MANAGEMENT OF COTTON WITH NITROGEN AND PIX.

Greg Constable, **NSW Agriculture & Fisheries,**
Agricultural Research Station, Narrabri

In dealing with nitrogen and Pix, points to put the issues in context are that nitrogen is the most important because it can can increase yield by much more than a growth regulator such as Pix can. However the two inputs interact because with nitrogen deficiency, Pix may decrease yield. My research aims to combine agronomic inputs so that we can manage cotton to improve efficiency or productivity in a sustainable way. The environmental ledger associated with nitrogen fertilizer use is a maintenance of soil fertility but potentially greater nitrate in the ground water and more nitrous oxide emission to air.

Nitrogen

Nitrogen increases yield by producing more mainstem nodes; more and bigger leaves; and more and bigger bolls. In producing more nodes, there can be a delay in maturity by having more late bolls; other problems can be: lower micronaire; more trash; greater attraction of insect pests; less effective pest control; and disease such as boll rots. Modern varieties do not show excessive vegetative growth and delayed maturity to the same extent as with other varieties 15 years ago. There are now many instances where **more than 200** kg N/ha should be used, particularly with high yields and continuous cropping. There are also many instances where **less than 100** kg N/ha can be used, such as on new country and with short seasons.

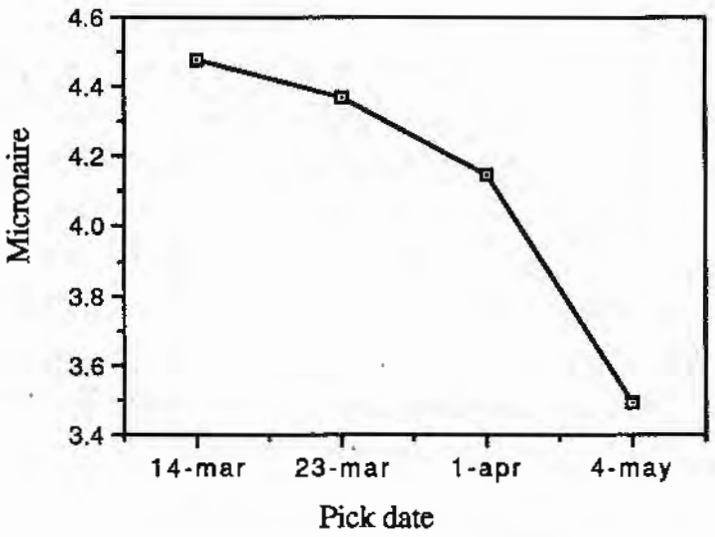
Under continuous cotton, nitrogen increases yield by up to 30%; but by less following a fallow (Table 1). Nitrogen will delay maturity by up to ten days for those yield increases. Furthermore, crop rotation or tillage practice can affect maturity by up to a week.

Late bolls have lower micronaire (Figure 1). Excessive nitrogen rates can sometimes delay maturity enough to cause quality penalties because a greater proportion of bolls are in the lower micronaire categories.

Table 1. The effect of nitrogen fertilizer and tillage/rotation on boll numbers, boll size and maturity of DP90; average of three seasons. Values of maturity are the date when 60% of lint was pickable (eg day 80 is March 21). Fallow is cotton grown after wheat; min and max-till are continuous cotton.

Measurement	Nitrogen (kg/ha)	Fallow	Min-till	Max-till
Bolls/m	0	89	73	75
	225	108	107	99
Boll size (g lint)	0	1.66	1.62	1.56
	225	1.78	1.79	1.80
Maturity date	0	83	77	77
	225	92	86	87

Figure 1. The decline in micronaire with boll opening date



The optimum nitrogen rate desirable to balance the benefits and disadvantages outlined above can be decided by:

1. Experience, common practice, rules-of-thumb. Most growers apply less nitrogen to fallow soils, and adjust fertilizer rates according to water availability, soil condition etc.

2. Soil nitrate tests. These tests are of greater value than current belief, if samples are taken correctly . Values of soil nitrate greater than 23 ppm, taken in September to a depth of 30 cm, indicate high nitrogen status where little fertilizer would be required.

3. Petiole nitrate tests. Again these tests can be helpful in diagnosing high and low nitrogen status crops. Sometimes low petiole nitrate values are obtained from a crop with adequate nitrogen; the technique therefore may recommend over-fertilization. We cannot yet identify all the factors creating these complications, but petiole nitrate values greater than 20000 ppm at flowering indicate no side dressing is necessary.

Pix

The effects of Pix are to reduce vegetative growth, possibly enhance early fruit set and possibly increase yield. In some areas in the USA, split applications of Pix at squaring, at flowering and ten days after flowering are more popular than the conventional single application at flowering. Label recommendations in the USA and Australia have been changed to accommodate the new strategy. **Our own data has so far not shown any benefit in splitting Pix applications compared with a single application at flowering.** In California, the split applications work best on narrow (75 cm) rows; on 1 metre rows a single application is best.

In 1988 Bill Weir, a Farm Advisor with the University of California, spent six months in Australia to assist us in establishing a Pix research program. Table 2 shows a summary of those experiments.

Table 2. Effect of Pix applied around flowering on boll setting, plant height and yield in 1988/89. Average of five sites with different cultivars.

