



CORN

GET THE MOST OUT OF YOUR NITROGEN

Cross-Canada agronomic and environmental benefit of advanced 4R nitrogen management of grain corn

The importance of proper nitrogen management on corn is clear to all farmers. One of the largest input costs year in and year out at any operation, nitrogen is being evaluated continuously on many performance aspects. A topical question for farmers and researchers alike is if even more could be done with the same or less in order to maximize return on investment. Simultaneously, a key goal that continues is to reduce environmental loss and determine if advanced 4R nitrogen management conditions change the most economical rate of nitrogen (MERN) to use during the growing season.

Research led by Mario Tenuta, this research is part of a four-year study that concludes in 2023. His research is being conducted in Ontario, Quebec and locally at Carman, Man. Results were somewhat hampered in both years due to late season droughts, which reduced yield. In addition, COVID-19 lockdowns and laboratory restrictions made it difficult to finish soil, plant and gas analyses.

Pre-plant N treatments

In 2018, ESN had a lower performance compared to SuperU and Urea. This was likely because ESN was used without blending with some urea. The following year, SuperU had the lowest average performance.

▼ **BELOW:** Graduate student **Claudia Esparza** (foreground) and her student assistant **Adam Freiling** take canopy reflectance measures for nitrogen status of corn of a 4R nitrogen trial site near Carman.





Lead Researcher:

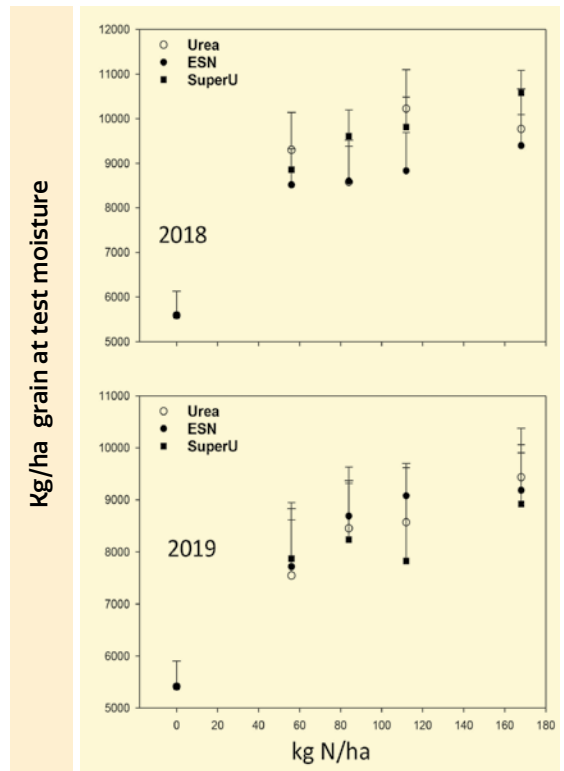
Dr. Mario Tenuta

Senior Industrial Research Chair for 4R Nitrogen Stewardship

Researcher bio: Mario Tenuta is the NSERC/WGRF/Fertilizer Canada Industrial Research Chair in 4R Nutrient Stewardship and professor of Applied Soil Ecology at the University of Manitoba. His training includes a BSc in botany and physical geography, an MSc in soil science, a PhD in plant sciences and post-doctoral research in nematology.

Collaborators: Curtis Cavers, Craig Drury, David Hooker, Gaetan Parent and Joann Whalen

GRAPH 1 | NITROGEN RATES



The ESN performance was lowest, or tied for lowest at five different rates (0, 55, 80, 110 and 170 kg/ha of nitrogen). In 2019, SuperU was lowest on three rates (80, 110, 170), while rates of 0 and 55 showed a virtual tie between all three nitrogen types (*Graph 1*).

In-season response of dribble band UAN

During the first two years of the study, 2018/2019, there were no significant effects on the yield of the three nitrogen sources tested—UAN, AgroTain, AgroTain Plus—although AgroTain Plus had the lowest performance of the three nitrogens tested (*Graph 2*).

