ADAS document ref: 1021801-04 (01)
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Trial type: N rate
Farm location: Hertfordshire

Variety: Graham
Soil type: Medium

This trial was part of the AICC Crop Nutrition Club 2022, which has been run in conjunction with the Farm-PEP project led by ADAS. This report contains the results of a winter wheat trial, testing the effect of varying N rate.

Treatments

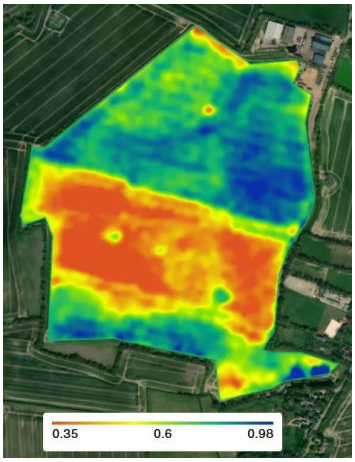
	1	2	3	4	5	6
Late Feb	60 kg N/ha as N37					
GS 30 (kg N/ha as N37)	80	80	80	100	80	80
GS 33 (kg N/ha as N37)	0	40	80	100	0 N Tester	0
GS 39 (l/ha Poly N Plus)						25
Total N rate (kg/ha)	140	180	220	260	140	140

The N tester treatment involved applying the N rate recommended by the hand-held Yara N tester tool; in this crop, it recommended no further N at GS33.

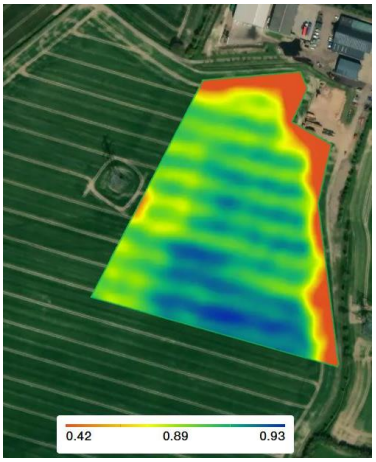
Satellite imagery

NDVI (normalized difference vegetation index) is a spectral reflectance index which shows a combination of canopy size and greenness, on a scale from 0 to 1. NDVI images were sourced from www.datafarming.com.au, based on freely available 10m resolution data from the Sentinel 2 satellites. The scale varies between images but always runs from red (low) through orange, yellow and green to blue (high). The availability of imagery is constrained by the need for cloudless conditions.

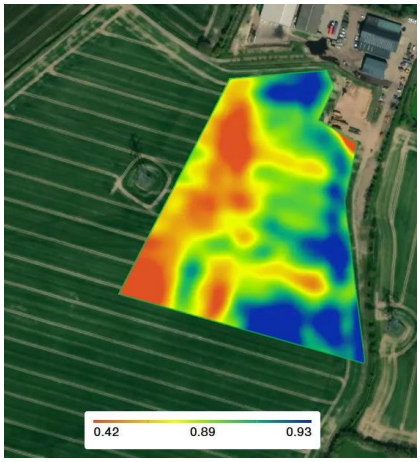
The trial was placed in the more even north half of the field. Prior to the main treatment applications, the main variation in this area ran across tramlines, so should not have impacted the fairness of the treatment comparison. During the trial, the lowest rate of nitrogen had the lowest NDVI, most noticeably pre-harvest in treatments 1 and 5.



NDVI before 1st application (13 Jan)



NDVI mid-season (08 May)



NDVI pre-harvest (10 Jul)

