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Demonstrating 4R Nitrogen Principles in Wheat

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Developing best management practices (BMPs) for nutrient applications has long been focused on the 4R principles which refer to using the: 1) right formulation, 2) right rate, 3) right placement and 4) right timing. A trial was established in the spring of 2017 to demonstrate CWRS wheat response to the 4R nitrogen principles in comparison to side-banded, untreated urea as a control. Depending on the formulation chosen, rate, timing and placement options that would normally be considered high risk can become viable.

Nitrogen fertilizer can be lost or tied-up in organic soil matter by microorganisms when the fertilizer is closely associated with crop residues of low nitrogen content, which is what we saw happen on site in Swift Current. Yield was lower for sidebanded treatments of urea compared to the pre-seed broadcast due to an adequate rainfall event after application that allowed the surface broadcast to weather and be immediately absorbed into the soil for plant uptake rather than lost to volatilization. This moisture did not reach the sidebanded fertilizer, therefore it remained in dry soil and was not as well absorbed.

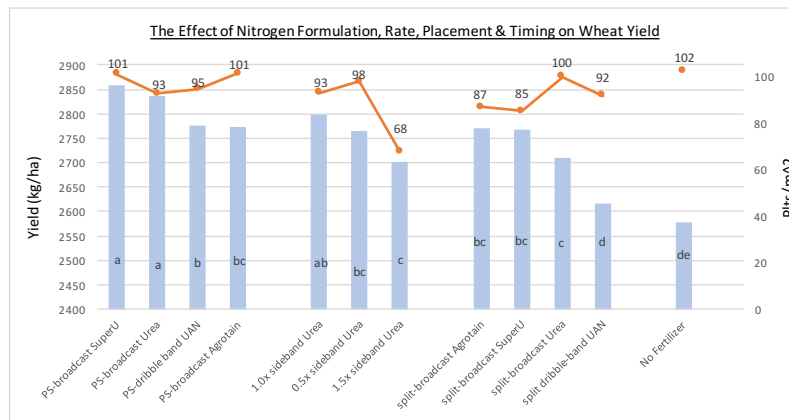


Figure 1. Wheat yield and plant density as a result of varied formulations, rate, placement and timing of nitrogen applications. PS (pre-seed), split-broadcast (split-application of urea – 50% at seeding, 50% at 4-6 leaf in the form of either Urea, Agrotain, SuperU, UAN).

There has been increasing use of UAN surface applications in a dribble band, but again reduces volatilization loss if followed by precipitation. By using a urease inhibitor application this loss can be reduced until favorable conditions are met for the fertilizer to successfully move into the rooting zone. In this trial, the pre-seed dribble band performed significantly better than split-applications of N, which did not perform well as moisture conditions remained extremely dry directly following the top-dressing application. The split-broadcast application of urea with UAN was even comparable to applying no fertilizer and not a good application in terms of yield.

Nitrogen sidebanded at seeding shows there is a limit as to how much fertilizer can be safely placed in the seed-row before reduced germination results due to toxic injury and retention of moisture from the seed. Yield and plant density from the 1.5x rate of sidebanded urea at seeding was much lower than the 1.0x rate. Although these applications are often the most efficient at increasing yield, results are dependent on environmental conditions and ultimately the plants ability to respond to available N.

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