Balanced fertilisation for optimising yield and quality of cotton in the Ord

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Introduction

Balanced fertilisation of major plant nutrients, nitrogen, phosphorus and potassium is a prerequisite for optimum growth and development of any crop including cotton. Interaction between nitrogen and phosphorus has been reported widely. For example, increasing level of N might influence the efficiency and uptake of P, and vice-versa. Similarly, optimum potassium nutrition for boll retention and boll loading is critical for cotton. Although Hearn (1975) and S. Yeates (1997; personal communication) conducted field experiments for optimising N levels, there has been no work involving all the three major nutrients for cotton production in the Ord. Our work reports results from a preliminary study conducted in 1999 on yield and quality of cotton in response to N, P and K fertilisation.

Materials and Methods

Experimental design and treatments: A split-split plot design was used with factorial combination and four replications of the following treatments: (1) Nitrogen @ 100 and 200 kg N /ha as Urea, as the main plot (2) Potassium @ 0 and 100 kg K/ha as Muriate of Potash, as the sub-plot, and (3) Phosphorus @ 0, 50, 100 and 200 kg P/ha as DAP and Double Super, as the sub sub-plot. A set of 3 wide beds (each 1.8 m wide between adjacent furrows was used for each plot. The length of plot was 50 m.

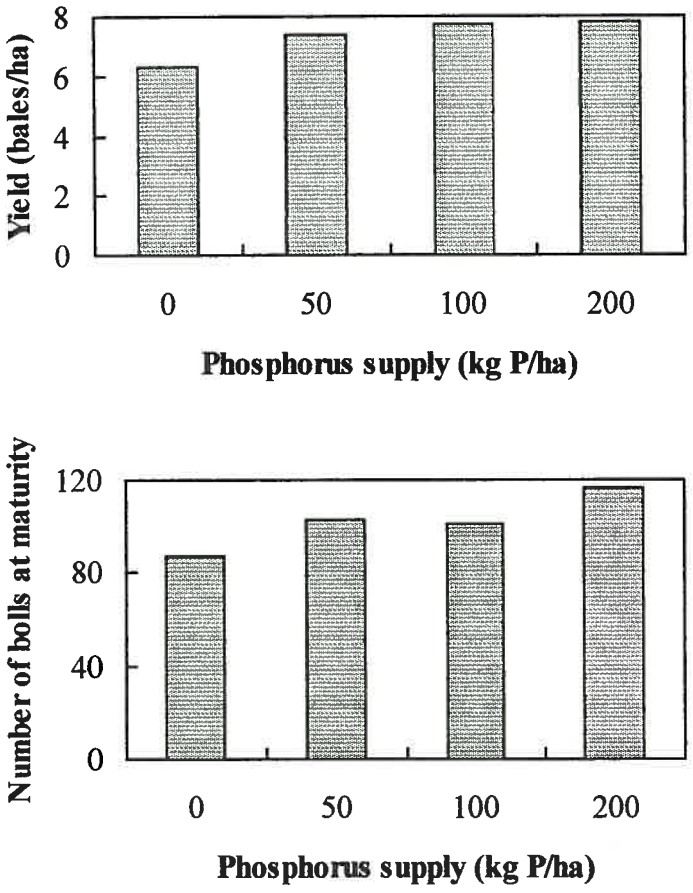
Variety and growing conditions: Siokra L-23i was used with a planting density of around 12.5 plants per linear metre. Row spacing on the wide bed system was 90 cm. Fertiliser treatments were imposed two weeks before planting. Fifty percent of P rates were applied as Double Super and placed at 15 cm below and 10 cm inside the plant lines. Remaining 50% P as DAP was mixed with appropriate levels of N and K treatments in addition to ZnSO4 @ 20 kg/ha and Sulphur @ 10 kg/ha. This mixture was placed at 30 cm below the plant line.

Measurements: Leaf and petiole samples were collected during early flowering for determination of N concentrations in the plant tissues. At maturity 20 m by two inside rows were machined picked and weighed for seed cotton yield per plot. Sub-samples of lint were used for HVI quality testing at Narrabri.

Results and Discussion

Yield: Increased P supply from 0 to 50, 100, and 200 kg P/ha resulted in 17.5%, 22.5% and 24.0% increases in yield, from 6.3 ba/ha to 7.4, 7.7 and 7.8 bales/ha respectively ($P<0.001$). Yield benefit with increased P supply was also supported by its influence on the increased boll number at maturity although boll size was smaller for 200 kgP/ha treatments (Figure 1). There was no response to N or K, nor there was any interaction between the treatments for yield.

