

## Effect of Fertilizer Formulation on Canola Response to Top-dress Nitrogen

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Canola acreage in North Dakota has increased from 15,000 in 1991 to more than 1.2 million in 2002 (Farm Service Agency, 1991 and 2002). However, high input costs are an increasing burden on producers and threaten to not only halt further increases in production, but also reduce current acreage. In 2003, production acres dropped to 958,208 (Farm Service Agency, 2003).

Previous research at North Dakota State University (NDSU) Research Extension Centers has shown dramatic (up to 31%) yield increases with top-dressing some or all of the nitrogen (N) fertilizer as urea during the growing season. However, this response has been sporadic and is apparently dependent upon timely rainfall after fertilizer application to carry the N into the root zone and avoid losses by volatilization.

The ammonium nitrate formulation of N fertilizer is more stable than urea on the soil surface, but is not as readily available for purchase. Growers are also interested in applying liquid N, especially since the advent of stream-bar technology, but data comparing the effectiveness of various solid and liquid formulations on canola are lacking.

At a February 2003 meeting of NDSU agronomists with representatives of the Northern Canola Growers Association, fertilizer management was identified as one of the top priorities for research on reducing canola input costs. A multi-location project was organized to continue previous work on N management. This proposal complements that work by providing information on the relative efficiency and efficacy of N fertilizer formulations as top-dress treatments.

The study was conducted in 2003 and 2004 on a low-N soil at the NDSU Carrington Research Extension Center in a randomized complete block design with four replications. Individual plots were 5' x 25' with a 5-foot border of canola between plots. The cultivar 'Hyola 357RR' was sown at the rate of 740,000 live seeds per acre. The total N (soil test + fertilizer) recommended for a 2000 lb. / acre yield goal was either broadcast and incorporated as urea prior to planting or divided into split applications. For the split applications, the soil test N level was brought up to 40 lbs. N / acre with urea, broadcast and incorporated prior to planting. The remaining N was applied in a preplant:post-emergence split of either 50:50 or 0:100 (see table). The post-emergence N was applied at approximately the 5-leaf growth stage and compared three N formulations: urea, ammonium nitrate, and 28% urea/ammonium nitrate. Application of the 28% urea/ammonium nitrate was evaluated when applied through flat fan nozzles and through stream bars.

### Preplant and post-emergence N applications (lbs. N / acre) for a 2000 lb. / acre yield goal.

Preplant Incorporated (soil test + fertilizer)	Post-emergence (fertilizer)
130	0
90	45 (urea)
90	45 (ammonium nitrate)
90	45 (liquid, flat-fan nozzles)
90	45 (liquid, stream bars)
45	90 (urea)
45	90 (ammonium nitrate)
45	90 (liquid, flat-fan nozzles)
45	90 (liquid, stream bars)

Averaged across 2003 and 2004, N formulation for split-application did not significantly affect days to physiological maturity, plant height, or yield characteristics (Table 1). Lodging tended to increase

with the high rate of top-dress N. Compared to applying all N pre-plant incorporated, yield was numerically increased by all top-dress treatments except the high top-dress rate applied with flat fan nozzles. Crop injury was observed with this treatment. Applying half of the recommended N fertilizer as a top-dress treatment shows promise, but the overall response and the relative effectiveness of the various formulations will depend upon timely rainfall.

**Table 1. Canola response to top-dressing with N fertilizer formulations, NDSU Carrington, 2004.**

Treatment	Formulation	Physiological Maturity (DAP) <sup>2</sup>	Height (cm)	Lodging (1-9) <sup>3</sup>	Yield (lb/acre)	Test Weight (lb/bu)	Seed Weight (g/200)
<i>N Treatment</i> <sup>1</sup>							
130 + 0	Urea	92.1	88.0	2.0	2435	49.9	0.65
90 + 45	Ammonium Nitrate	91.1	93.5	2.0	2665	49.5	0.66
90 + 45	UAN - Flat Fan	94.4	90.1	2.4	2671	49.6	0.65
90 + 45	UAN - Stream Bars	93.3	90.4	2.4	2539	49.5	0.65
90 + 45	Urea	92.6	91.9	2.1	2568	49.8	0.64
45 + 90	Ammonium Nitrate	92.5	85.4	2.6	2512	49.9	0.66
45 + 90	UAN - Flat Fan	92.8	87.9	2.8	2323	49.2	0.66
45 + 90	UAN - Stream Bars	94.6	84.9	2.3	2637	49.7	0.64
45 + 90	Urea	94.1	88.6	2.4	2491	49.6	0.65
LSD (0.05)		NS	NS	0.5	NS	NS	NS
LSD (0.01)		NS	NS	0.6	NS	NS	NS
2003		83.8	90.8	2.2	2908	50.4	0.61
2004		102.3	87.1	2.4	2168	48.8	0.69
<i>t</i> -test		**	NS	NS	**	**	**
Mean		93.1	89.0	2.3	2538	49.6	0.65
C.V. (%)		3.0	8.7	18.1	11.2	1.0	5.0

<sup>1</sup>Total lbs. N / acre (Pre-plant + Top-dress)

<sup>2</sup>Days after planting

<sup>3</sup>1 = erect, 9 = prostrate