



Hit it hard or hit it often?

Early season N application tactics for cotton in 2021/22

Summary

1. It still pays to put on N, but the profit margin from an N response will be significantly reduced.
2. Cost of overapplication at least double the cost in the previous years.
3. Soil N supply and plant responsiveness are critical factors in making profitable N decisions.
4. In a High response situation, an N budgeted rate could be to be reduced by about 25 % to reflect the high Np/Cp ratio in 2021/22. In a Moderate response scenario reduced by 35 %, and in the Low response scenario, a rate reduction of 50% was likely to reflect the most economic use of N.
5. Most in-crop N application tactics will fit into either of two categories. The right choice will depend on a range of local factors. The most important and biggest unknown is the impact of key weather conditions (light, heat, and water) for the remainder of the season.

What are the options?

Once we have assessed the crop status and can get a fix on the amount for N that is needed to replace that lost before flowering because of waterlogging, the questions

that follow are "should I hit it hard early and build the soil supply ahead of the plant N requirement" or "should I play the season and try to match supply with short term requirement"?

There is no universal correct answer to this question. Ultimately, the right choice will depend on a range of local factors, but the most important and biggest unknown being the weather conditions for the remainder of the season.

With the current N price and N product availability, possible limitations this season, N decisions may be a bit more complex. With the current N cost per kg/int price per kg being double last season i.e. relatively, it will take twice as much lint to pay for 1kg of N compared to last season (Figure 1).

Cotton price (\$/bale)	Urea Price (\$/t)												
	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600
200	0.99	1.23	1.48	1.73	1.97	2.22	2.47	2.71	2.96	3.21	3.45	3.70	3.95
250	0.79	0.99	1.18	1.38	1.58	1.78	1.97	2.17	2.37	2.57	2.76	2.96	3.16
300	0.66	0.82	0.99	1.15	1.32	1.48	1.64	1.81	1.97	2.14	2.30	2.47	2.63
350	0.56	0.70	0.85	0.99	1.13	1.27	1.41	1.55	1.69	1.83	1.97	2.11	2.26
400	0.49	0.62	0.74	0.86	0.99	1.11	1.23	1.36	1.48	1.60	1.73	1.85	1.97
450	0.44	0.55	0.66	0.77	0.88	0.99	1.10	1.21	1.32	1.43	1.54	1.64	1.75
500	0.39	0.49	0.59	0.69	0.79	0.89	0.99	1.09	1.18	1.28	1.38	1.48	1.58
550	0.36	0.45	0.54	0.63	0.72	0.81	0.90	0.99	1.08	1.17	1.26	1.35	1.44
600	0.33	0.41	0.49	0.58	0.66	0.74	0.82	0.90	0.99	1.07	1.15	1.23	1.32
650	0.30	0.38	0.46	0.53	0.61	0.68	0.76	0.84	0.91	0.99	1.06	1.14	1.21
700	0.28	0.35	0.42	0.49	0.56	0.63	0.70	0.78	0.85	0.92	0.99	1.06	1.13
750	0.26	0.33	0.39	0.46	0.53	0.59	0.66	0.72	0.79	0.86	0.92	0.99	1.05
800	0.25	0.31	0.37	0.43	0.49	0.56	0.62	0.68	0.74	0.80	0.86	0.93	0.99
850	0.23	0.29	0.35	0.41	0.46	0.52	0.58	0.64	0.70	0.75	0.81	0.87	0.93
900	0.22	0.27	0.33	0.38	0.44	0.49	0.55	0.60	0.66	0.71	0.77	0.82	0.88
950	0.21	0.26	0.31	0.36	0.42	0.47	0.52	0.57	0.62	0.68	0.73	0.78	0.83
1000	0.20	0.25	0.30	0.35	0.39	0.44	0.49	0.54	0.59	0.64	0.69	0.74	0.79

Figure 1 Quantity of cotton (kg lint) required to pay for 1 kg N for a range of urea and cotton price

What effect does a higher N price/lint price ratio (Np/Cp) have on fertiliser N budget application rates?