Figure 1. Effect of applied P fertilizer on yield and boll number.



No significant response to N in this study might be due to a greater amount of residual N in the soil from the previous crop. No response to K was expected as K content of the soil was quite substantial in the region. Significant yield responses to P supply indicate that sub-surface soil P concentration was not enough for the optimum growth and development of the cotton as surface P concentrations in these soils are quite high (around 20 to 35 Colwell P value). Therefore, appropriate amount of P application in the effective rooting zone would be necessary to achieve optimum yield levels in the Ord.

N concentration in plant tissue: Plant tissue analysis indicated that leaf N concentration was more influenced by increasing the P supply ($P<0.001$) than the N rates ($P<0.05$). There was a 10% increase in the leaf N content when P supply increased from 0 to 200 kg P/ha (Table 1). On the other hand, increasing N levels from 100 to 200 kg/ha increased the leaf N concentration by 3%. Petiole NO_3 was also influenced by P supply ($P<0.05$), whereas there was no effect of N levels on the Petiole NO_3 concentration. Potassium had no effect on the N concentrations in either of the plant tissues analysed.

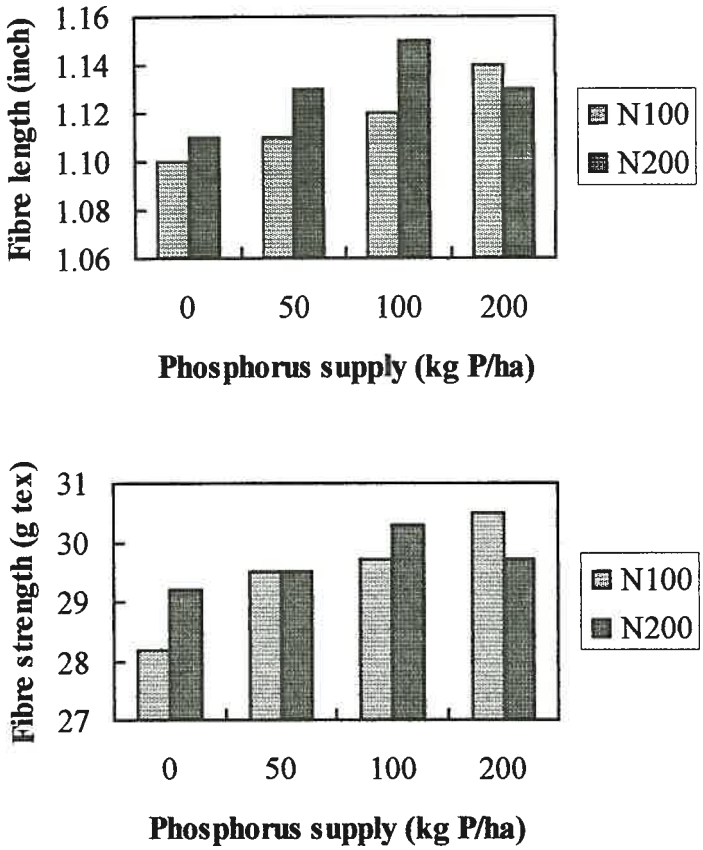
Table 1. Main treatment effects for phosphorus and nitrogen on leaf N and petiole NO_3 concentrations on dry weight basis.

Treatment	Rates (kg/ha)	Leaf N %	Petiole NO_3 g/kg
Phosphorus	0	4.05	17.1
	50	4.25	18.0
	100	4.27	18.8
	200	4.41	19.6
	Significance	***	*
Nitrogen	100	4.17	18.1
	200	4.31	18.6
	Significance	*	ns

ns, not significant; *, $P<0.05$; ***, $P<0.001$.

Fibre quality: Fibre quality, particularly length and strength were also increased with increasing P supply (Figure 2; $P<0.001$). However, response to P supply was influenced by interactions with N levels for fibre length ($P<0.001$) and strength ($P<0.05$). Large increases in the fibre length and strength occurred with 200 kg N and 100 kg P/ha in this study. There was no effect of any main treatment or interaction between the treatments on micronaire.

Figure 2. Interaction of N and P on fibre length and strength.



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