Top Dressing Canola with Urea: Amounts and Timing

Ken Motley, NSW Agriculture, Forbes. David Harbison, Hi-Fert Fertilisers, Molong. Andrew Rice, Central West Farming Systems Group.

Background

Research has shown that urea top dressed onto wheat can be subject to large N losses to the atmosphere (Ellis, 1999). This is especially a problem on alkaline soils where there is enhanced break down of urea to ammonia, which is then easily lost to the atmosphere. To overcome this problem, it has been suggested that topdressing should occur just before a rainfall event so as to wash the urea into the soil.

There has been a perception by farmers that urea top-dressed onto canola is also subject to large losses, and that pre-drilled N is a more efficient and cost effective way of applying urea to canola. This perception has most probably come from well-published research with wheat on alkaline soils.

Trials at the Forbes CWFS regional sites in 1999 (Motley and Rice, 1999) suggested that the theory of pre-drilled urea being more efficient and cost effective than top-dressed urea was not necessarily the case for canola on acidic or slightly acidic soils. These trials clearly showed that canola top dressed with urea could produce similar yield and N recovery as pre-drilled urea. Furthermore, the trials showed topdressing of canola was effective regardless of rainfall events.

Based on the 1999 results, further canola trials were sown at three Forbes CWFS Regional Sites in 2000 looking at the effectiveness of top-dressed urea on canola and the importance of timing prior to rainfall.

This paper reports on the 2000 trial results.

Methods

Canola trials were sown at Gunning Gap, Wirrinya and Mulyandry (Table 1,2 &3). The variety Oscar was used at Gunning gap and Wirrinya, and 46C03 at Mulyandry. All treatments were sown with 250 kg/ha of single super providing 22 kg P/ha and 32 kg S/ha. The Gunning Gap trial site was pre-sown by the co-operator with 45 kg N/ha as anhydrous ammonia. Treatments were arranged in a randomised block design with three replicates.

The N rate treatments consisted of Nil, 50 and 100 kg N/ha. Urea was used as the N fertiliser.

Timing treatments included N at sowing and two top-dress timings; ‘on time’ and ‘poor time’. The N applied at sowing was completed as a separate operation just before sowing. The 'on time' top dress treatments were to be applied just before a rainfall event where as the 'poor time' applications were to be made at least 1 week before a rainfall event was predicted. The poor and on time applications were made as close as possible to each other.

Grain quality was analysed for oil and protein. N removal was calculated by the following formula:

Grain N removal (kg N/ha) = $\frac{\text{Yield (kg/ha) x Protein (\%)}}{625}$

Table 1. Trial details

Location	**Paddock History**	**Date** sown	**Herbicides**
Gunning Gap	Wheat	10/5/00	Treflan, Lontrel, Fusion and Verdict
Wirrinya	Grassy pasture	11/5/00	Treflan, Lontrel and Fusion
Mulyandry	Grassy pasture	12/5/00	Treflan, Lontrel and Verdict

Table 2. Soil 1 test details

Location	**pH (CaC12)**	**P (Colwell) (ppm)**	**CEC meq/100g**	Exch. **Al** (%)	**Profile N (0-60cm) kg/ha**
Gunning Gap	**5.2**	16	14.61	0	113
Wirrinya	**5**	20	10.56	0.5	**64**
Mulyandry	**6.7**	11	18.31	0	106

Table 3. Monthly rainfall received at the For bes trial **es**

Location	May	**Jun**	**Jul**	Aug	Sep	**Oct**	Nov
Gunning Gap	57	**25**	**22**	75	15	**84**	82
Wirrinya	52	46.5	9.5	77	15	**53**	94
Mulyandry	23	**44**	40	109	26	**68**	86

Results and Discussion

N response

The trial sites at Wirrinya and Mulyandry showed significant yield responses to additional N. The Mulyandry site was particularly responsive to N, showing significant yield responses by increasing N rates from 50 to 100 kg/ha. An economic analysis at Mulyandry shows that a rate of 100 kg N/ha was also economical, producing a return of $2 for every dollar invested in N (assuming N costs $l/kg applied).

