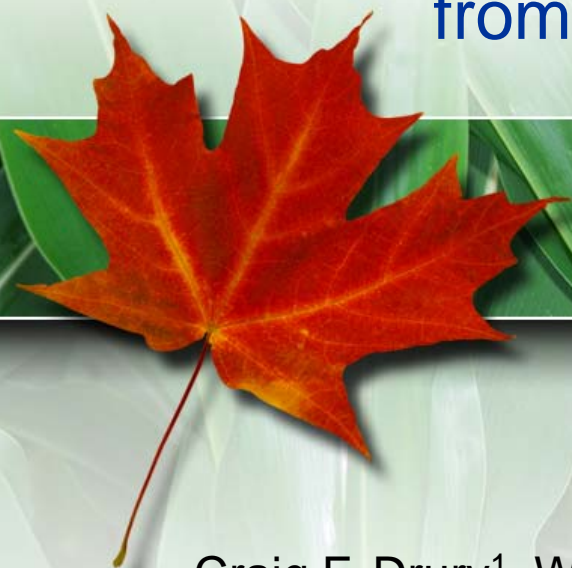




Agriculture and
Agri-Food Canada

Agriculture et
Agroalimentaire Canada

Reactive Nitrogen Transformations and Losses from Agricultural Soils

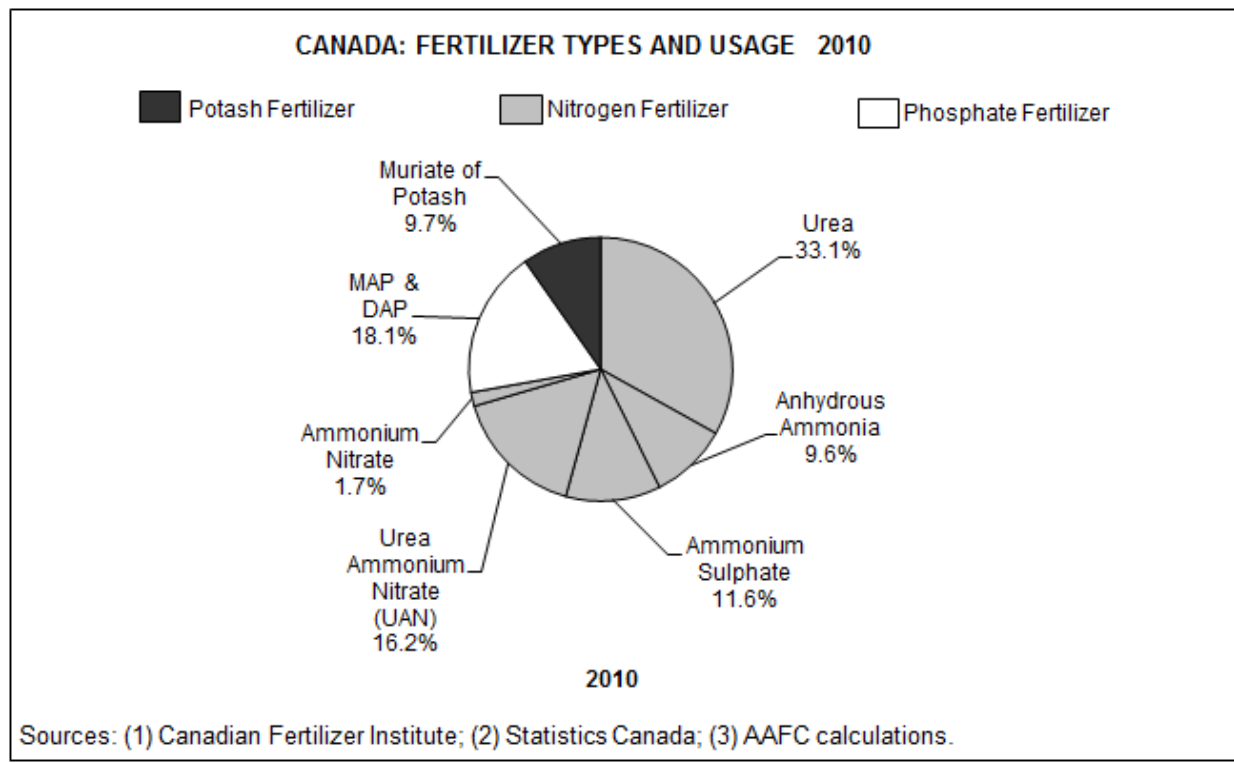


Craig F. Drury¹, W. Dan Reynolds¹, Chin S. Tan¹, Xueming Yang¹, Neil B. McLaughlin² and Jingyi Yang¹