For at least the last 10 years, the Np/Cp ratio for most years has varied from about 0.5 to 0.9/1. In a recent exercise, I compared calculated N budgeted rates and the economic maximum rate of nitrogen (EMRN). The comparison included scenarios with Np/Cp of 0.55 (representative of 2021) and 1.06 (possible outcome for 2022).

High, Moderate and Low crop N response scenarios (Figure 1) were also included in the analysis to explore how a significantly higher Np/Cp ratio in 2021/22 impacts typical N rate recommendations. Soil N contribution from estimated mineralisation and mineral N was varied from 60-150 kg/ha across response scenarios. The site maximum yield was about 3000kg lint /ha (13 bales/ha) in all cases. Yield response to applied N was in the range (4 – 6 bales/ha). Responsiveness scenarios were

Low = 6 kg lint/kg N applied

Moderate = 9 kg lint/kg N applied

High = 12 kg lint/kg N applied

in the linear section of the N response function.

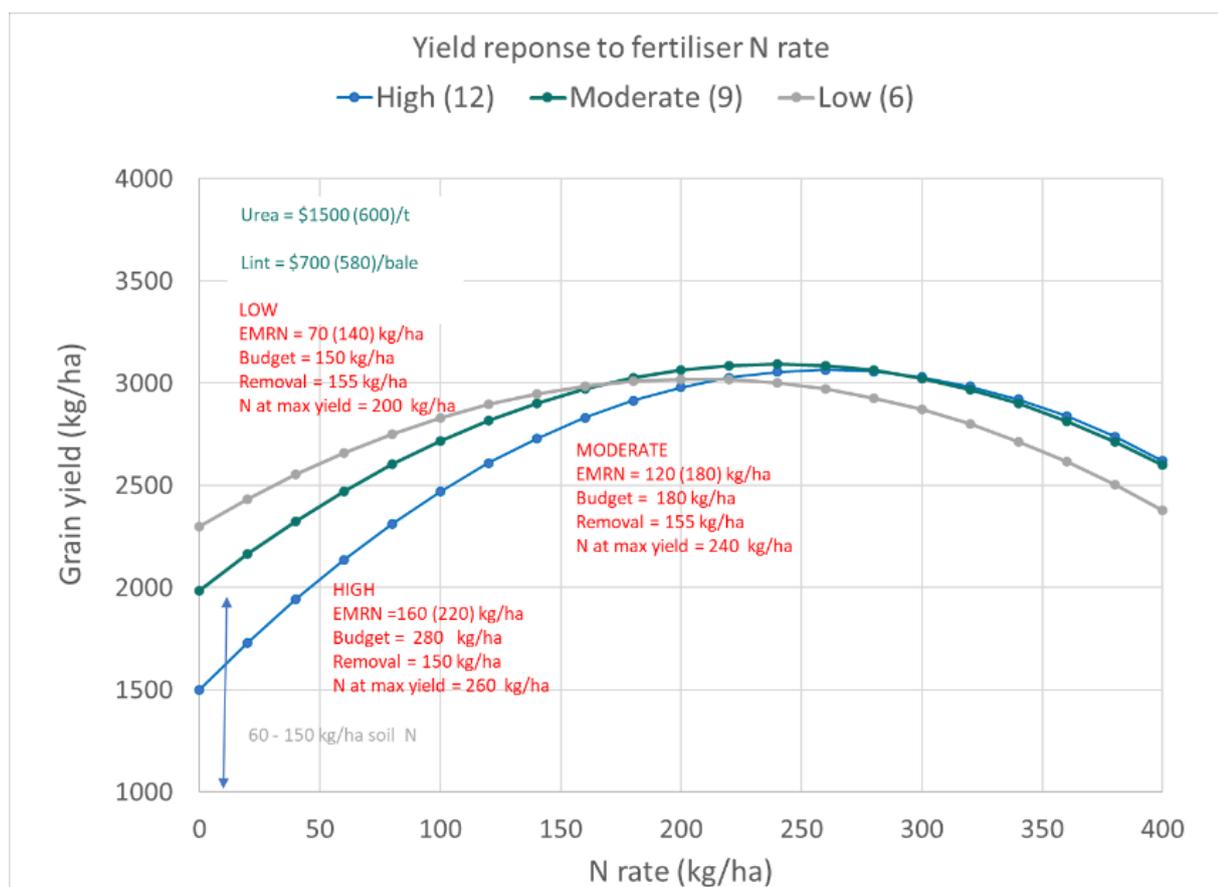


Figure 2 - Effect of cotton N response class (low, medium. high) on calculating N rate for a group generalised typical N response functions. High = response average 12kg lint/kg fertiliser N , Moderate = response average 9 kg lint/kg fertiliser N and Low = response average 6 kg lint/kg fertiliser N

The broad take-home messages from this assessment were

- The alignment between the N budget rate and the EMRN when the Np/Cp ratio was in the range of 0.5 – 0.8/1 (urea price and EMRN in brackets for 2021) was reasonable in the high and moderate responsiveness scenarios. The N budget rate was more related to N removal than EMRN in the low responsiveness scenario.
- Where the Np/Cp ratio was >1 (2022), there was a more significant difference between typical N budget rates and EMRN. The variance increased with reducing responsiveness.
- In the High response scenario, the N budgeted rate needed to be reduced by about 25 % to reflect the high Np/Cp ratio, in the Moderate scenario by 35 % and in the Low scenario, a reduction in the rate of up to 50% was likely to reflect the most economic use of N.

The above analysis says that despite the high N price, it still pays to put on N. The more challenging question will be "given I have possibly lost a significant amount of soil N before peak demand than usual; do I have enough fertiliser N secured to replace it and then apply the requirement for the remainder of the season?".

