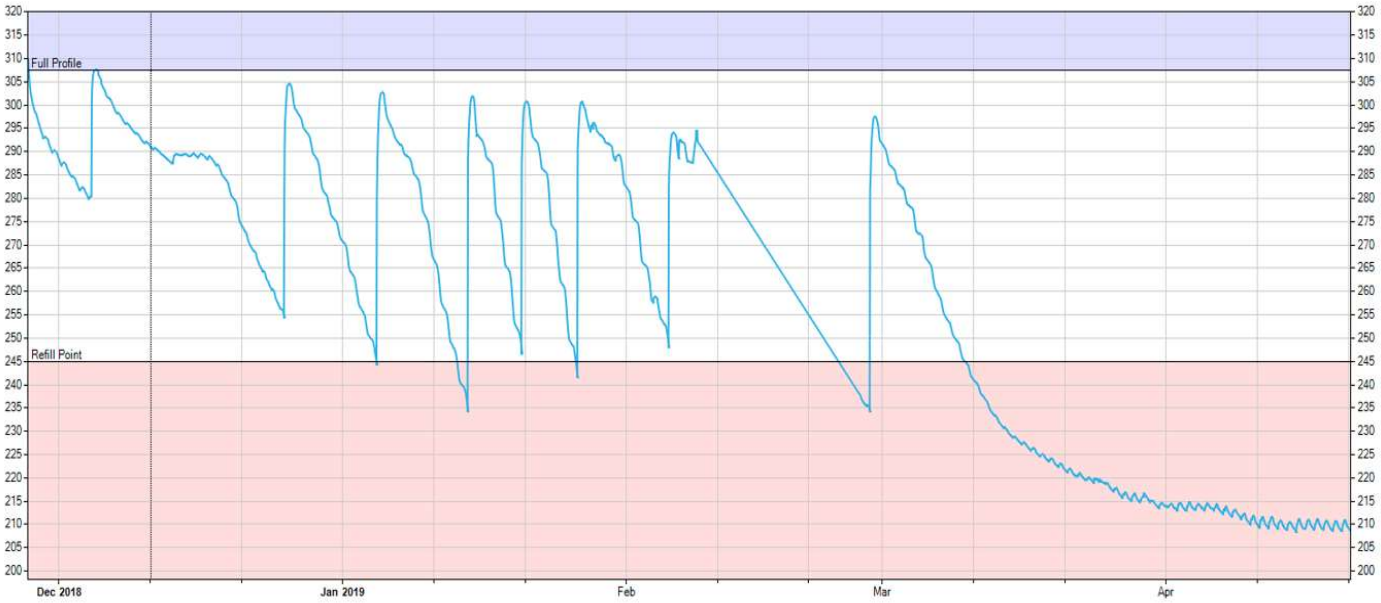
Any comments or question please contact me;
Steve Buster
Mob 0427 248 413,
Email steve.buster@rivcott.com or steve.buster@summitag.com
RivCott Ltd. Summit Ag,

Appendix 6.1

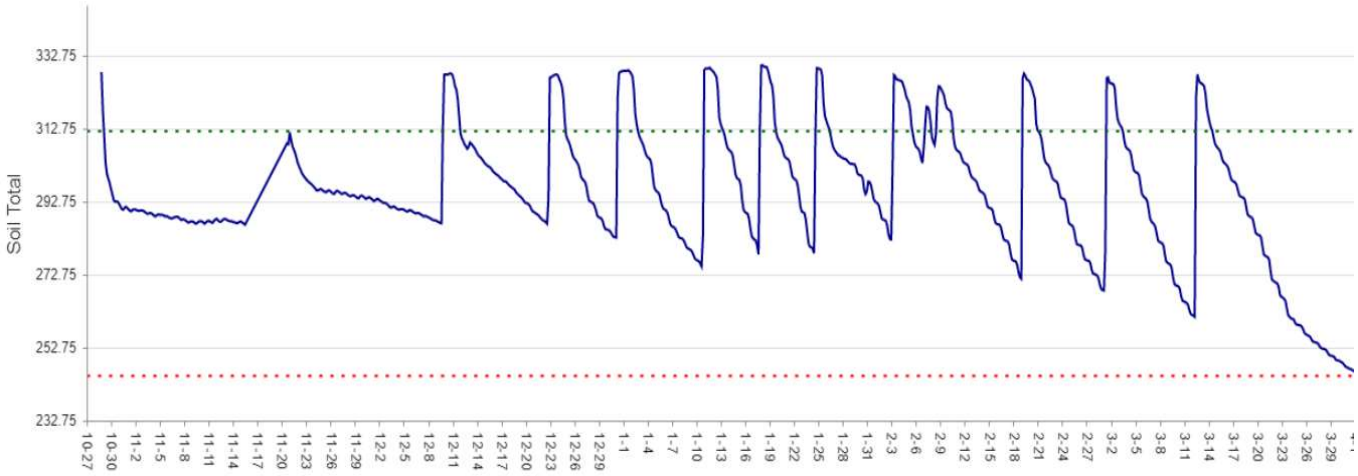
Probe Graphs - Field 1.



Probe Graph – Field 2.



Probe Graph – Field 3.



Probe Graph – Field 4.