Urea is as effective as CAN when no rain for 10 days

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KEY MESSAGES

When urea or calcium ammonium nitrate (CAN) were applied at the same N rate to Mundah barley 4 weeks after sowing, the yield response to urea was twice that of the CAN when the nitrogen (N) was applied just prior to a 27 mm rainfall event. Suprisingly, when these N fertilisers were applied after the rain and no rain fell in the next 10 days, the urea still performed as well as the CAN in terms of grain yield. With both timings, with respect to rainfall, the urea was economically better than the CAN where more than 20 kgN/ha was applied giving up to an extra $110/ha return.

AIM

To determine if CAN has a niche to perform better than the urea in the absence of eminent rain and on a moist soil surface for barley production in Western Australia.

METHOD

A field trial with control plots every third plot was used to compare 4 rates of CAN (0, 20, 39, 59 kgN/ha) against 4 rates of urea (0, 26, 52, 78 kgN/ha) and this was done at two timings. The timinigs were either the day before 27 mm of rain (6th July) or three days after this rain with no rain for the next 10 days (then 10 mm fell). The timing treatments were separated in space (adjacent) and therefore can not be precisely compared to each other. All treatments were replicated twice. The plots were 15 m long by 2 m wide.

Mundah barley was no-till sown at 70 kg/ha on 250 mm row spacings on 15th June 2004 with 12.5 kgP/ha, 5.5 kgS/ha and 10 kgK/ha and a further 30 kgK/ha was topdressed 4 weeks after sowing. Nitrogen was applied by hand when the barley was at 3-3.5 leaf stage on the 6th July (on dry soil before the rain) and on the 10th July on moist soil.

Sap nitrate uptake data was measured with the Nitraquik test kit on the 10th and 22nd of July and 5th August. Grain yield was collected with a mechanical harvestor on 19th December 2004 and protein was measured by CBH for each plot. Grain yield was analysed spatially.

The site was very N responsive, as it had grown a good wheat crop in 2003, a poor lupin crop in 2002 (drought) and a good wheat crop in 2001. The soil was sandy to at least 40 cm depth and the western end (second N timing) was lower yielding.

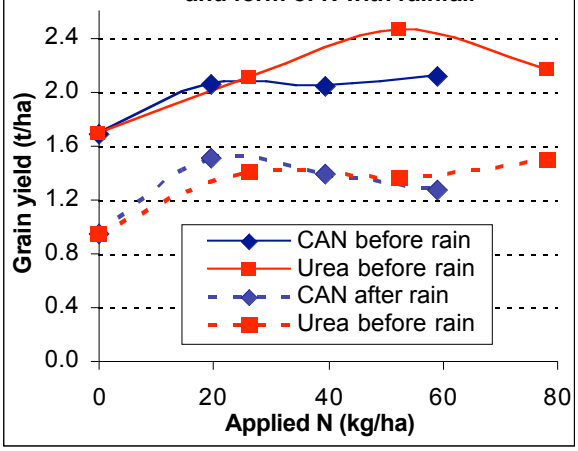
RESULTS

There was an increase in grain yield when N was applied before or after the rainfall event (Figure 1). The greatest N responses were with urea applied before the rain (and on the better soil).

When N was applied before rain, urea at the higher rates, yielded 400 kg/ha more than CAN. When N was applied after the rain, and on a moist soil surface with no rain for the next 10 days, yield was similar per unit of applied N for both CAN and Urea, but at a greater cost per unit of N for CAN.

N removal in harvested grain gave similar results to the grain yield (Figure 2), the one exception being that CAN gave better N uptake efficiencies than urea at the low rate of 30 kgN/ha at both timings. But this was no more economical than the urea.

