# Enhanced Efficiency Nitrogen Fertilizer's Use in Grain Corn

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## What are Enhanced Efficiency Nitrogen Fertilizers (EENFs)?

EENFs are designed to release nitrogen (N) closer to when plant demand is higher and increase nitrogen uptake by the plant (1). This has potential for reducing environmental impact of N fertilizers as less N is left in the soil to cause air and environmental pollution.

## Types of EENFs

There are two main types of EENFs - slow release and inhibitors. Slow-release fertilizers have a coating (usually polymer or inert compounds) that have to be dissolved before the N is released. The thickness of these coatings can be altered to delay release longer if desired. Inhibitor products fall into two categories: urease and nitrification inhibitors. These products contain inhibitors that slow down nitrification and ammonia volatilization by inhibiting enzymes that catalyze these processes. (2).

## Previous Research

Research on EENFs has been a hot topic recently. Studies have been done looking at the effects of EENFs in many crops, including corn. Results on the effect of EENFs in corn varies greatly. Multiple studies have found EENFs to reduce $N_2O$ emissions when compared to standard uncoated urea, however the degree of reduction varies (3,4). In terms of nitrogen use efficiency in grain corn, some studies see a positive impact of EENFs compared to urea, while others have found no significant difference (3,5). Similarly, yield results are varied with some studies finding EENFs to improve yield, while others found no significant difference (3,5,6). Up until now there is still no widely accepted consensus on the use of EENFs in grain corn which prompts further research.

There is an ongoing research project at Dalhousie University Faculty of Agriculture to further investigate the effects of EENFs in grain corn (hybrid Pride Seeds A4939G2). Dr. Yunfei Jiang currently has a master's student, Baillie Lynds, looking at the effects of EENFs and split applications on agronomic and environmental parameters. The project has been funded by Atlantic Grains Council under the Sustainable Canadian Agricultural Partnership (S-CAP) program.

Currently three EENF products are being used in the study, two slow-release polymer coated ureas, PurYield™ (PY) and CoteX, and a double inhibitor product named SuperU® (SU), compared to uncoated urea as control. The experiment was conducted in Truro, NS in 2023 and Truro, NS as well as Harrington, PEI in 2024.

We looked at yield responses to reducing fertilizer application rates for each EENF. In 2023, rates of 100 kg N $ha^{-1}$ and 125 kg N $ha^{-1}$ were applied for both PY and SU. It was found that reducing the rate for SU led to significantly lower yields, while PY was unaffected at Truro, NS in 2023 (Fig. 1). In 2024 at both sites, rates of 75 kg N $ha^{-1}$, 100 kg N $ha^{-1}$, 125 kg N $ha^{-1}$, and 150 kg N $ha^{-1}$ were applied for PY and SU, while CoteX omitted the rate of 150 kg N $ha^{-1}$. Results showed that in Truro, 75 kg N $ha^{-1}$ of SU led to significantly lower yields than the other

three rates (Fig. 2), while Harrington showed the same trend but for PY (Fig. 3).

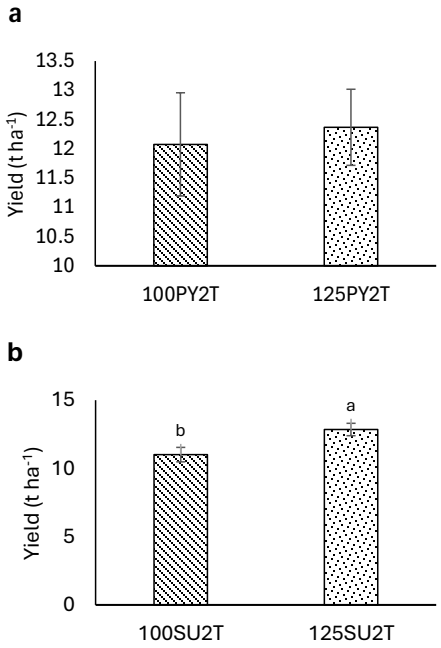


**Figure 1.** Effects of reduced N rates of different enhanced efficiency fertilizers on grain yield of corn at Bible Hill, NS in 2023. ~~1~~a) PurYield™. 100PY2T, 100 kg ha$^{-1}$ PurYield™ split applied at planting and V6-V8 stage; 125PY2T, 125 kg ha$^{-1}$ PurYield™ split applied at planting and V6-V8 stage. ~~1~~b) SuperU®. 100 kg ha$^{-1}$ of SuperU® split applied at planting and V6-V8 stage; 125SU2T, 125 kg ha$^{-1}$ of SuperU® split applied at planting and V6-V8 stage. Means not sharing a letter are statistically significant.