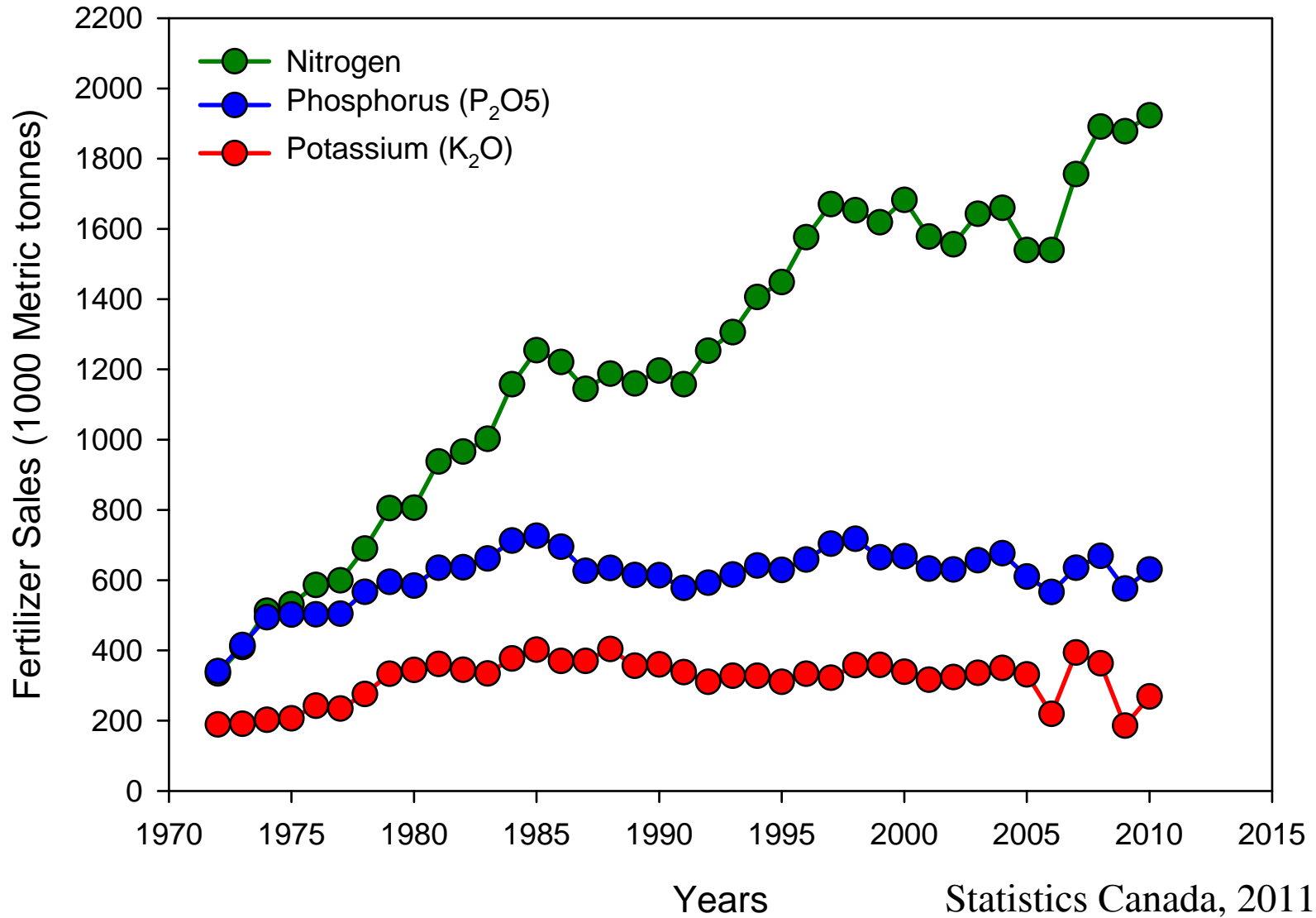
1. Greenhouse and Processing Crops Research Centre, Agriculture & Agri-Food Canada, Harrow, ON, Canada
2. Eastern Cereal and Oilseed Research Centre, Agriculture & Agri-Food Canada, Ottawa, ON, Canada

Canadian Fertilizer Facts

- ✓ Nitrogen fertilizers account for 72% of the total fertilizer usage in Canada (2010)
- ✓ 4.2 Million tonnes of N fertilizer were sold/applied in Canada (2010)
- ✓ Fertilizer expenses in Canada were estimated at \$4.4 billion (2011)

