

Questioning Assumptions Regarding Fertilizer Application and N₂O Fluxes for RRV Farms in Production

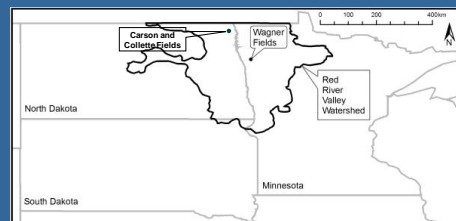
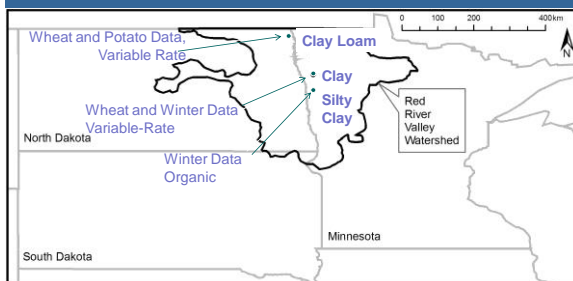
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How does N management affect fluxes of N₂O to the atmosphere?

Using farms located in the fertile Red River Valley of the North, we questioned the following assumptions:

1. N₂O emissions are lower when growers vary N application rates because they reduce N inputs
2. Fall application of N does not affect N₂O emissions because microbes are not active when soils freeze
3. There is a linear relationship between N application rate and N₂O emissions

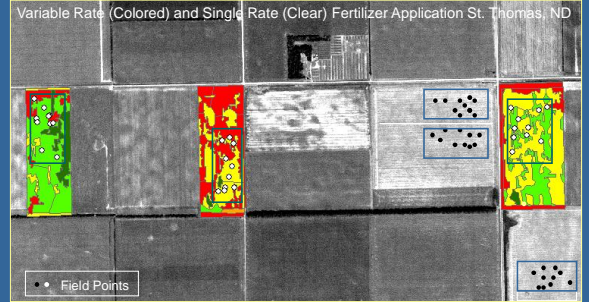
OUTLINE



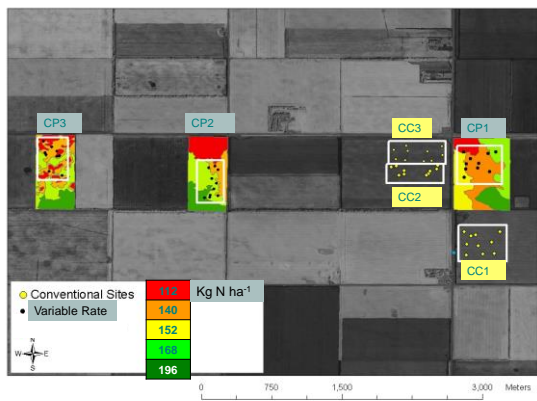
Urea Fertilizer Applied in "Zones" vs. Broadcast
Clay Loam Soil, St. Thomas, ND



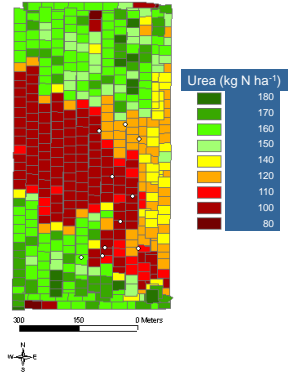
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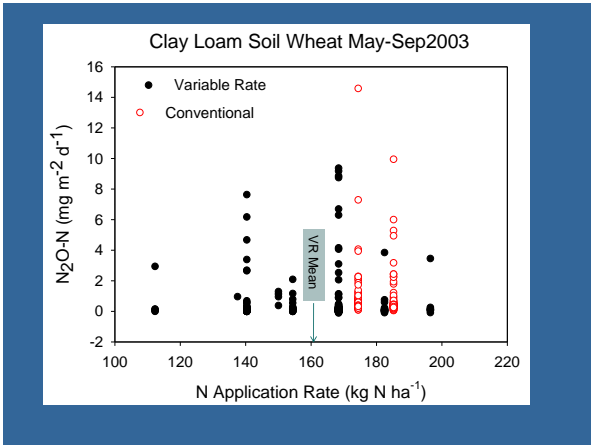
Different year, different zoning plan, Clay Loam Soil, St. Thomas, ND