Agronomics analysis

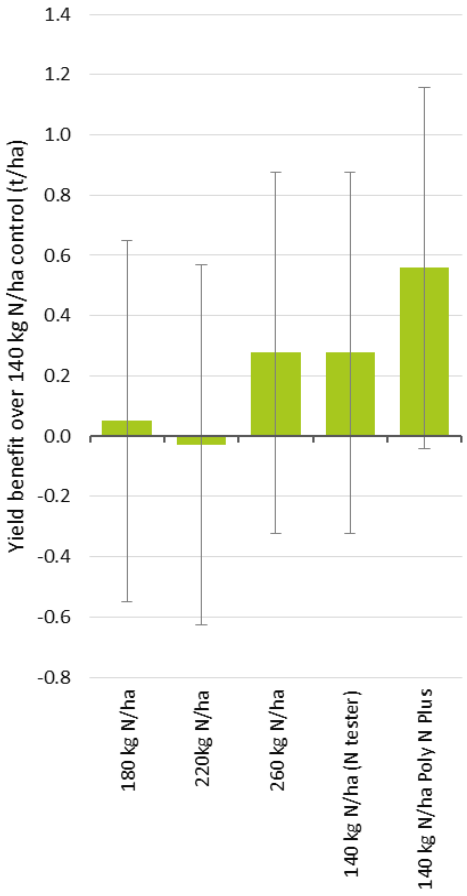
The yield data were analysed using the ADAS Agronomics approach. First the data were cleaned to remove headlands and other data outside the trial area, anomalous combine runs (header not full or spanning two treatment areas), and locally extreme data points, and to correct any offset created by changes in combine direction. Then a model of underlying variation was applied to the data to account for spatial variation across rows and along rows, and for the effect of the treatment. The statistical analysis led to estimates of the treatment effects and the associated standard errors. Thus, subject to the assumptions of the underlying statistical model, it was possible to calculate 95% confidence limits for the yield effects and the % probability that the yield effect was greater than any chosen threshold.

Yield results

The average measured yield of the 140 kg N/ha treatment was **12.71 t/ha**, for the area retained in the yield map analysis. This is likely to be a little higher than the true field average due the exclusion of headlands and the poorer south half of the field from the analysis.

Using the Agronomics analysis to fit a statistical model to the data, we found that adjusting the N rate had very little effect on yield. We estimate that none of the treatments increased or decreased yield by more than 0.28 t/ha, relative to the 140 kg N/ha control, with the exception of the 140 kg N/ha treatment with an additional 25 l/ha PolyN Plus, which increased yield by **0.56 t/ha ± 0.60 t/**ha (95% confidence interval). However, measured yield values do vary across a field even when the same treatment is applied everywhere; the bounds of the confidence intervals indicate that, according to the underlying statistical model, these estimated effects could have been the result of this unexplained variation.

With a break-even ratio of 10, each 40 kg/ha increase in N rate would need to result in a 0.4 t/ha increase in yield to maintain gross margin. The minimal yield differences seen in this trial suggest that in this case, gross margin was highest at 140 kg N/ha. The recommendation of the N tester to apply no further N after GS33 turned out to be correct, and there may have been a benefit of using Poly-N-plus. However, the prices of wheat and fertiliser continue to fluctuate, so the exact impact of treatment on gross margin will depend on your own grain price and fertiliser costs.