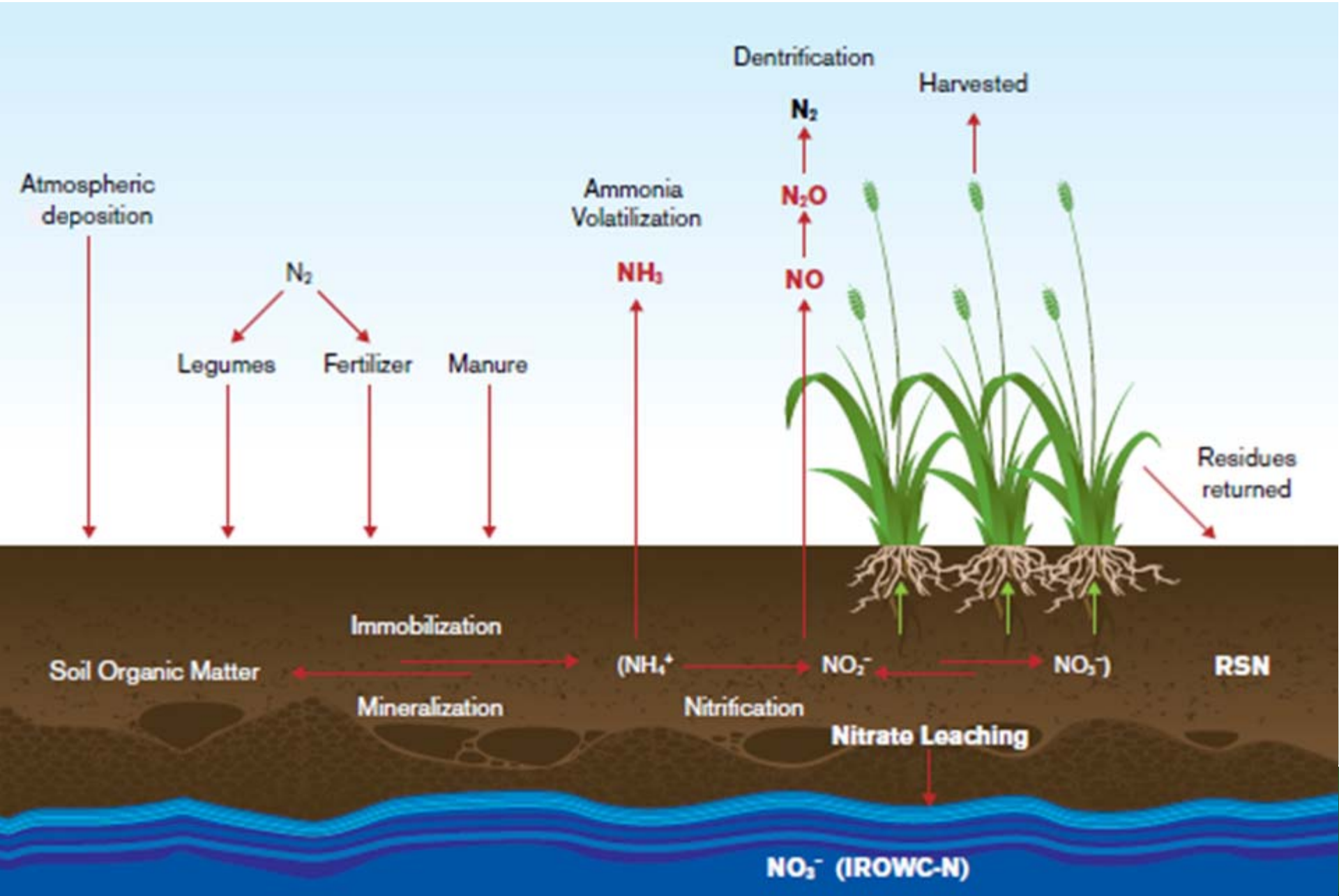


Canadian Fertilizer Sales

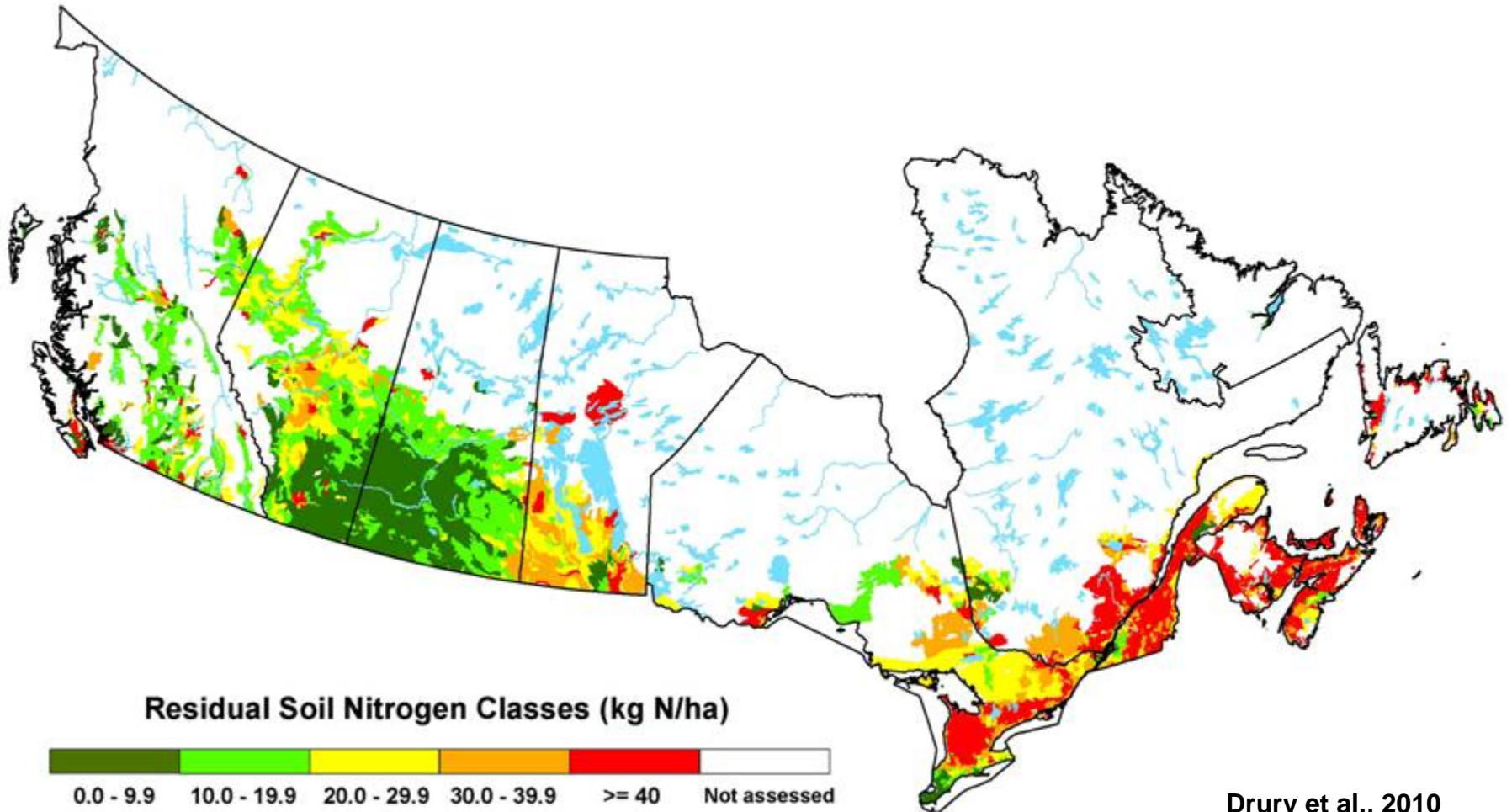


Statistics Canada, 2011

The Soil Nitrogen Cycle



Residual Soil Nitrogen (2006)



Drury et al., 2010

Objectives

1. To determine the amount of ammonia lost following sidedress N application.
2. To determine the effectiveness of injecting or streaming N application in reducing NH_3 volatilization losses compared to broadcast application.
3. To evaluate the ability of urease and nitrification inhibitors to reduce NH_3 volatilization and N_2O emissions.



Ammonia Volatilization Study

Treatments:

Application Methods

1. Broadcast Application
2. Injection
3. Streaming

Fertilizer Nitrogen Sources

1. Urea or UAN
2. Urea or UAN + Urease Inhibitor
3. Urea or UAN + Urease & Nitrification Inhibitor



Injecting UAN Solution



Broadcasting Granular Urea



Streaming UAN



Measuring Ammonia Volatilization with Wind Tunnels



Air Sampling at the Entrance of the Wind Tunnel

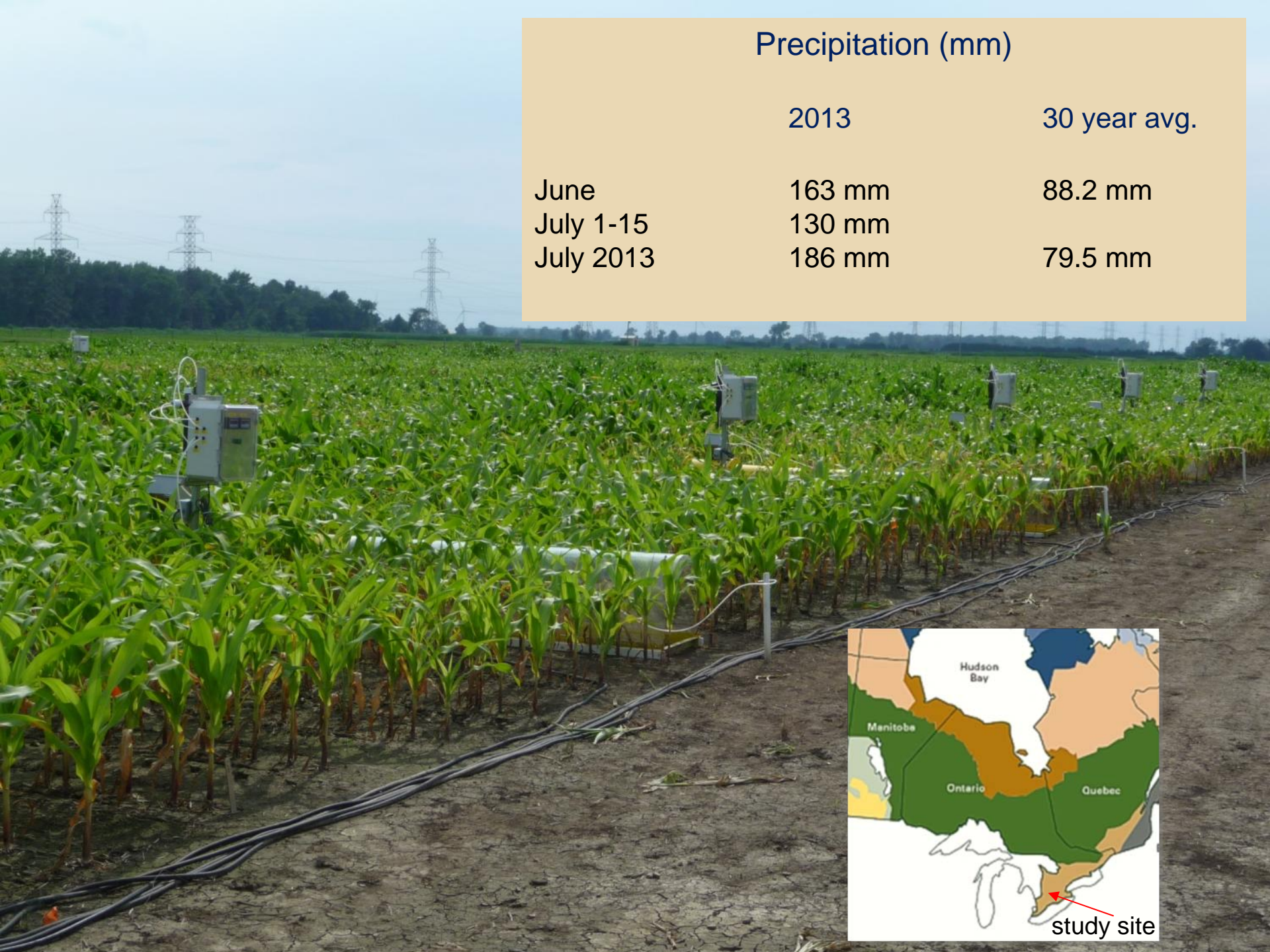


Wind Tunnel & Air Sampling Instrumentation



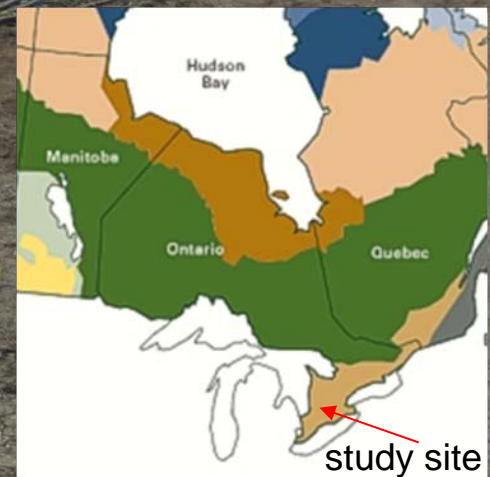
Brookston clay loam soil:
Orthic Humic Gleysol