Given that responsiveness is a key factor in determining the appropriate N rate, in looking after profitability, what are the key factors that might help me determine the N responsiveness of my crop?

Factors that would be considered to indicate potential for increased responsiveness to post emergent N application includes

- Low pre-sowing soil mineral N and low preplant fertiliser N rate pre-flowering coming out of fallowed or cereal rotation.
- Significant waterlogging event/s pre-flowering in fields where pre-plant fertiliser N had been applied.
- Determinant varieties
- High light intensity and moderate temperature during flowering
- Non-limiting soil moisture conditions, although subsequent waterlogging events will further reduce N supply but may also simultaneously lower yield potential.
- Low plant tissue total N and petiole nitrate-N just prior to and during flowering
- Low soil test mineral N (0-60 cm) prior to and during flowering
- Poor plant vigour when light heat and water are optimal
- Visible foliar symptoms of N deficiency

What are some considerations when deciding on in-crop N application tactics?

As mentioned earlier, I think that most in-crop N application tactics will fit into either of two categories;

- “hit it hard early and build the soil supply ahead of the plant N requirement”
or
- “play the seasonal conditions and try to match supply with a shorter-term requirement”.

Some of the pros and cons of the two approaches are listed below

"Hit it early and hard."

Pro	Con
Lower management and labour requirement and application cost.	Increased potential for significant N loss from subsequent waterlogging events.
If growing conditions are favourable post flowering, the crop will have some soil N buffer for the 4 – 6 week period of peak N requirement.	May have limited application method options due to rate.
	May increase lateral flow N losses during subsequent irrigation if recirculation is not optimal.

"Play the seasonal conditions."

Pro	Con
Decreased severity of total N loss due to smaller losses in subsequent waterlogging events	Soil mineral N buffer is minimal, making the effectiveness of each application critical to prevent N related cut-out during peak requirements.
A larger number of application methods possible	Higher management requirements and the possibility of increased labour and application cost
N rate can be moderated for unfavourable seasonal yield potential	More likely to be affected by wet weather