Impact of crop management on cotton crop maturity and yield

G. N. Roberts and G. A. Constable

Australian Cotton Cooperative Research Centre and CSIRO Plant Industry Locked Bag 59, Narrabri, NSW 2390 Grant.Roberts@csiro.au

Abstract

Poor crop management strategies may delay crop maturity which increases chemical costs and risks exposure to greater degrees of climatic risk, which may affect yield and fibre quality. Factors affecting maturity include sowing date, insect control, crop nutrition, and the timing of last irrigation. Strategies to reduce the time from cotton planting to crop maturity were examined in a detailed factorial experiment. Specific impacts of combinations of rates of nitrogen fertiliser, timing of last irrigation, varying amounts of crop growth regulants, and varieties differing in their maturity were examined. Crop maturity could be brought forward by utilising a combination of short season variety, optimum nitrogen fertiliser and applying one less irrigation at the end of the season. The application of growth regulants had an erratic effect on crop maturity. In the 2000-01 season this equated to 15 days earliness compared to a standard long season management strategy. Some combinations of treatments suffered significant yield penalties.

Key Words

Cotton, maturity, earliness, nitrogen, water, mepiquat chloride

Introduction

Cotton is an indeterminate crop and managing for crop maturity (earliness) is complex. Variety, soil and fertilizer nitrogen, irrigation management, insect control and growth regulators can interact to different degrees to effect final crop maturity. Earliness is a farming systems issue and previously has been examined in this context (5, 6), but these studies were unable to determine whether earliness was driven largely by agronomic factors (variety, nitrogen, water, growth regulators) or by high fruit retention through better insect management. Studies that separate these components to determine those factors that have the greatest impact on crop maturity are ongoing. This paper briefly reports on the results of one these experiments that has examined the impact of agronomic management: variety, nitrogen, growth regulant and last irrigation timing on crop maturity and yield.

Methods

An irrigated field experiment was established at the Australian Cotton Research Institute, Narrabri, NSW in 2000/01. The trial design consisted of four treatments in a randomised factorial split plot design (Table 1.). Main plots were timing of last irrigation and sub plots variety, nitrogen, and mepiquat chloride (a plant growth regulator).

Table 1. Treatments used in 2000/01 crop maturity experiment.

Main Plot	Sub plots		
Last Irrigation Timing	Variety Maturity	Nitrogen	Mepiquat chloride
Reduced – last irrigation not applied	Early	Optimum	Optimum

Optimum	Full	High – 80 kg/ha more than optimum	High – 300 ml/ha applied 1st flower + as required.

Low insect control thresholds were used to minimise fruit loss. The varieties were Siokra 101*i* (early) and Siokra V-16*i* (full). Other treatments were based on optimum management with the alternate options adjusted to shorten the period from planting to maturity in an attempt to generate earliness. Optimum last irrigation timing was assessed according to the guidelines developed by Hearn and Constable (4), optimum nitrogen based on Constable *et al* (3) and mepiquat chloride applications were based on a vegetative growth rate index (1). Cotton was grown on 1m rows with plot size 12m ? 8 rows wide. Plots were machine picked with a spindle picker and ginned to obtain lint yield. The method of determining maturity was that used by Constable *et al* (2) and refers to the time from planting until 60% harvestable bolls. Analysis of variance was conducted to determine interactions between treatments.

Results

There were significant ($P < 0.05$) main effects of variety and nitrogen on yield. The early variety reduced lint yield by 170 kg/ha when grown under full season conditions. Nitrogen had an even greater effect on yield resulting in 331 kg/ha more lint from the additional 80 kg/ha of N applied, suggesting the optimum treatments required more N. There was a significant ($P < 0.05$) last irrigation timing ? variety ? nitrogen ? mepiquat chloride interaction on days after planting to 60% harvestable bolls (Table 2.). The earliest treatment had optimum irrigation, a short season variety, optimum nitrogen and high mepiquat chloride, but was also the lowest yielding. In general as maturity was brought forward, yield decreased significantly (yield = 34?maturity – 3518, $P<0.01$) but there was one treatment that did not follow this pattern and provided both early crop maturity and relatively high yield (optiumum irrigation, early variety, high N and high mepiquat chloride).

Table 2. Effects of agronomic management on cotton yield and maturity in 2000/01.

Irrigation	Variety	Nitrogen	Mepiquat Chloride	Lint (kg/ha)	Days to 60% open
Optimum	Early	Optimum	Optimum	2008	164
Optimum	Early	Optimum	High	1886	160
Optimum	Early	High	Optimum	2238	166
Optimum	Early	High	High	2435	164
Optimum	Full	Optimum	Optimum	2201	167
Optimum	Full	Optimum	High	2154	172
Optimum	Full	High	Optimum	2574	175

Optimum	Full	High	High	2347	173
Reduced	Early	Optimum	Optimum	2024	164
Reduced	Early	Optimum	High	2020	168
Reduced	Early	High	Optimum	2319	171
Reduced	Early	High	High	2229	168
Reduced	Full	Optimum	Optimum	2052	169
Reduced	Full	Optimum	High	2004	167
Reduced	Full	High	Optimum	2447	171
Reduced	Full	High	High	2319	172
			s.e.d. main effects =	47	0.7
			s.e.d. interaction =	ns	2.2

Conclusion

Crop maturity could be brought forward (up to 15 days) by changing agronomic management, however, there can be severe yield penalties in achieving this earliness. Selecting the appropriate variety for season length then adjusting nitrogen and timing of last irrigation should be the order of focus for farm managers. Selecting and adjusting nitrogen rates can be difficult given that season length varies with temperature. Mepiquat chloride does not appear to be a major factor in adjusting maturity itself and can have varying effects on both maturity and yield. Similar studies examining the influence of insect management on fruit retention were also conducted (data not presented). Insect management needs to be considered when discussing the concept of cotton crop maturity because the number and position of crop fruit also influence maturity.

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