## Influence of Controlled-Release Urea on Crop Yield, N Uptake, Soil Nitrate-N and Nitrous Oxide Gas Emissions in Northeastern Saskatchewan

**S. S. Malhi[1], C.A Grant[2] and R. Lemke[3]**

[1]Agriculture and Agri-Food Canada, P.O. Box 1240, Melfort, Saskatchewan, Canada S0E 1A0
[2]Agriculture and Agri-Food Canada, Brandon, Manitoba, Canada R7A 5Y3
[3]Agriculture and Agri-Food Canada, 107 Science Place, Saskatoon, Saskatchewan, Canada S0E 1A0

A field experiment was conducted from 2004 to 2006 at Star City in northeastern Saskatchewan to determine if using CRU rather than conventional urea can increase crop yield and N uptake, and reduce the risk of excessive nitrate-N accumulation in the soil and gaseous N loss to the atmosphere. Two tillage systems (conventional tillage - CT and zero tillage - ZT) as main plots, while two sources of N (conventional urea and CRU), placement methods (side banded – SB, broadcast, blend, split), N rates (30, 60 or 90 kg N $ha^{-1}$) or timing of application (autumn and spring) in different combinations as subplots were employed. The treatments were maintained on the same plots for a three-year cropping cycle (wheat – canola – barley ), although there were no autumn-applied N treatments for 2004 crop (N fertilizers instead were applied in spring to keep similar residual mineral N in soil). All plots received a blanket application of P, K and S fertilizers at seeding. Crop was harvested for biomass and seed yield at maturity. Soil samples (in 0-15, 15-30, 30-60 or 60-90 cm increments) were taken over the growing season, usually in early spring, at seeding, anthesis, harvest, and in autumn. There was a substantial crop response to increasing rate of applied N under both ZT and CT, and crop yields and response trends were similar for both tillage systems. Autumn-applied (banded) urea was less effective in increasing crop yield and N uptake than spring-applied (side-banded) urea. The effectiveness of autumn-applied urea was increased with CRU, where it produced higher crop yield and N uptake than uncoated urea. This also suggests that CRU can be a good fit for winter wheat or other winter cereals or oilseed crops. For side-banded N in spring, CRU tended to produce higher crop yield and N uptake than uncoated urea, suggesting CRU may have the potential to replace split applications under certain conditions. Application of CRU resulted in a lower accumulation of nitrate-N in soil in top 60 cm depth at harvest than uncoated urea, thus reducing the potential for N losses over the winter and in spring. Split application of N (i.e., a half of N at seeding and the other half at tillering) tended to produce higher crop yield and N uptake. Spring 50:50 blend application of CRU and uncoated urea produced higher crop yield and N uptake than uncoated urea. This suggests that blending urea with CRU may improve efficiency of applied N. CRU tended to reduce nitrous oxide emissions compared to uncoated urea. The findings suggest that under wetter soil moisture conditions in the Parkland region CRU/coated urea can be an effective management tool in enhancing plant biomass, seed yield and N uptake, while also minimizing potential for gaseous and/or leaching N losses over the winter and in early spring, particularly for fall-applied N. This may benefit both crop yield and environment.