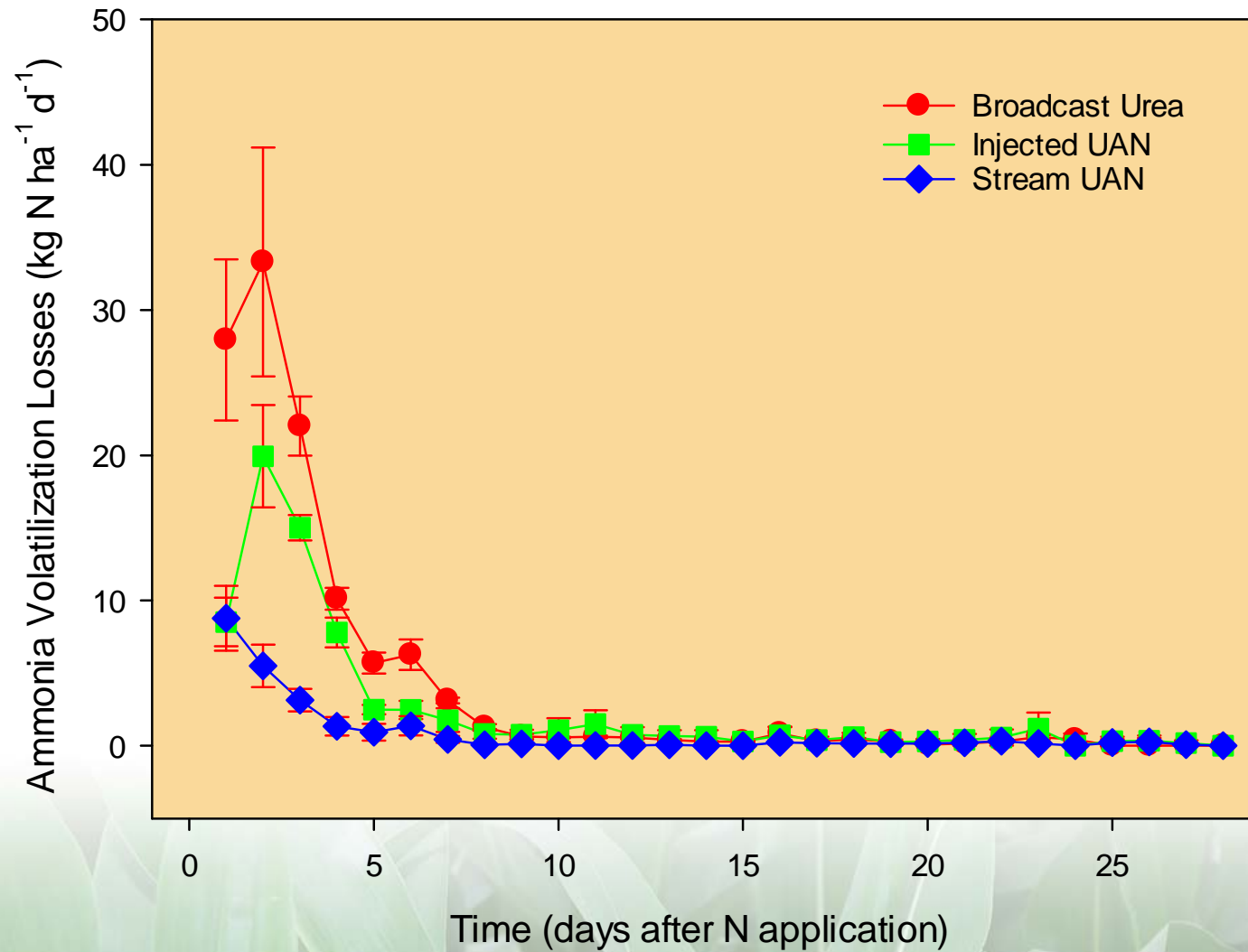


Precipitation (mm)

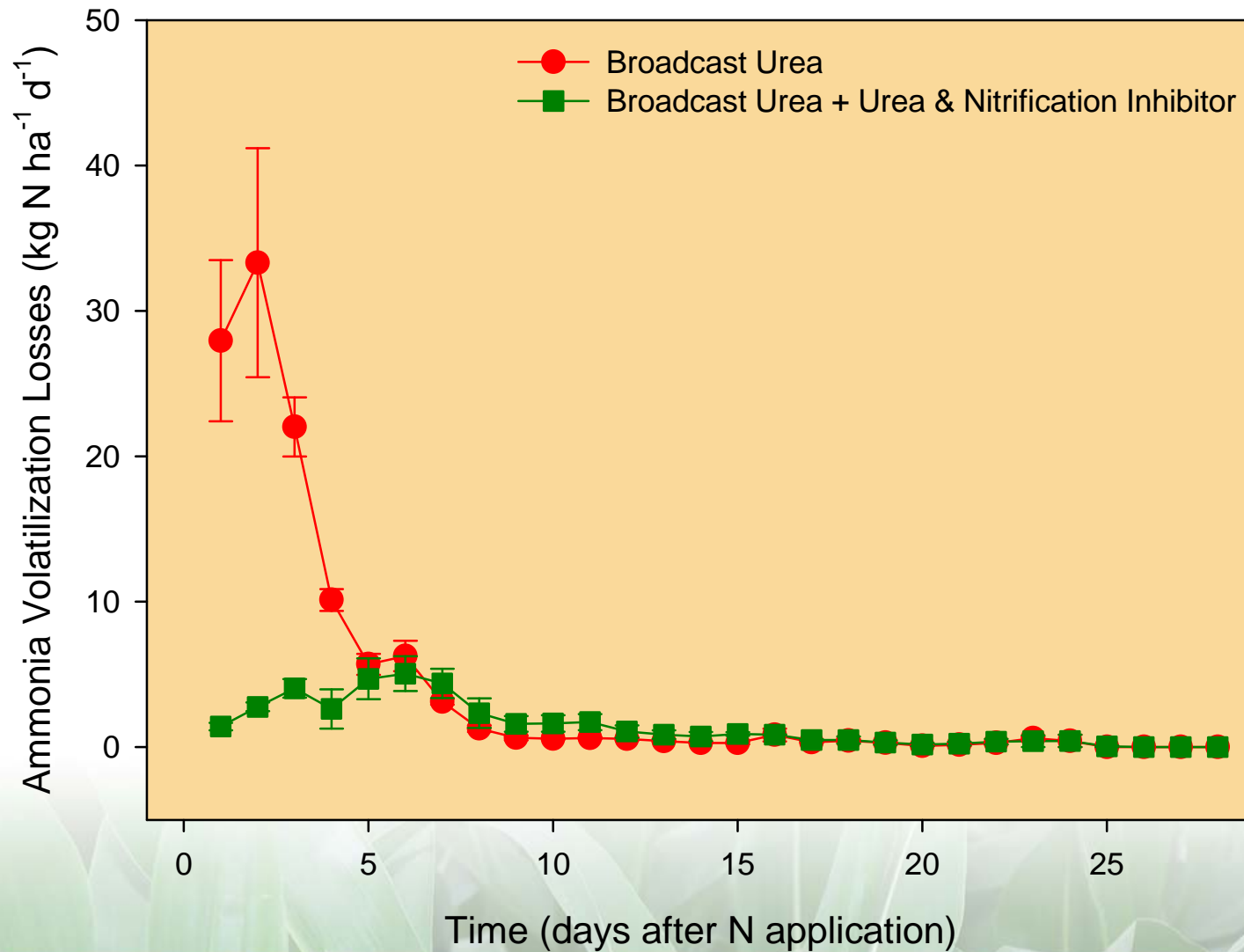
	2013	30 year avg.
June	163 mm	88.2 mm
July 1-15	130 mm	
July 2013	186 mm	79.5 mm