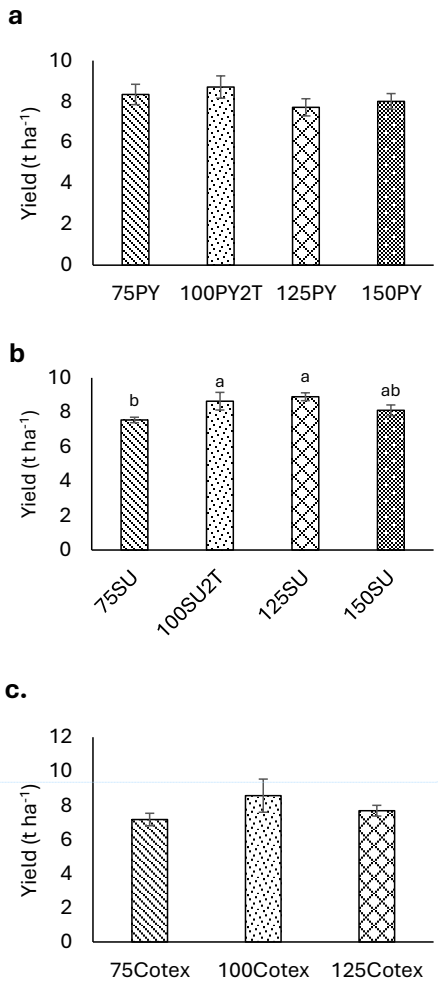


**Figure 2.** Effects of reduced N rates of different enhanced efficiency fertilizers on grain yield of corn at Truro, NS in 2024. ~~2~~a) PurYield™. 75PY, 75 kg ha$^{-1}$ PurYield™ applied at planting; 100PY2T, 100 kg ha$^{-1}$ PurYield™ split applied at planting and V6-V8 stage; 125PY, 125 kg ha$^{-1}$ PurYield™ applied at planting; 150PY, 150 kg ha$^{-1}$ PurYield™ applied at planting. ~~2~~b)

**Commented [YJ1]:** Can you increase the font size in Figure 1 (similar to Figure 2 for easy reading)?

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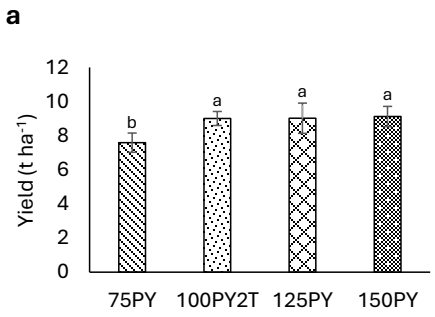
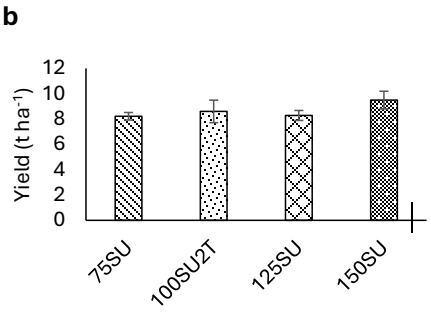
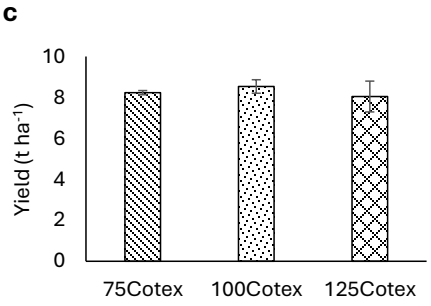
SuperU®. 75SU, 75 kg ha$^{-1}$ SuperU® applied at planting; 100SU2T, 100 kg ha$^{-1}$ SuperU® split applied at planting and V6-V8 stage; 125SU, 125 kg ha$^{-1}$ SuperU® applied at planting; 150SU, 150 kg ha$^{-1}$ SuperU® applied at planting. Means not sharing a letter are statistically significant. ~~2~~c) CoteX. 75CoteX, 75 kg ha$^{-1}$ CoteX applied at planting; 100CoteX, 100 kg ha$^{-1}$ CoteX applied at planting; 125CoteX, 125 kg ha$^{-1}$ CoteX applied at planting.