Variable Rate Application Map

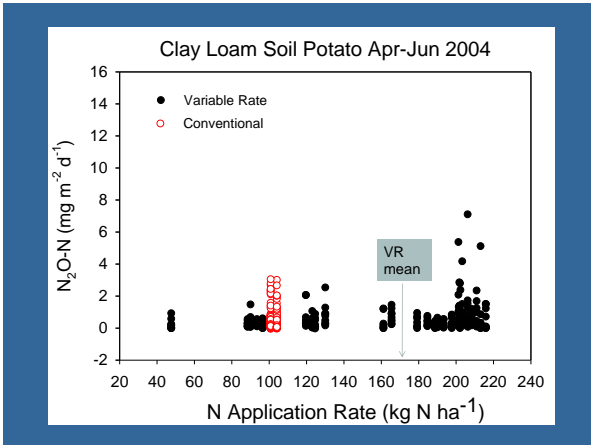


Actual zone application example used in this study



Clay Loam Soil Wheat Yields

- Wheat Yield, Both Growers: 167-178 bushels ha^{-1}
Dry matter produced: 1100-1150 $g\ m^{-2}$
- Were yield goals met? Yes.
- Did yield vary between growers? No.
- Did N_2O flux vary by N application rate? No.



Potato Yield Determination- Did yield vary with zone?

Identified random points per zone in each field and harvest 3-m plots (12 plots per field)
Tested for yield differences between growers

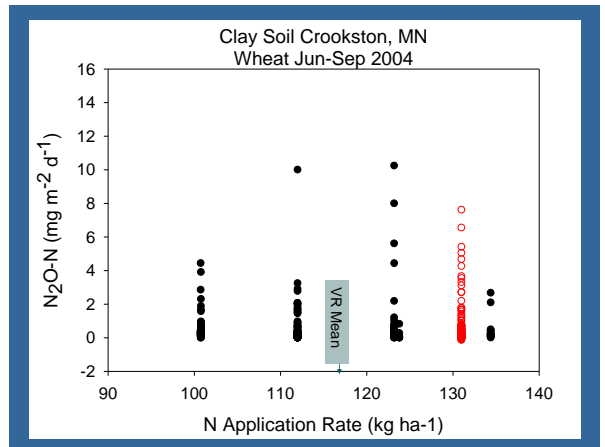
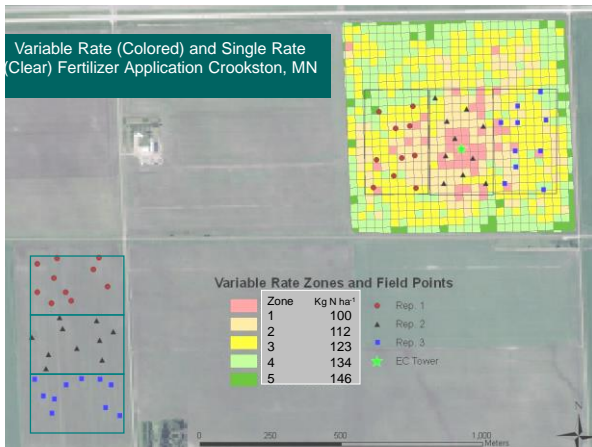
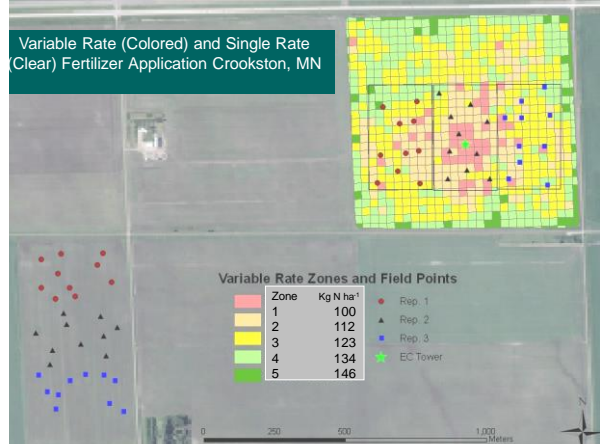
Variable-Rate		Conventional	
Goal	Actual	Goal	Actual
3048	3220	2807	2855
2840	3135	2807	3972
3047	3077	2807	3653

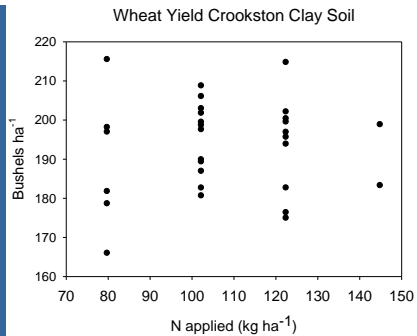
Clay Loam Soil Potato Yield

- Were yield goals exceeded? Yes.
- Did yield vary among zones? No.
- Did yield vary with application rate? No.