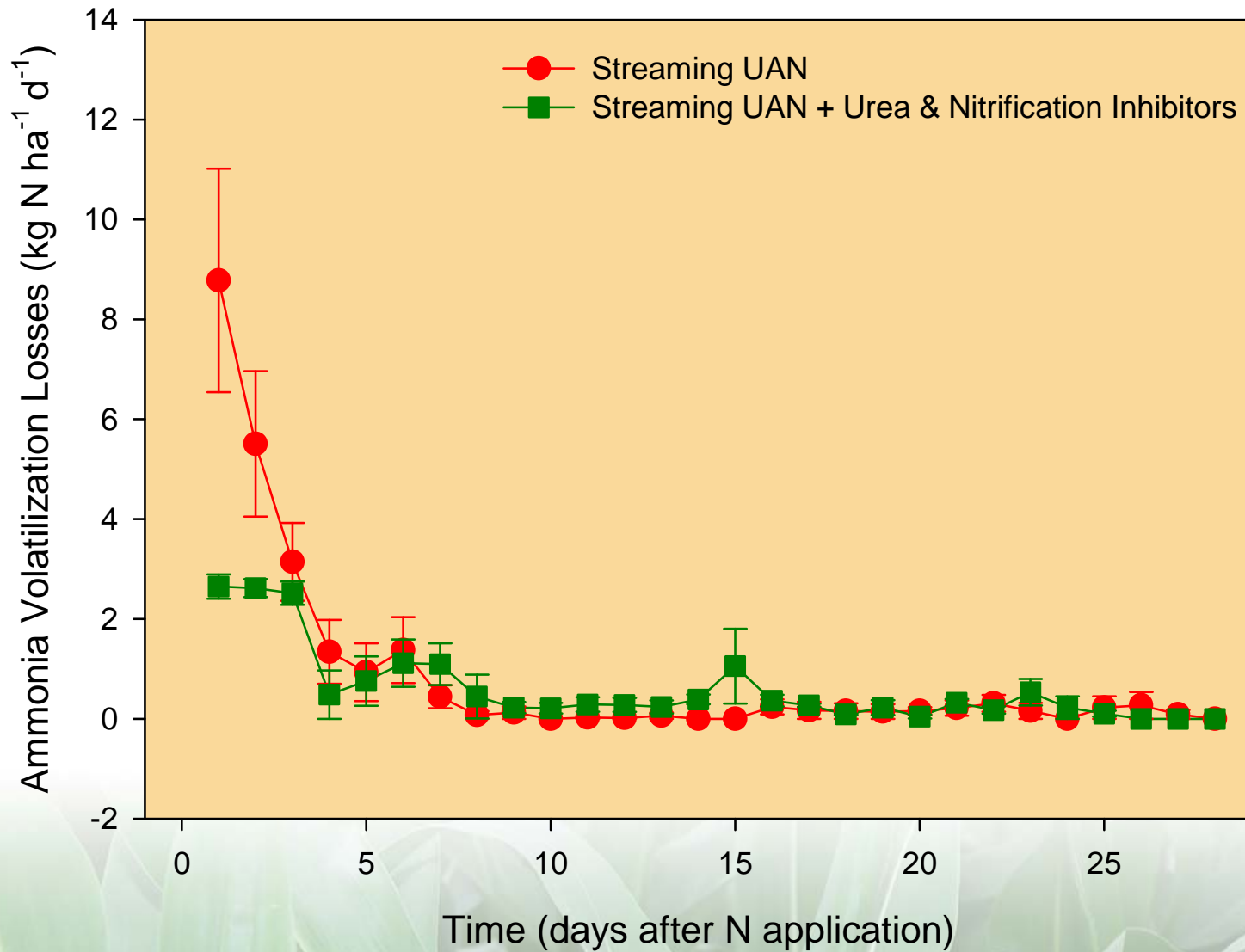
Ammonia Volatilization



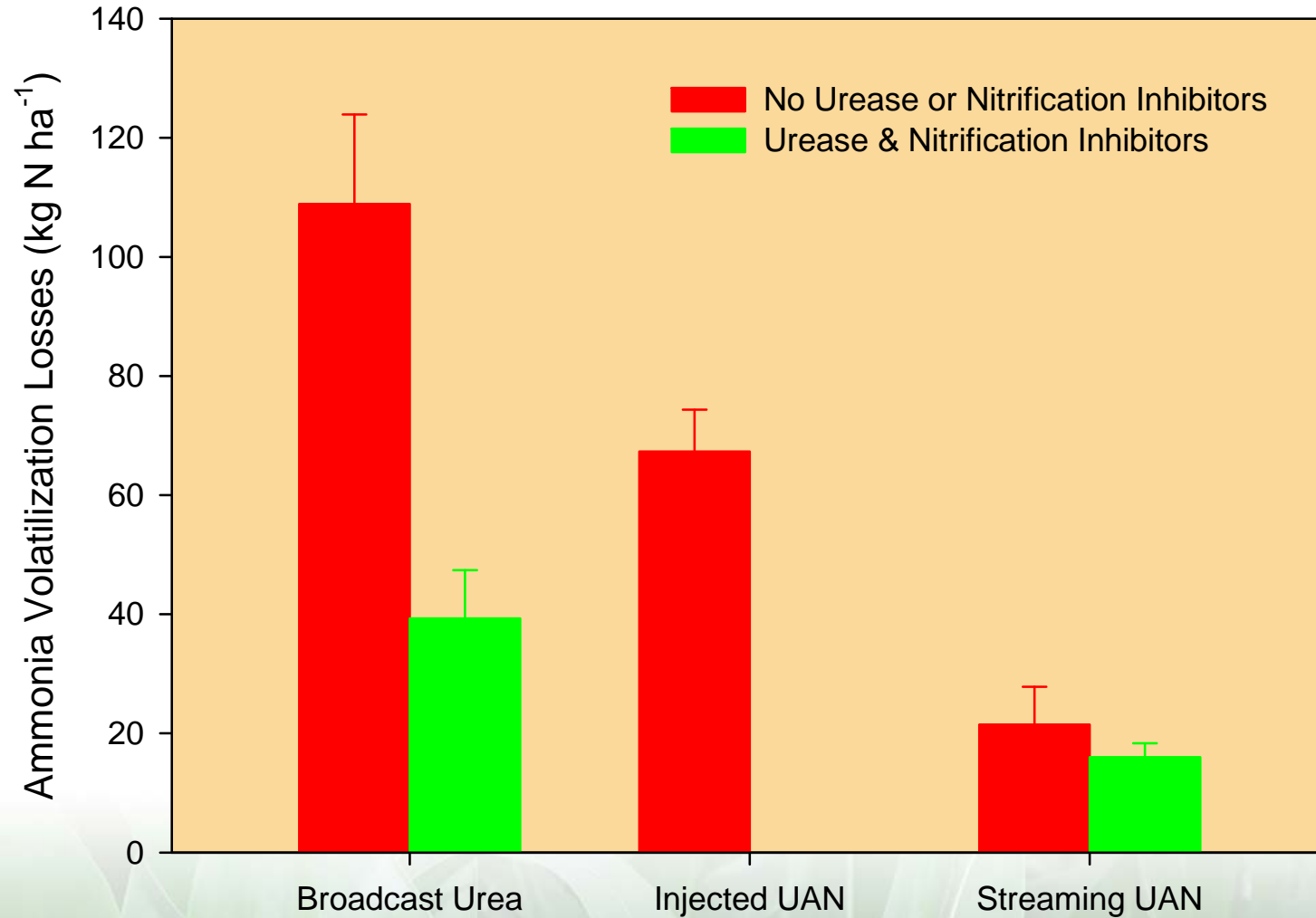
Ammonia Volatilization

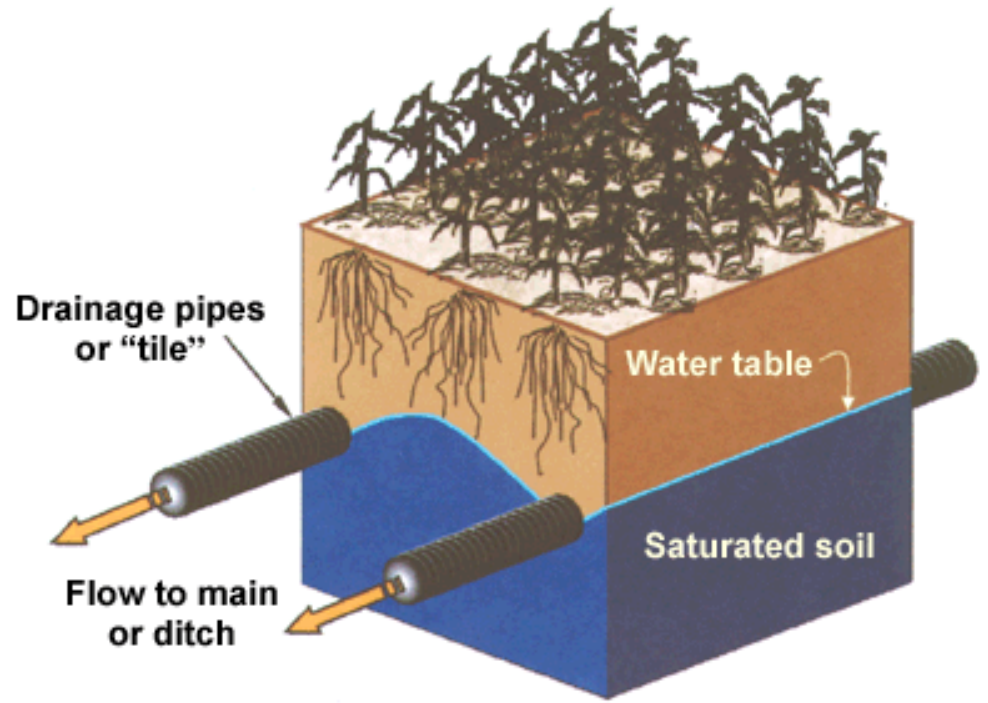


Ammonia Volatilization



Total Ammonia Volatilization Losses

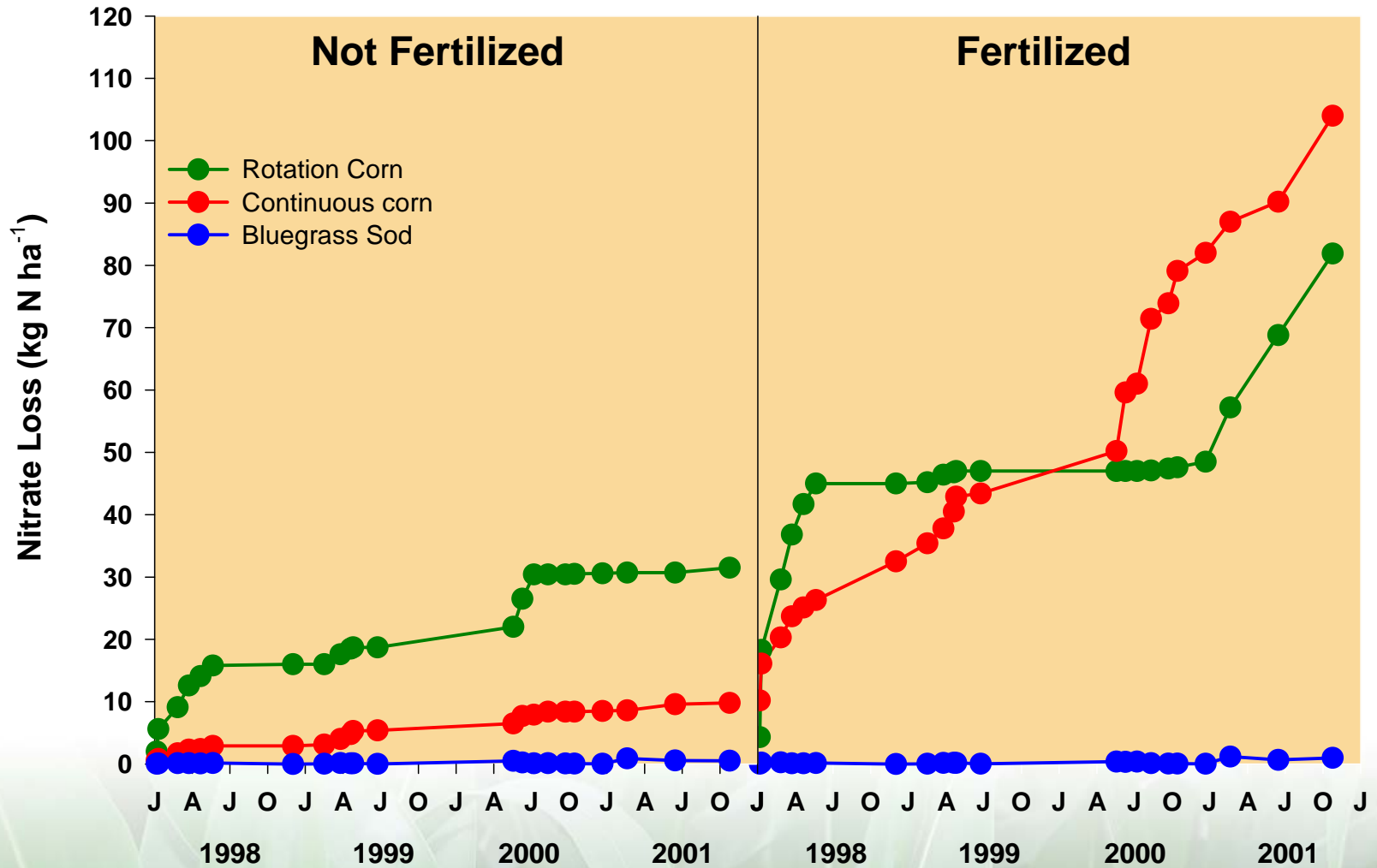




Courtesy of L. Busman and G. Sands,
Extension Dep't., University of Minnesota, 2002