The Gunning Gap trial site was less responsive because of the anhydrous ammonia applied presowing by the cooperator.

N recovery rates did not appear to decline with increasing N rates at any of the three sites. This occurred at Gunning Gap even though there was very little yield response. The high N recovery measured at Gunning Gap and at Wirrinya and Mulyandry on the high N treatments was largely because of significant increases in grain protein.

From these results it appears that canola has the ability to recovery large amounts of soil N even if the crop does not respond to additional N in terms of a yield increase. The additional N will be recovered by an increase in protein levels.

Oil results were variable but show a trend of increasing N rates resulting in slight reductions in oil content.

Pre-sowing N vs. *top dressing*
Composite analysis of the data across all three sites shows no significant yield difference between pre-sown N and top dressed N. At rates of 50 kg N/ha there is a clear trend that top dressing was giving a yield and N recovery advantage over pre sown N. This trend was not evident when 100 kg N/ha is used.

Top dressing may be giving a slight yield advantage by closely mimicking N demand by the crop. This advantage was probably not apparent at rates of 100 kg N/ha because high N rates at sowing provide enough N to last through the growing season and still provide enough N at periods of peak demand later in spring.

Significant yield responses to top dressed N were also recorded across a wide range of crop growth stages. N recovery rates for top dressing were similar to pre-sown recovery rates when top dressing occurred just before canopy closure (Gunning Gap), after full canopy closure (Wirrinya) and late flower (Mulyandry). These results highlight canola's ability to respond to top dressed N applications across a wide range of growth stages up to the end of flowering.

These results are supported by the 1999 trial results, which also showed no differences between top dressed N vs pre-sown N.

Top dress timing prior to rainfall
The poor time top dress treatments were just as effective as the on time treatments. This indicates that top dressing prior to rainfall was not as important as generally thought for achieving good N responses in these trials. These results are supported by the 1999 results, which also show that top dressing prior to rainfall was not needed for effective N recovery.

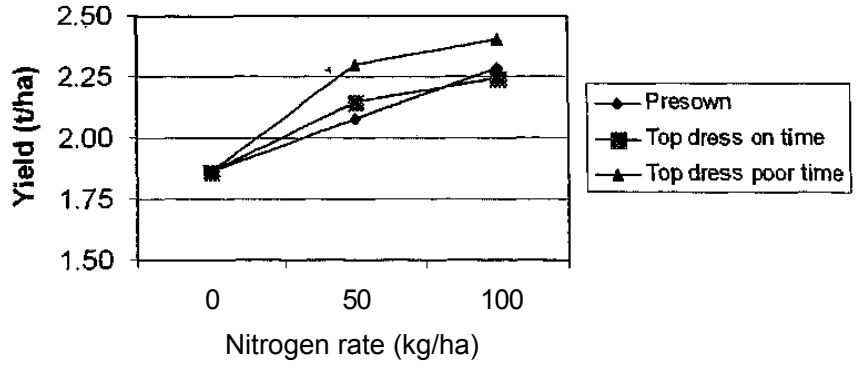

Figure 1. Canola response to N across three sites at Forbes
(5% lsd 0.2 and CV 7.4%)

Conclusion
Two years of trial data show that top dressed urea on canola can be just as effective as N applied at sowing. The results also show that the timing of rainfall events does not appear to influence the effectiveness of top dressed urea on canola. The N losses from top dressed urea on canola are not high in these trials most likely because of the crop's thick canopy cover, and they were grown on acid soils.

However, for top dressing to be effective on canola the following points are required:

- It needs to be applied to a crop with marginal soil N levels that has the potential to respond.
- It must be applied before the crop suffers an unreasonable yield potential loss due to N deficiency. This will usually mean top dressing before stem elongation.
- The crop also needs good growth conditions after top dressing so that it has potential to provide an economic response.

Top dressing canola with urea is best used as a tool for applying^additional N when seasonal conditions become better than expected and extra N is needed to allow yield potential to match the improved conditions. These trial results show that a canola crop in this situation will reliably respond to urea top dressing.