Pix treatment	Total bolls on lower 8 nodes (%)	Plant height (cm)	Seed cotton yield (kg/ha)
600 ml/ha	26	81	4414
Control	19	87	4189

Pix reduced final plant height and resulted in more bolls set on the first 8 mainstem nodes. The yield from multiple applications of Pix was not significantly different from Pix applied in a single dose, despite showing a greater set of lower bolls. Yield differences did not always fully agree with plant mapping, or fruit count data because Pix slightly reduced boll size.

In 1989/90, the experiment aimed to examine split applications in greater detail on all cultivars. Yield data is summarised in Table 3: there were only very small yield responses to Pix, and then only with DP90, and only with a single application.

Table 3. Lint yield (kg/ha) of three cultivars in 1990 in response to various Pix application strategies.

Treatment	Application dates	Siokra 1-4	Sicala 33	DP90
3*200 ml Pix/ha	Dec 6, 21, Jan 2	1951	1726	1691
2*300 ml Pix/ha	Dec 6 and 21	2007	1706	1679
1*600 ml Pix/ha	Dec 21	1909	1709	**1720**
1*1200 ml Pix/ha	Dec 21	1999	1733	1687
1*1200 ml Pix/ha	Jan 31	1867	1730	1644
Nil		**2014**	**1735**	1636

Dec 6: height 35 cm; 8 leaves. Dec 21: height 60 cm; 12 leaves.
Jan 2: height 75 cm; 14 - 15 leaves. Jan 31: height 91 - 105 cm; 22 leaves.

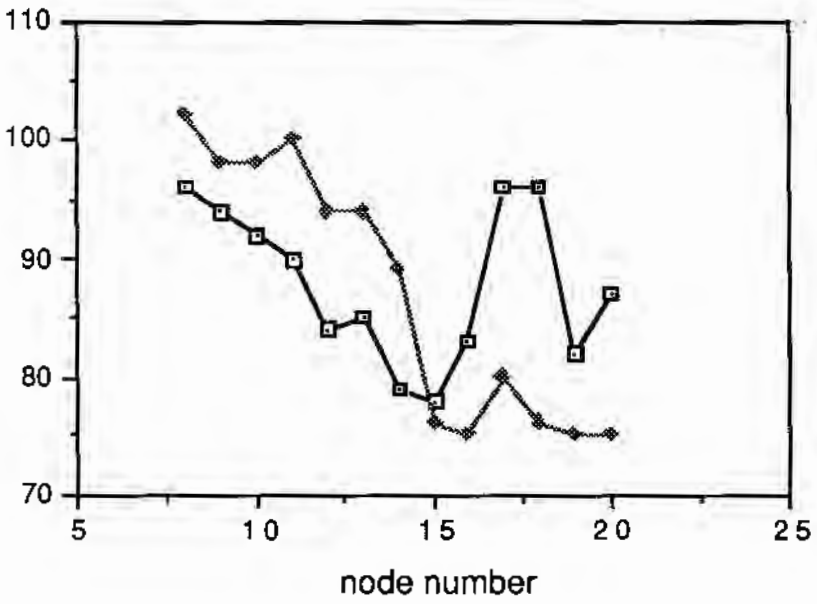
Pix did not enhance maturity date by more than two days, however there were more bolls set on the lower parts of plants which were treated with Pix (Table 4). In common with our data from previous years, Pix reduced boll size.

Table 4. Maturity and boll size in response to Pix

Date	% pickable by date		Boll size (g lint) by date	
	Pix	Nil	Pix	Nil
Feb 27	**25**	15	1.97	2.12
Mar 6	55	43	1.61	1.65
Mar 14	85	80	1.45	1.53
Mar 27	100	100	1.21	1.26

DP90 had the greatest plant height response to Pix, with a reduction of 16 cm; achieved by a reduction in number of mainstem nodes (by one), and up to a 25% reduction in the length of internodes, particularly on upper nodes (Figure 2). When Pix was applied as split applications, starting at squaring, lower internodes were reduced in length more than when Pix was applied once at flowering (Figure 2). For all Pix application strategies, the nodes ultimately reduced in length were <u>not visible</u> at the time of application; this result emphasises the importance of application timing with Pix. It is too late to apply Pix when plants are already tall.

Figure 2. The relative length of mainstem internodes of DP90 as affected by Pix application strategy. Values are expressed as a percentage of internode length on untreated plants; solid line is for split Pix applications starting at squaring; grey line is for a single Pix application at flowering.



My experiments have not been able to duplicate overseas data on the advantages of multiple Pix applications, even on narrow rows. A pilot experiment in 1990 on narrow rows showed an increase in number of bolls set with split applications of Pix on narrow rows, but these bolls were significantly reduced in size compared with bolls from wide rows or no Pix. This work will be repeated.

Conclusions from two seasons experiments with Pix

* The best timing is close to flowering and the most economical rate is 600 ml/ha. Split applications have not been superior to a singe application, although a split application strategy allows more flexibility in response to environmental conditions such as water availability, etc.

* Work will continue on the relative response of different cultivars and more sites with rank growth will be included in the experimental program.

* Pix is an important tool to enhance crop setting and control vegetative growth as occurs on river soils or with late sowing. Most average crops offer the potential to respond in some manner to Pix, with yield increases up to 5% possible. Crops under moisture stress or some other problem will not be helped by Pix.

LAST 50kg N/ha only gives only 5% yield
Nitrogen deficient crop - applying pix will reduce yield.

Soil Test

Sept → 23 ppm. — high N status.

P12C

At first flower 600ml/ha.

Late sowing -