p>0.05

**Figure 3.** Effects of reduced N rates of different enhanced efficiency fertilizers on grain yield of corn at Harrington, PEI in 2024. ~~3~~a) PurYield™. 75PY, 75 kg ha$^{-1}$ PurYield™ applied at planting; 100PY2T, 100 kg ha$^{-1}$ PurYield™ split applied at planting and V6-V8 stage; 125PY, 125 kg ha$^{-1}$ PurYield™ applied at planting; 150PY, 150 kg ha$^{-1}$ PurYield™ applied at planting. ~~3~~b) SuperU®. 75SU, 75 kg ha$^{-1}$ SuperU® applied at planting; 100SU2T, 100 kg ha$^{-1}$ SuperU® split applied at planting and V6-V8 stage; 125SU, 125 kg ha$^{-1}$ SuperU® applied at planting; 150SU, 150 kg ha$^{-1}$ SuperU® applied at planting. ~~3~~c) CoteX. 75CoteX, 75 kg ha$^{-1}$ CoteX applied at planting; 100CoteX, 100 kg ha$^{-1}$ CoteX applied at planting; 125CoteX, 125 kg ha$^{-1}$ CoteX applied at planting.

Additionally, we looked at the effects of EENFs vs urea on grain yield and all site-years showed no significant yield difference (Fig. 4).

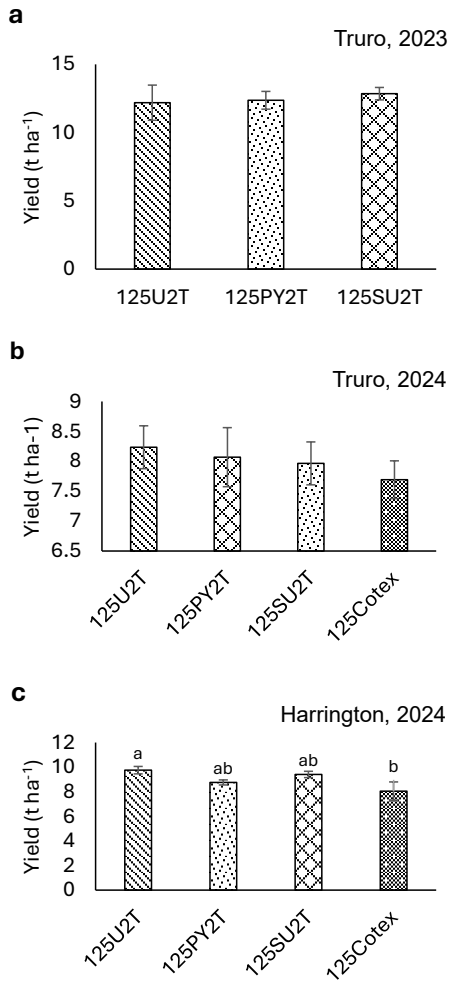



**Figure 4.** Effects of different enhanced efficiency nitrogen fertilizers, (PurYield™, SuperU®, and CoteX) compared to urea on grain yield of corn at three locations. 125U2T, 125 kg ha$^{-1}$ urea split applied at planting and V6-V8; 125PY2T, 125 kg ha$^{-1}$ PurYield™ split applied at planting and V6-V8; 125SU2T, 125 kg ha$^{-1}$ SuperU® split applied at planting and V6-V8; 125CoteX, 125 kg ha$^{-1}$ CoteX applied at planting. 4a) Bible Hill, NS, 2023. 4b) Truro, NS, 2024. 4c) Harrington, PEI, 2024. Means not sharing a letter are statistically significant.

p=0.098

Lastly, we observed the effects of applying each EENF as a split application vs single application. For the most part, there were no significant differences with the exception being Truro 2023 where SU applied as a split application had significantly higher yields than when applied as a single application at planting.

## Benefits of this research

The results of this research will directly benefit growers as it will provide them with information on the best type, rate, and application timing of EENFs in grain corn. It will also help work towards climate goals including goal 13 (Climate Action) of the United Nations Sustainable Development Goals and reaching Net Zero emissions by 2050 set by the Canadian government as part of their Canadian 2030 Emissions reduction plan (7,8).

## References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