Table 4. Gunning Gap Canola N trial results

Treatment	N applied Kg N/ha	Date of N applied	Rainfall in 7 days after topdress	Days before Rain (>1mm)	Yi t/ha	eld %	Protein %	N Removal kg N/ha	N recovery %	Oil %
Nil	Nil	NA			2.72	100%	21.1	92	NA ,	49.0
50.0	50	Sowing			2.84	104%	22.4	102	20	47.6
0.50 on time	50	9-Aua	40	**0**	2.89	106%	22.9	106	28	47.3
0.50 poor timing	50	31-Jul	**0**	**8**	3.01	110%	22.7	109	34	47.1
100.0	100	Sowing			**2.77**	102%	23.7	105	13	47.3
0.100 on time	100	9-Aua	40	**0**	2.91	107%	24.2	113	21	46.1
0.100 poor timing	100	31-Jul	**0**	**8**	2.94	108%	24.1	113	21	46.4
50.50 on time	100	sow & 9-Aua	40	**0**	2.91	107%	23.7	110	18	47.4
50.50 poor timing	100	sow & 31 Jul		**8**	2.95	108%	23.8	**112**	21	47.9
mean 5%LSD CV					2.88 0.17 **3.4%**	6%	23.2 0.8 .40%	107 **8 6.2%**	22 14 NA	47.3 1.2 **1.4%**

Table 5. Wirrinya Canola N trial results

Treatment	N applied Kg N/ha	Date of N applied	Rainfall in 7 days after topdress	Days before Rain (>1 mm)	Yi t/ha	eld %	Protein %	N Removal kg/ha	N recovery %	Oil
Nil	Nil	NA			1.01	100%	20.4	33		51.5
50.0	50	Sowing			**1** 18	117%	21.2	40	**14**	50.4
0.50 on time	50	9-Aua	11	**0**	1.24	122%	21.4	42	19	522
0.50 poor timing	50	6-SeD	**2**	**1**	1.48	146%	21.0	49	33	49 **8**
100.0	100	Sowing			1.50	148%	22.7	54	**21**	51.1
0.100 on time	100	9-Aua	11	**0**	1.48	146%	22.4	53	20	52.0
0.100 Door timing	100	6-Sep	**2**	**1**	1.57	155%	23.0	58	24	49.3
50.50 on time	100	sow & 9-Aua	11	**0**	1.40	138	22.5	50	17	50.3
50.50 Door timing	100	sow & 6-SeD	**2**	**1**	1.41	140%	22.6	51	18	507
mean 5%LSD CV					1.36 0.20 8.4%	20%	21.9 0.7	48 **7** 141%	21 10 NA	50.8 1.1 **3.5%**

Table 6. Mulyandry Canola N trial results

Treatment	N applied Kg N/ha	Date of N applied	Rainfall in 7 days after topdress	□ays before Rain (>1mm)	Yi t/ha	eld %	Protein %	N Removal kg N/ha	N recovery %	Oil %
Nil	Nil	NA			1.85	100%	18.8	55		47.7
50.0	50	Sowing			2.20	119%	**19.5**	69	26	47.6
0.50 on time	50	28-Sep	**4**	**0**	2.30	125%	21.2	78	45	47.2
0.50 poor timing	50	15-Sep	**0**	10	**2 42**	131%	20.8	80	49	47.1
100.0	100	Sowing			2.59	140%	20.3	84	28	47 **2**
0.100 on time	100	28-Seo	**4**	**0**	2.33	126%	22.1	82	27	47.4
0.100 Door timing	100	15-Sep	**0**	10	2.70	146%	21.9	95	39	46 **6**
50.50 on time	100	sow & 28-Sep	**4**	**0**	2.50	135%	20.9	84	28	46.8
50.50 Door timing	100	sow & 15-Sep	**0**	10	2.71	146%	21,3	92	37	46.**9**
mean 5% LSD CV					2.40 0.28 **6.8%**	15%	20.8 0.5 **1.5%**	80 10 **2.3%**	35 15 NA	47.2 1.4 1,7%

References

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