Nitrate Loss in Tile Drainage Water



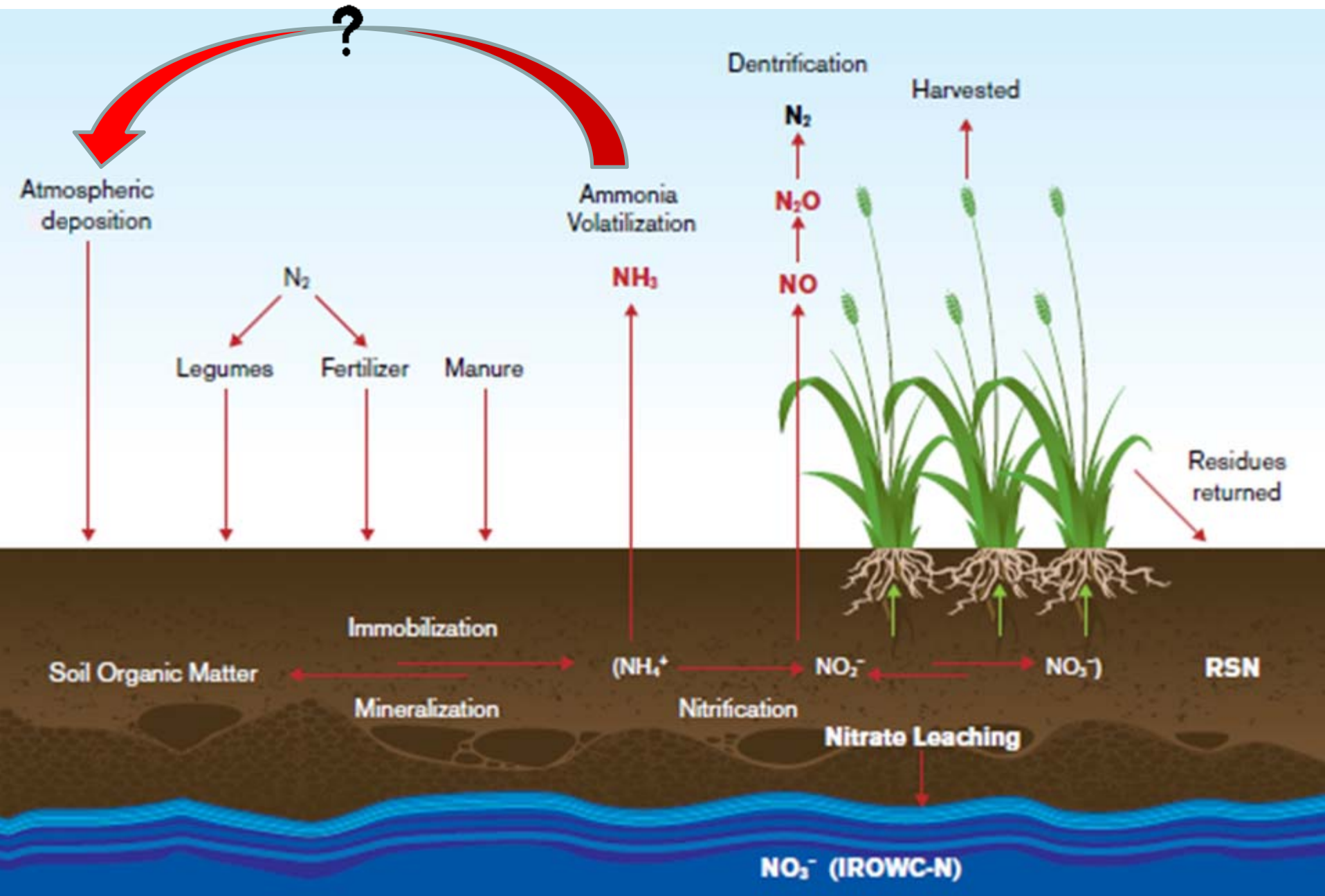
Tan et al., (2002)

Summary

- Reactive N can be lost from the soil via NH_3 volatilization, leaching and N_2O emissions.
- Broadcasting urea can lead to very high NH_3 losses under warm, windy and humid conditions (i.e. SW Ontario climatic conditions).
- Ammonia volatilization was effectively reduced with both UAN injection and streaming UAN as compared to broadcasting urea.
- Urease inhibitors were also found to be effective at reducing NH_3 volatilization losses.

NB: These results are based on 1 growing season only – so these results should be considered as preliminary.

The Soil Nitrogen Cycle



Thank you!