Yield response to in-season UAN dressing

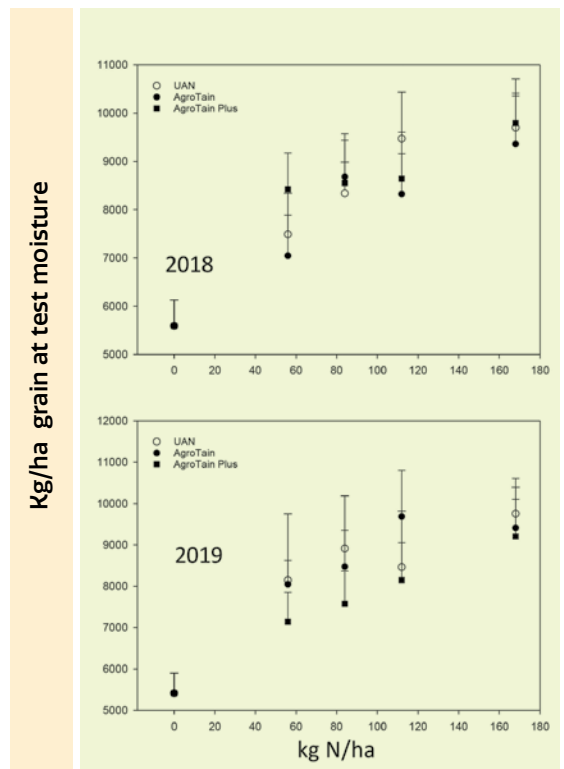
In both years, 2018/2019, UAN dribble performed significantly better of the three in-season placements tested—surface dribble, shallow side-dress and deep side-dress—although the 2019 surface dribble was best while deep side-dress was the worst.

Despite the full project not being completed, early findings show, at least in terms of raw data, there is not a clear advantage of an in-season nitrogen application. Weather-related factors such as rainfall may have been a contributing factor to the results as both years were dry.

As corn yields continue to increase, nitrogen has to keep in step with that, but Tenuta cautions that the dollar costs of fertilizer and nitrogen escapes to the environment will push to get more yield out of nitrogen applications.

“Getting more yield bang for fertilizer additions with less environmental impact needs to be a major goal now so future yields are not constrained by nitrogen additions” he says.

GRAPH 2 | NITROGEN TESTED



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PHOTOS: MARIO TENUTA



ON YOUR FARM

Prudent nitrogen use to achieve greater profitability, sustainability



▲ **ABOVE:** Technician Megan Westphal weighing corn grain combined from a 4R nitrogen trial site.

▶ **OPPOSITE:** Technician Megan Westphal combining a plot of a 4R nitrogen trial site near Haywood.

Corn in Manitoba continues to become a key contributor to the province's agricultural output. With consistently over 450,000 planted acres between both grain and silage corn, farmers are eager to continue with it. There are concerns about how to maximize return on agronomic inputs, though, namely nitrogen. The return farmers seek coincides with the increased investment they continue to make with hybrid cultivars.

Typically, nitrogen tests are done through soil samples to calculate residual nitrate. From there, a farmer can know their yield goal based on what variety or hybrid they are growing and set a nitrogen target. However, after doing this practice for years but getting no yield difference, it seems as though change is needed.

Recent research and data demonstrate that farmers generally adhere to their usual nitrogen program. They adjust rates based on increasing yield goals that, but that may cost them both profit in the long run if yield suffers.

Newer options available to farmers such as polymer-coated urea such as ESN as well as SuperU (urea fertilizer containing urease and nitrification inhibitor) showed a strong pre-plant response compared to in-season applications and dressings, both side and top. The SuperU outperformed the AgronTain (urea ammonium nitrate solution fertilizer containing a urease inhibitor) and AgroTain+ (urea ammonium nitrate solution fertilizer containing a urease and nitrification inhibitor), which were applied during an in-season dribble band of UAN.

Early research results such as this show that Manitoba farmers can simply do one pre-plant application and saves themselves the time and money it takes to make additional in-season applications.

In-season nitrogen applications, either through a top-dressing or side dressing without various inhibitors, have proven not to be disadvantageous. This is good news for farmers as it gives them a little bit of breathing room during the growing season and relieves some of the pressure to get it all done immediately during spring seeding. The in-season application should give farmers a better nitrogen delivery and avoid losses before the corn's peak nitrogen demand.



Research conducted by Mario Tenuta shows that in a year where planting is not delayed and there are no significant rainfall events, at-plant nitrogen addition gives similar performance as nitrogen dressing at the four-leaf stage.

The reality is that farmers will want more return on their nitrogen investment. Also, farmers will have to remain vigilant about shifting societal expectations for

environmental stewardship, which could further increase farmers' pressure to reduce greenhouse gases such as nitrous oxide, ammonia volatilization losses, and nitrate leaching. These losses of nitrogen are ultimately wasted farmer money.

Tenuta labels reduced GHGs and better use of farmers' nitrogen inputs a true win-win because they save money and protect the environment. ●



PHOTOS: MARIO TENUTA

