PROJECT DETAILS

- **Title**: Canola response and minimizing nitrogen losses in two-pass seeding-fertilization systems with varying placement methods in Manitoba
- **Funders:** Manitoba Canola Growers, SaskCanola, Alberta Canola and Koch Fertilizers
- **Research program:** Canola Agronomic Research Program
- **Principal investigator:** Mario Tenuta
- **Collaborators/additional investigators:** Kevin Baron
- **Year completed:** 2017

Final report

With increasing pressure to complete field operations in a timely manner and the trend to using fertilizer custom applicators, a segment of growers in Western Canada are transitioning towards surface applications of granular urea; this represents a departure from the recommended practice of deep banding. Surface applications of fertilizer increases the risk of nitrogen loss through NH_3 volatilization, which occurs when urea hydrolysis elevates pH levels and increases the concentration of gaseous NH_3 around granules. When fertilizer granules are deep banded (3" plus) or buried in the soil, gaseous NH_3 formed around urea granules can be interconverted to ammonium (NH_4^+), a non-volatile ion which subsequently absorbs to negatively charged soil particles. While deep banding is a superior technique with respect to protecting nitrogen fertilizer from gaseous losses via NH_3 volatilization or N_2O emissions, the placement technique does require additional horsepower, can slow field operations at seeding time, and may also have undesirable effects on seedbed quality and moisture content. As a compromise, many canola growers are shallow banding (<1") urea or using commercially available enhanced efficiency fertilizers (e.g. SuperU or Agrotain) to reduce NH_3 losses from surface application. This project established six research trials from 2014-2016 in the Red River Valley of Manitoba to evaluate the agronomic and environmental performance of treatment combinations of source (urea, Agrotain, SuperU), placement (surface, shallow and deep mid-row banded) and rate (100 and 70% of soil test recommendation) for spring applications. Inclusion of the 70% rates was purposely to short nitrogen for the canola crop to determine treatments providing better nitrogen use efficiency evident as yield improvements. In addition, fall surface placement treatments were done for the 2016 growing season. Nitrous oxide (N_2O) emissions from urea and SuperU as well as ammonia volatilization using dosimeters were also detailed.

The results of the study indicate that the N source products examined did not affect canola yield. For the spring application timing, surface placement had lower yields (3 to 5 bu/ac) than shallow or deep banding (see figure). Fall surface application of granular urea and enhanced efficiency fertilizer products with urease and nitrification inhibitor at 100% of Provincial recommendation rates had lower yield (13 bu/ac) than spring surface applications of the products. Across the whole study, there was no clear pattern of a placement effect on N_2O emissions. At some sites subsurface placement decreased emissions while for some others, increased

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emissions. Granular urea with urease and nitrification inhibitor (SuperU) did consistently reduce N_2O emissions from ¼ to ¾ of that for regular granular urea. Surface application of granular urea consistently had greater NH_3 emissions than subsurface placement. For surface application, granular urea with urease and nitrification inhibitor (SuperU) consistently reduced or delayed NH_3 loses compared to regular urea. The results verify past research that subsurface banding of granular urea improves yields compared to surface application. As well, surface application in fall is way less efficient than spring application. There was no benefit to yield in using granular urea with urease alone or urease plus nitrification inhibitors to yield. However, urease plus nitrification inhibitor did reduce N_2O and NH_3 loses for surface applied granular urea. For future studies, we recommend examining N_2O and NH_3 loses and canola yield on lighter texture soils. Also that studies be conducted examining in-season application of N to canola. For soils prone to N loses such as with good drainage or prone to fall and spring water-logging, in-season N application may reduce loses and improve yields.

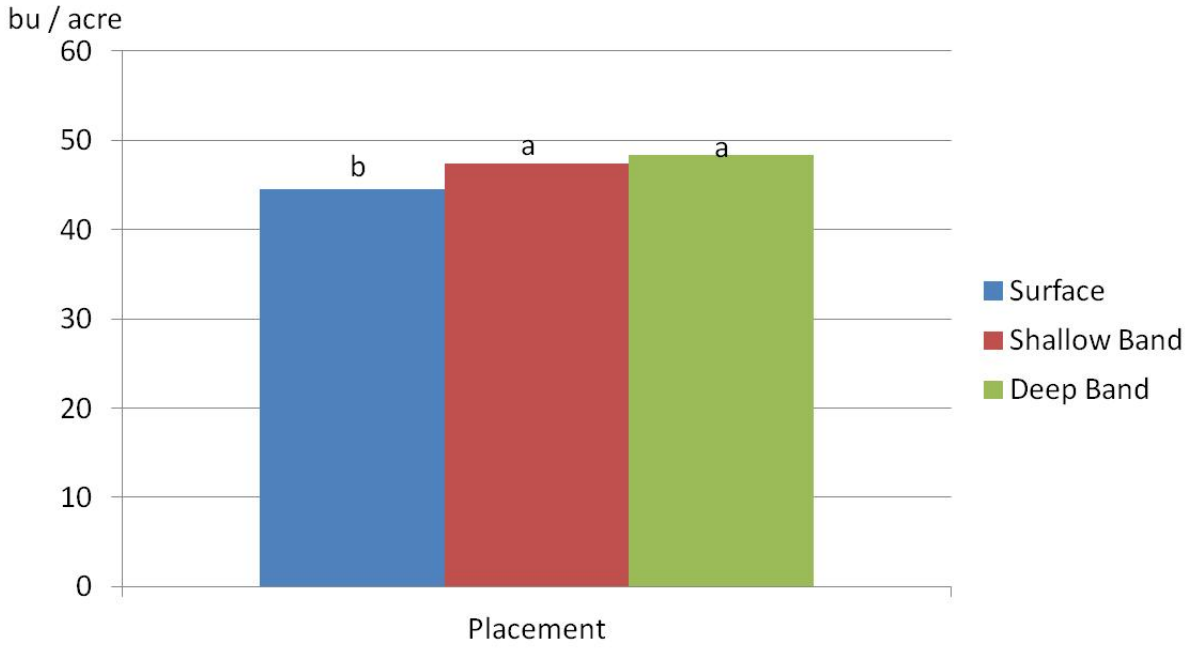

Figure. Yield of canola across five of the six trial sites in response to spring N addition placement at the 70% recommended N rate. Date for one site (Carman2) is not included as that site had poor emergence. Mean grain yield as columns topped by different letters are significantly different $P < 0.05$.

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