EFFECT OF TILLAGE PRACTICE & ROTATION ON NITROGEN FERTILISER STRATEGY

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One of the aims of this project is to assess the N fertiliser requirements of cotton under more enlightened tillage systems currently being adopted. The application method for nitrogen fertiliser may change as the tillage system changes. For example, true minimum tillage is inconsistant with an anhydrous ammonia application shank working down the centre of each hill at 20 to 30 cm depth, particularly in wet soil. The alternatives are often less convenient than the traditional method and to date there has been little research in comparing methods of application. Results for the first two seasons of this experiment are summarised in this article.

Tillage / crop rotation treatments

a) **Cotton-wheat rotation.** Approximately one third of cotton is grown in this system. Benefits of the rotation include reduced disease incidence, reduced fertiliser requirements, more time available for soil preparation and better soil structure.

b) **Continuous cotton, minimum tillage.** This treatment is true minimum tillage: after cotton slashing, the only workings are to clean out the furrows or incorporate fertiliser or herbicide.

c) **Continuous cotton, 'maximum' tillage.** This treatment involves major soil disturbance between cotton crops: slashing, discing, deep ripping (if dry), chiselling and listing.

N fertiliser strategies

Combinations of N form, timing and placement being tested are:

a)	Anhydrous ammonia	Pre sow	Hill - band
b)	Anhydrous ammonia	Pre sow	Furrow - band
c)	Anhydrous ammonia	Post sow	Furrow - band
d)	Urea	Pre sow	Hill - incorporate
e)	Urea	Pre/post sow	Furrow - water run

Yield and nitrogen response

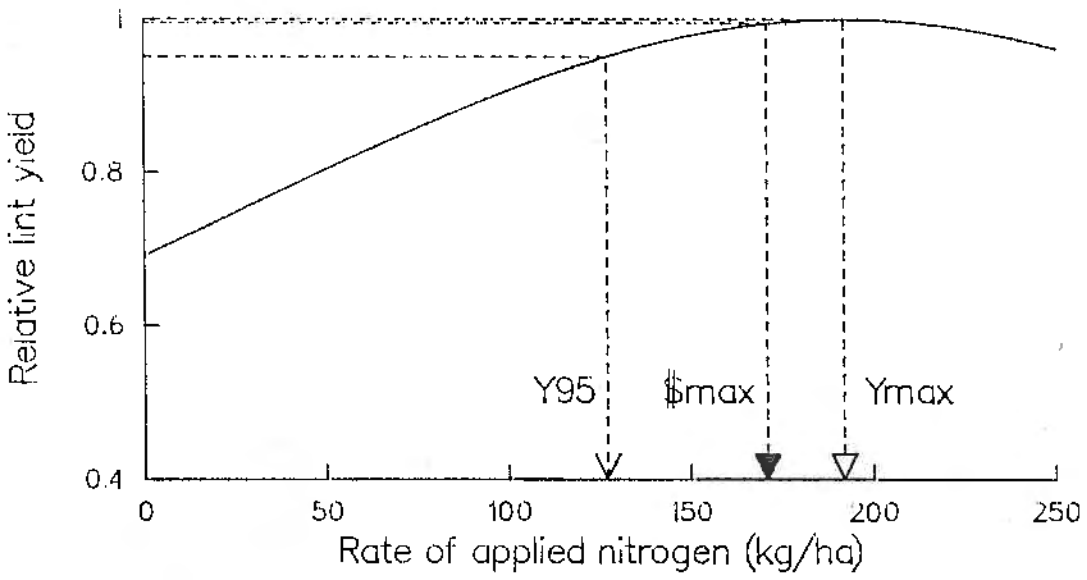
Table 1 presents some measurements from this experiment. Maximum yield has been obtained from cotton grown in rotation with wheat: continuous cotton has yielded 9% less on average. The minimum tillage treatment has been superior to maximum tillage, especially in 1987/88 when soil preparation occurred on wetter soil.

Table 1. The effect of tillage practice and nitrogen fertiliser on performance of Deltapine 90 over two seasons.

	Best N treatment		Nil N treatment		
Season and treatment	Lint yield	N rate	Rel. yld	Sept soil NO_3	750 D^o Petiole NO_3
	kg/ha	kg/ha	%	ppm	ppm
1986-87					
Minimum till	1501	183	70	10.7	14,300
Maximum till	1466	190	73	8.2	13,000
Rotation	1598	110	88	15.8	19,200
1987-88					
Minimum till	1537	172	54	4.3	14,400
Maximum till	1388	216	71	2.5	15,700
Rotation	1622	165	56	2.9	10,900

In keeping with previous results, cotton grown in rotation with wheat required less fertiliser, although the actual amounts varied with season (soil N status - see below). On average the shape of the N response was such that it took 45 kg N/ha to achieve the last 5% of economic yield (Figure 1). This extra yield, though economically significant, was achieved at the expense of 3 to 8 days delay in maturity.