Figure 1: Barley grain yield with timing and form of N with rainfall

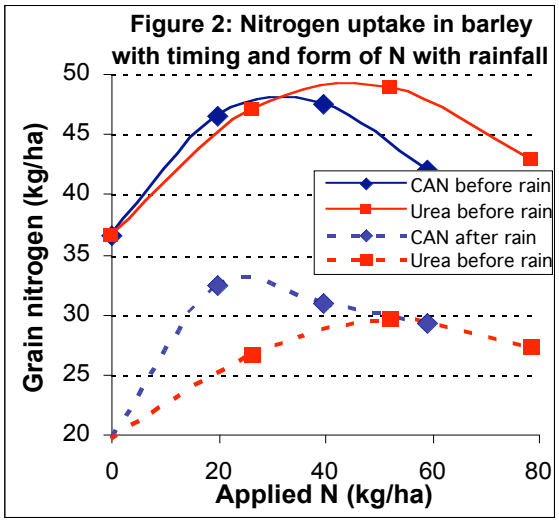


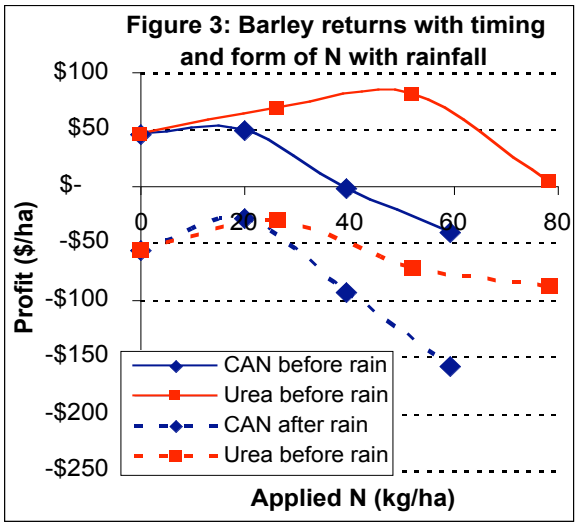
The plant sap nitrate tests showed that CAN, applied before the rain, was taken up within 4 days of being applied (data not shown). The second sap test (Table 1) taken 12 days after the first N was

Table 1	Sap nitrate from **CAN** (g/kg)			Sap nitrate from **urea** (g/kg)		
KgN/ha	N timing	22-Jul	4-Aug	KgN/ha	22-Jul	4-Aug
0	before rain	240	320	0	220	200
20	before rain	540	640	26	480	580
39	before rain	1160	1400	52	960	1160
59	before rain	1680	2380	78	1640	1760
0	after rain	240	200	0	260	220
20	after rain	640	780	26	280	400
39	after rain	880	1120	52	320	740
59	after rain	800	1400	78	340	1300

applied (and before the rain) on 22-July showed that CAN and urea gave similar uptakes (for similar N applied) being up to an 8-fold increase over the control [3.4% N {Leco} a CSBP test]). While the CAN applied after the rain gave modest N uptake and the urea gave poor early N uptake. Within two weeks this later applied urea gave equal plant N uptake as all other CAN and urea treatments.

CAN never performed better than urea in terms of profits generated. At all N rates, except 20 kgN/ha, the urea gave large economical benefits over CAN. This was from $40-110/ha (Figure 3). These calculations are based on; a) barley @ $140/t farm gate price, b) CAN @ $440/t, c) Urea @ $420/t, d) other costs to grow the crop are $190/ha, and e) there were no differences in grain quality (assessed from grain samples).





CONCLUSION

Caution is urged with this single trial data set as it needs to be compared to other data generated independently by non fertiliser companies. The data is however consistent with three 1999 WANTFA trials which showed that urea gave much greater economic responses than CAN.

These data suggest that urea was superior to CAN when applied before a rain event. Interestingly, urea gave similar grain yield responses, but superior economics, to CAN when it was topdressed onto a moist soil surface without any rain for 10 days. This is a sobering data set for those farmers and the promoters of CAN who believe that it is superior to urea if applied when rain is not forecast within 7-10 days. This data suggests that, in our cool agricultural climes (3-17^{O}C range), when urea is topdressed on the soils surface that losses to volatolisation are perhaps small (given how it compared to CAN). Research into exact N losses from urea in these conditions is encouraged.

KEY WORDS

CAN, calcium ammonium nitrate, urea, N, nitrogen, timing, rainfall, volatolisation, barley, grain yield.

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