Early-season Mepiquat chloride trial during the 2023-24 cotton season in Griffith, NSW

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Cotton is a perennial plant that has a tendency for vegetative growth to dominate over the reproductive growth phase. Mepiquat chloride (MC) is a plant growth regulator (PGR) used to manage excessive vegetative growth of cotton, as it can assist with improving the ratio of reproductive to vegetative growth at and/or during early flowering, especially in very favourable growing conditions. Industry discussions frequently flag the need for more research into PGRs.

Expanding cotton regions into new areas has resulted in questions around tailoring MC management in non-traditional cotton regions. Southern cotton regions have a shorter growing season than many other Australian cotton regions, and consequently, require intensive management to balance maturing the crop quickly and achieving high yields. Discussions with consultants and growers in the Southern cotton region raised the research questions (1) how "hard" and how early can MC be applied in irrigated crops in Southern growing regions? And (2) what are the implications if we get it wrong? This experiment explored alternative early-season MC management strategies during the 2023-24 cotton season in Griffith, NSW.

Field details and experimental design

Location: Brogden Rd, Griffith NSW (34^{O}17'0.2"S, 145^{O}49'26.3"E)

Cotton Variety: Sicot 746B3F

Imbibe Date: 4/10/23, field was established on rain. This date is used as the starting reference point "days after planting (DAP)" throughout this report.

Planting Density/Establishment: 170000 seeds/ha, 12.7 plants/m

Row Configuration: Solid (1m), furrow irrigated

Starting soil N (0-60): 92.52 kg/ha

Pre-plant N: 92 kg/ha

Nitrogen Regime

1. Soil Test N = 92.52 kg/ha

2. Pre-plant N = 92 kg/ha

3. Topdress 1 = 69 kg/ha

4. Topdress 2 = 41.4 kg/ha

Total N available = 294.9 kg/ha

The experiment was designed as a randomised complete block with three treatments as outlined in Table 1, and four replications. Plots were 15m x 3m. Spray applications were applied using Brolga hand-spray equipment.

Table 1: Details of Mepiquat chloride treatments, rate and timing of application.

	Treatment 1 (Nil)	**Treatment 2 (High-rate split MC)**	**Treatment 3 (Low-rate split MC)**
Application 1 (7/12/2023; 64 DAP)	Nil	60 ml/ha RX-380®	25 ml/ha RX-380®
Application 2 (28/12/2023; 85 DAP)	Nil	100 ml/ha RX-380®	60 ml/ha RX-380®
Treatment 3 (28/1/2024; 116 DAP)	Nil	100 ml/ha RX-380®	100 ml/ha RX-380®

Growth and development responses to mepiquat chloride (MC) applications

Plant growth responses were measured weekly on ten plants in each plot from squaring to four weeks after flowering. Height and node responses to each treatment are shown in Figure 1. Across all treatments, plants were reported to have reached squaring on the 8/12/23 and flowering on the 26/12/23. At 140 DAP, 1m of plants in each plot were harvested for biomass sampling. By 140 DAP, plants in Treatment 1 were 16 – 21 cm taller than plants in Treatment 2 and Treatment 3 (P= 0.001, Table 2), however, there were no significant differences in the number of nodes (P= 0.769, Table 2). There were no significant differences in leaf area, biomass or retention (P> 0.05, Table 2) between treatments. Photos of plants in each treatment at 140 DAP are shown in Figure 2.

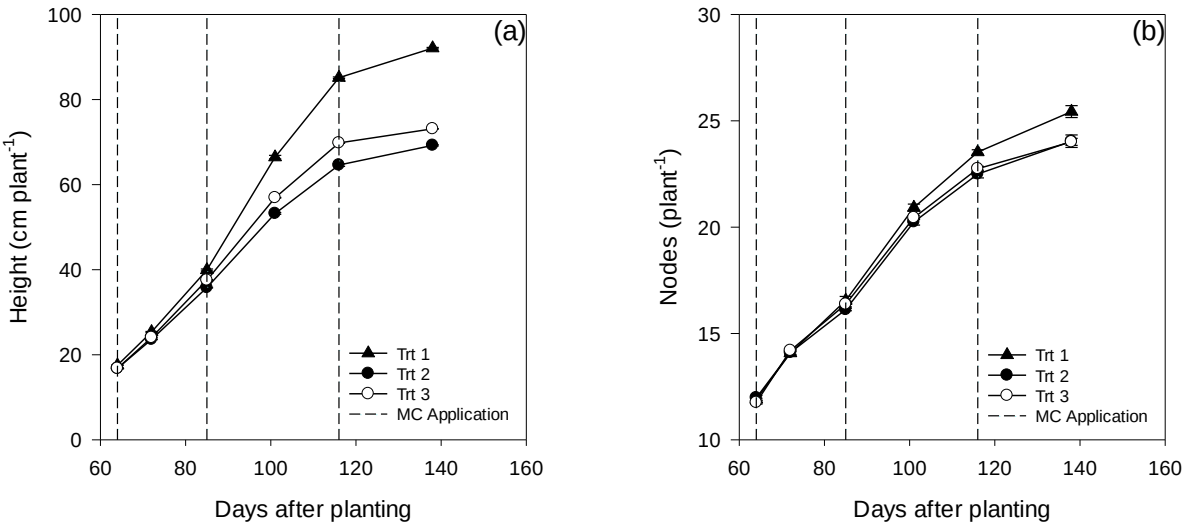

Figure 1: (a) Plant height and (b) the number of nodes for cotton applied with mepiquat chloride (MC). Values represent the mean ± standard error of the mean. Dashed vertical lines represent MC applications.