Figure 1. The average shape of an N response curve for DP90 cotton. The three arrows denote the N rate for 95% of maximum yield (Y95), maximum profit ($max) and maximum yield (Ymax) respectively.



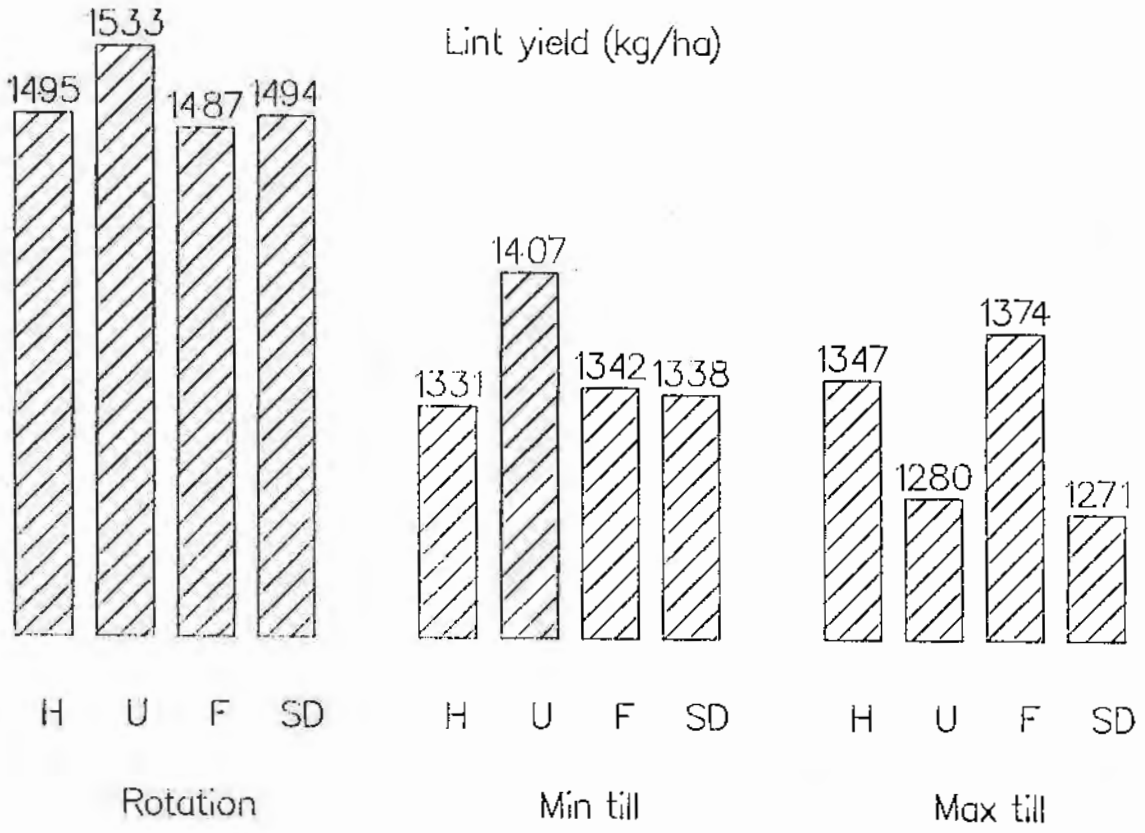
Soil and plant tests

Table 1 also shows the results of (i) soil nitrate tests taken in September to a depth of 30 cm and (ii) petiole nitrate values at 750 day degrees from sowing. In all cases greater N responses were obtained where soil and plant nitrate status were the least.

Nitrogen application method

The values in Table 1 are for treatments with anhydrous ammonia applied in the hill before sowing. In general there has been little difference in N response when applied as different forms or methods. There has been a tendency for poorer response to N when applied in the furrow as a sidedressing particularly with continuous cotton (Figure 2).

Figure 2. The effects of different application methods on cotton. Average of two seasons for each tillage treatment. Symbols: H - anhydrous ammonia in hill before sowing, U - urea in hill before sowing, F - anhydrous ammonia in furrow before sowing, SD - anhydrous ammonia in furrow after sowing.



Cultivar

Even though yield levels of each cultivar vary, it has been found that the optimum N rate was identical for both DP90 and Siokra. There were indications that Sicala required 13% less N fertiliser than other cultivars.

Conclusions

* In these instances of continuous cotton where compaction was not severe and harvest occurred on dry soil, there has been a small but clear advantage (yield, costs) of reduced soil disturbance on permanent beds.

* N fertiliser strategies did not differ markedly for each of the tillage systems

* Soil and plant N tests have been a reliable guide of N status.

* DP90 and Siokra had similar N fertiliser requirements.