TOP DRESSING CANOLA WITH UREA: THE IMPORTANCE OF TIMING PRIOR TO RAINFALL

Ken Motley¹, Andrew Rice² and David Harbison³

¹NSW Agriculture, Forbes
²Central West Farming Systems Group, Parkes
³Hi-Fert Fertilisers, Molong

ABSTRACT

The majority of nitrogen (N) fertiliser applied to canola in Central West (CW) NSW is pre-sown. This is largely because farmers are in a routine of applying N on canola in a similar pattern to that used on wheat. The most commonly promoted management system for top dressed urea on wheat is clear about the importance of rainfall just after top dressing urea for effective N recovery. Farmers have assumed similar weather conditions are needed for effective top dressing of urea on canola. Therefore, the varying reliability of weather forecasts in CW NSW has generally made it impractical for farmers to adopt widespread nitrogen topdressing on canola. Results from trials at Forbes (CW NSW) give cause to question the generally accepted belief that pre-sown urea is more effective than top dressed urea for canola grown on acidic soils. Data from nitrogen application trials conducted in 1999 and 2000 have shown that canola top dressed with urea can produce similar yield and N recovery to that of pre-sown urea. Further more, the trials suggested that the effectiveness (gauged by N recovery and yield response) of top dressing canola with urea is relatively insensitive to the timing of rainfall events.

INTRODUCTION

Canola has a high nitrogen (N) requirement and substantial amounts of N fertiliser are generally needed to meet yield potential (Holmes, 1980). For many canola growers N fertiliser represents the biggest single growing cost (Patton and Mullen, 2001).

Traditionally the majority of N fertiliser used on canola in CW NSW has been applied pre-sown, with less than 5% of total use estimated as top dressed urea. Effective post emergent applications of top dressed urea could help reduce some of the financial risks of growing canola by allowing farmers to delay spending on N fertiliser until the crop is established and growing adequately.

There has been a farmer perception that top dressed urea on canola is subject to large losses. This perception has most probably come from well-published research on wheat on alkaline soils (Ellis, 1999). This research has shown good rainfall is required just after topdressing urea for effective N recovery. Alkaline soil conditions enhance breakdown of urea to ammonia, which can lead to large N losses to the atmosphere due to volatilisation. Rainfall immediately after top dressing helps to move the urea into the soil, thereby reducing volatilisation losses.

Many farmers have taken this message developed for wheat on alkaline soils and applied it to canola on acid soils. Applying top dressed urea just prior to forecast rainfall events has proven to be difficult in CW NSW and has been an impediment to farmer adoption of top dressing urea on canola.

This is despite N top dressing trials on canola that have clearly shown effective N responses can be achieved from top dressed urea (Sykes and Mailer, 1989). Canola has also been shown to have the ability to respond to post sowing N applications over a wide range of growth stages. Applications of top dressed N have been shown to be effective up to the growth stage where flower buds are visible, provided that the N supply has been adequate before this stage of development (Hocking, 1987).
However, much of this research has occurred in the higher rainfall area’s, where rainfall events are easier to forecast. Many farmers in the lower rainfall areas of the CW NSW cropping zone have decided pre-sown N is more effective and practical than top dressed urea.

This paper reports on a series of trials conducted at Forbes over two years looking at the influence of rainfall timing on the effectiveness of top dressed urea on Canola when grown on slightly acid soils.

**METHODS**

Canola trials (cv. Oscar) were sown at two sites in 1999 (Wirrinya and Gunning Gap) and three sites in 2000 (Wirrinya, Gunning Gap and Mulyandry). All of the trial sites had a pH (CaCl$_2$) less than 5.5, with the exception of Mulyandry with a pH (CaCl$_2$) of 6.7. The trials were sown with basal phosphorus (16-22 kg P/ha) and sulphur (25-50 kg S/ha) fertiliser rates typically used by farmers in the surrounding district. 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 were:
- **Pre-sown N**
- **Top dressed N** at two top dress timings:
  - ‘on time’:
  - ‘poor timing’.

The pre-sown N was completed as a separate operation just before sowing. Weather forecasts were closely monitored to time top dressing with rainfall events. The ‘on time’ top dress treatments were to be applied just before a rainfall event. In contrast the ‘poor timing’ applications were to be made at least 1 week before a rainfall event was predicted. The poor timing and on time applications were made as close as possible to each other.

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

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\text{Grain N removal (kg N/ha)} = \frac{\text{Yield (kg/ha)} \times \text{Protein (% as is basis)}}{625}
\]

**RESULTS**

**Grain yield and protein response to N**

Additional N fertiliser increased canola yields at all trial sites. A composite analysis across all sites shows yields were increased by an average of 21% with 50 kg N/ha when compared to nil N. 100 kg N/ha further increased yield by an average of 13% compared to 50 kg N/ha, producing a total average yield response of 34% over Nil N (Figures 1 and 2).
Individual trial sites showed different levels of yield response to additional N fertiliser. Differences were largely attributable to varying profile N levels at sowing between the trial sites (Figure 3). The profile N takes into account both nitrate and ammonium N forms with sampling to a depth of 60 cm.

N recovery rates did not decline with increasing N rates from 50 to 100 kg N/ha at any of the sites (Figure 4). This trend occurred at Gunning Gap even though there was very little yield response. The high N recovery from 100 kg N/ha was largely because of significant increases in grain protein.

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

Grain oil content results were variable but suggested a general trend of slight reductions in oil content with increasing N rates. The protein and oil trends with N fertiliser observed in these trials are in accordance with other trials (Sykes and Mailer, 1989).
Pre-sown N vs top dressing
Analysis of the data across all five sites shows no significant yield or N recovery difference between pre-sown N and top dressed N.

Good yield responses to top dressed N were 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, after full canopy closure and even late flower. These results highlight canola’s ability to respond to top dressed N applications across a wide range of growth stages up to flower buds visible stage.

Timing of topdressing in relation to rainfall
The ‘poor timing’ top dress treatments were just as effective as the ‘on time’ treatments. This suggests that top dressing prior to rainfall was not as important as generally thought for achieving good N responses in canola (Figure 5).
CONCLUSION

Two years of trials at Forbes highlight that top dressed urea on canola grown on acid soils can be just as effective as pre-sown N. The results also show that the timing of rainfall events does not appear to have a large influence on the effectiveness of top dressed urea on canola grown on acid soils. The N losses from top dressed urea are not high in these trials, most likely because of canola’s thick canopy cover and that 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 a significant loss in potential yield due to N deficiency. This will usually mean top dressing before flower are buds visible.
- The crop also needs good soil moisture after top dressing so that it has yield 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 on acid soils a canola crop in this situation will reliably respond to urea top dressing.

REFERENCES


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