Table 2: Plant growth and retention of cotton applied with mepiquat chloride (MC), measured 140 DAP (21/2/24). Values represent the treatment mean. Different letters represent significant differences at P< 0.05.

	P-value	**Trt 1**	**Trt 2**	**Trt 3**
Height (cm plant^{-1})	0.001	91^{b}	70^{a}	75^{a}
Nodes (plant^{-1})	0.769	26	25	26
Leaf Area (cm^2/m)	0.614	12796	11311	12768
Vegetative biomass (g/m)	0.176	603	466	490
Fruit biomass (g/m)	0.693	518	552	551
Total biomass (g/m)	0.766	1122	1017	1041
Green bolls /m	0.523	234	217	203
Boll size (g/boll)	0.071	2.4	3.1	3.1
Node of first fruiting branch	0.397	9	9	10
Total retention (%)	0.747	63	62	64
Position 1 retention (%)	0.118	68	68	75

Figure 2: Plant growth of cotton applied with differing MC treatments measured 21/2/24 (140 DAP). (L-R) Treatment 1, Treatment 3 (low split rate) and Treatment 2 (high split rate).

The number of nodes above white flower (NAWF) were measured weekly on 10 plants in each plot from 101 DAP (13/1/24). The estimated date of cut-out (where NAWF= 4) was calculated for each treatment. Treatment 2 reached cut-out at 123 DAP (4/2/24), Treatment 3 reached cut-out at 126 DAP (7/2/24) and Treatment 1 reached cut-out at 134 DAP (15/2/24).

Yield and Quality

Estimated yield was based on handpicks of 1m in each plot (Figure 3). Cotton was ginned and fibre quality was tested using HVI. Results are shown in Table 3. There was no significant difference in estimated yield (P= 0.140), although yield ranged from 11.4 bales/ha in Treatment 1 to 13.2 bales/ha in Treatment 3. Therefore, relative yield (the yield difference between the control and the mepiquat chloride treatment) was up to 1.8 bales/ha more with applied mepiquat chloride compared with the control. There were also more gains in relative yield with a low-rate split application (Treatment 3) compared with a high-rate split application of mepiquat chloride (Treatment 2).

There were no significant differences in fibre quality parameters (P> 0.05). Strength ranged 32.2 g/tex in Treatment 2 to 33.5 g/tex in Treatment 1 (P= 0.543), length averaged 1.2 inches across all treatments (P= 0.901) and micronaire ranged 4.0 in Treatment 3 to 4.4 in Treatment 1 (P= 0.278).

Figure 3: Handpicks were sampled from 1m in each plot.

Table 3: Estimated yield and fibre quality.

Parameter	P-value	Trt 1	Trt 2	Trt 3
Estimated yield (b/ha)	0.140	11.4	12.6	13.2
Relative yield (b/ha, relative to unsprayed cotton)	N/A	N/A	1.2	1.8
Strength (g/tex)	0.543	33.5	32.2	32.7
Length (inches)	0.901	1.2	1.2	1.2
Micronaire	0.278	4.4	4.3	4.0

Summary

A grower/consultant led trial was conducted at Griffith during the 2023-24 cotton season to understand the implications of various early season mepiquat chloride (MC) applications in irrigated cotton in Southern growing regions. Results showed that early season mepiquat chloride application predominantly reduced plant height and resulted in a more compact plant, however, there were no significant differences in biomass at 140 DAP. Plants applied with mepiquat chloride reached cut out 8 – 11 days earlier than plants not sprayed with mepiquat, thereby facilitating crop maturation. Although not statistically significant, relative yield of cotton sprayed with mepiquat chloride was up to 1.8 bales/ha more than the unsprayed control (Treatment 1). However, there were more gains in relative yield with a low-rate split application (Treatment 3) compared with a high-rate split application of mepiquat chloride (Treatment 2). There were no differences in fibre quality parameters, with all falling within the optimal commercial range. Data from this experiment suggest that a good understanding of the implications of applying mepiquat chloride is essential for systems level management of cotton in shorter season cotton growing regions.

Acknowledgements

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Further information

Australian Cotton Production Manual, 2024 and read more in Chapter 15. Australian Cotton Production Manual 2024 | CRDC

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