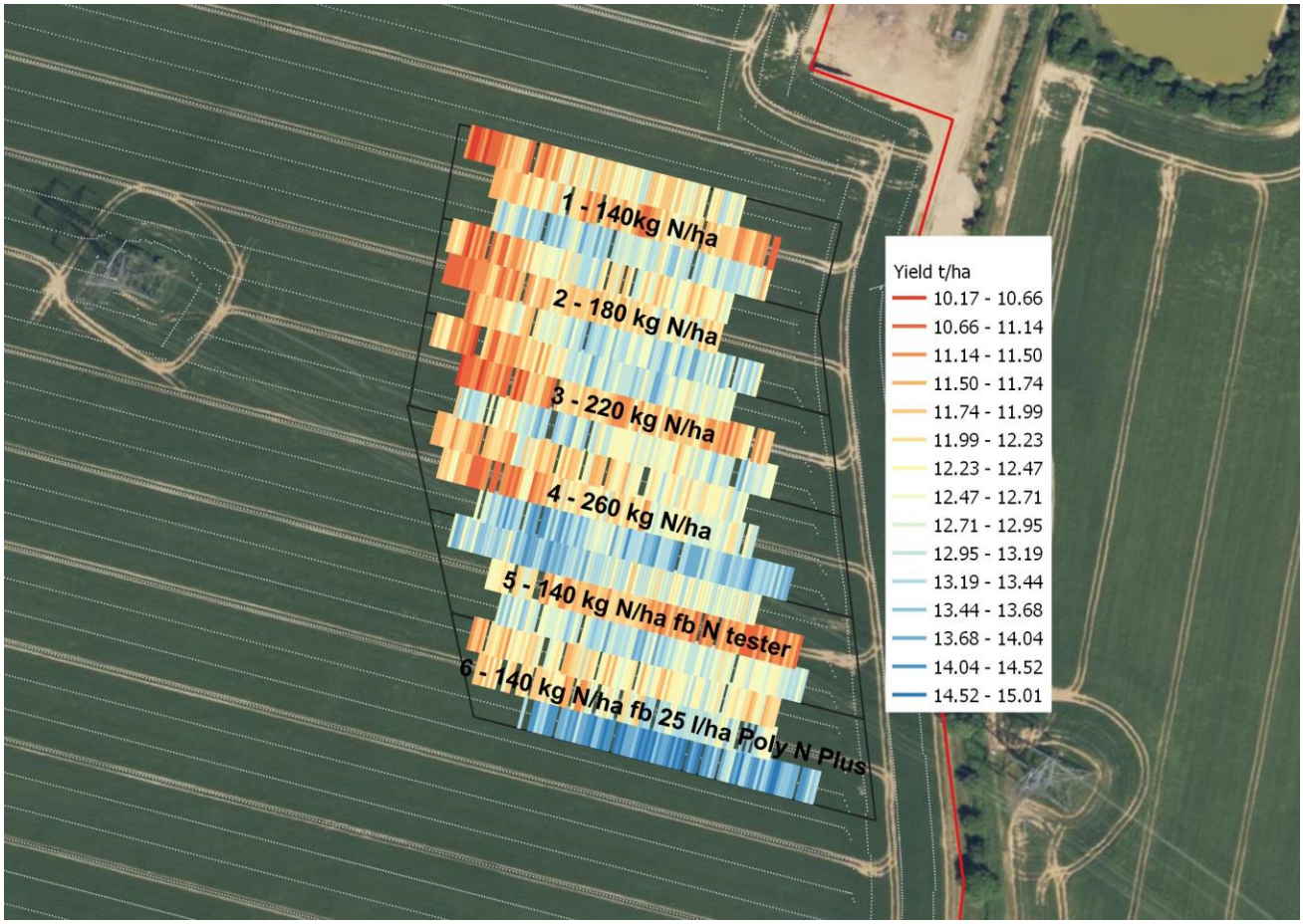


Error bars show 95% confidence intervals

Relative likelihood of a yield effect of different sizes from N rate treatments, according to the Agronomics analysis of this trial. Consider the relative costs of the treatment programmes to determine what yield effect would be required for an economic benefit.

Yield benefit or loss relative to control (140 kg N/ha)	180 kg N/ha Probability	220 kg N/ha Probability	260 kg N/ha Probability
> (greater than) 0.6 t/ha yield benefit	4 % (very unlikely)	2 % (very unlikely)	14 % (unlikely)
> 0.4 t/ha yield benefit	13 % (unlikely)	8 % (very unlikely)	34 % (about as likely as not)
> 0.2 t/ha yield benefit	31 % (unlikely)	23 % (unlikely)	60 % (about as likely as not)
> 0.0 t/ha yield benefit	56 % (about as likely as not)	46 % (about as likely as not)	82 % (likely)
> 0.0 t/ha yield loss	44 % (about as likely as not)	54 % (about as likely as not)	18 % (unlikely)
> 0.2 t/ha yield loss	21 % (unlikely)	29 % (unlikely)	6 % (very unlikely)
> 0.4 t/ha yield loss	7 % (very unlikely)	11 % (unlikely)	1 % (very unlikely)

Yield benefit or loss relative to control (140 kg N/ha)	140 kg N/ha with N tester Probability	140 kg N/ha with Poly N Plus Probability
> (greater than) 0.8 t/ha yield benefit	4 % (very unlikely)	21 % (unlikely)
> 0.6 t/ha yield benefit	15 % (unlikely)	45 % (about as likely as not)
> 0.4 t/ha yield benefit	35 %(about as likely as not)	70 % (likely)
> 0.2 t/ha yield benefit	60 % (about as likely as not)	88 % (likely)
> 0.0 t/ha yield benefit	82 % (likely)	97 % (very likely)
> 0.0 t/ha yield loss	18 % (unlikely)	3 % (very unlikely)
> 0.2 t/ha yield loss	6 % (very unlikely)	1 % (very unlikely)



Future trials

The trial was well placed within an even area of the field, but a longer trial area would be beneficial; these plots near the minimum area which can be successfully analysed using ADAS Agronomics. In any future trials, seek to use even fields, or fields where the variation runs across the tramlines to affect all treatments equally, and avoid trees and pylons as far as possible.

Greater precision in the yield effects and therefore confidence in the results of altering the N rate could be achieved by replicating the treatments within the field. Replication could be facilitated by reducing the number of treatments, e.g. having just two treatments repeated across the field in alternating single or double tramlines.