Wheat and potato years flux data

- Did N application rate influence N₂O? No.





188 bushels per ha yield- Variable Rate

207 bushels per ha yield- Conventional

No significant difference between management

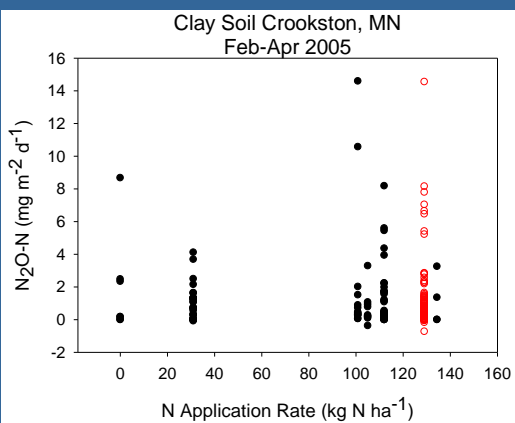
Management Following Harvest

Chisel-plowed, disked, then fertilized with urea in November

Actual application mapped against random points

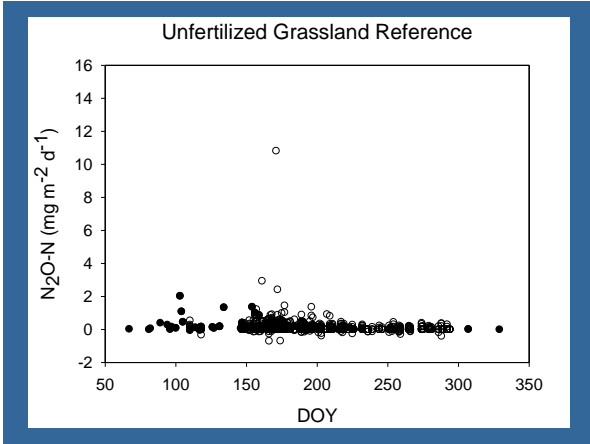
Gas sampling resumed in January

Does variable-rate N application affect N_2O fluxes during winter and early spring?



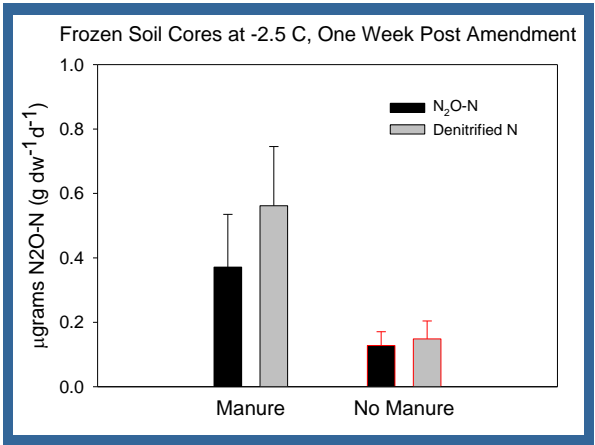
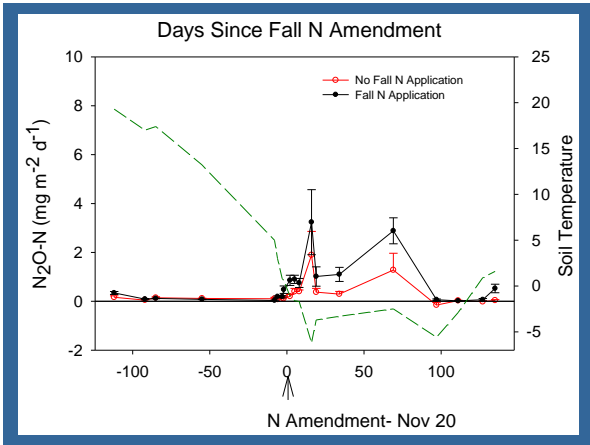
Crookston Summary

- Did variable-rate management result in lower N inputs? Yes.
- Did yield vary with N application? No.
- Did N application rate affect N_2O fluxes? No.



Does N addition in late-fall influence N₂O flux?

- Organic growers typically apply manure in fall.
- RRV soils typically stay frozen from late-Nov through March (no thaw)
- Will soils denitrify at sub-zero temperatures?



Conclusions

Variable rate N application does not necessarily result in lower N inputs and lower N₂O emissions

Denitrification occurs in winter, even at sub-zero soil temperatures

An incremental increase in N fertilizer

- does not necessarily increase yield
- does not necessarily increase N₂O emissions

Thank you for your attention

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