Some thoughts about effective fertilizer usage and fertility management

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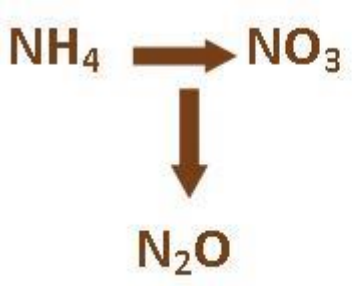
U of A researchers make discovery that has impact on climate change research

http://edmontonjournal.com/storyline/u-of-a-researchers-make-discovery-that-has-impact-on-climate-change-research

Edmonton Journal: Published August 23, 2017

ammonia-oxidizing microbe *Nitrospira inopinata*



U of A researchers make discovery that has impact on climate change research

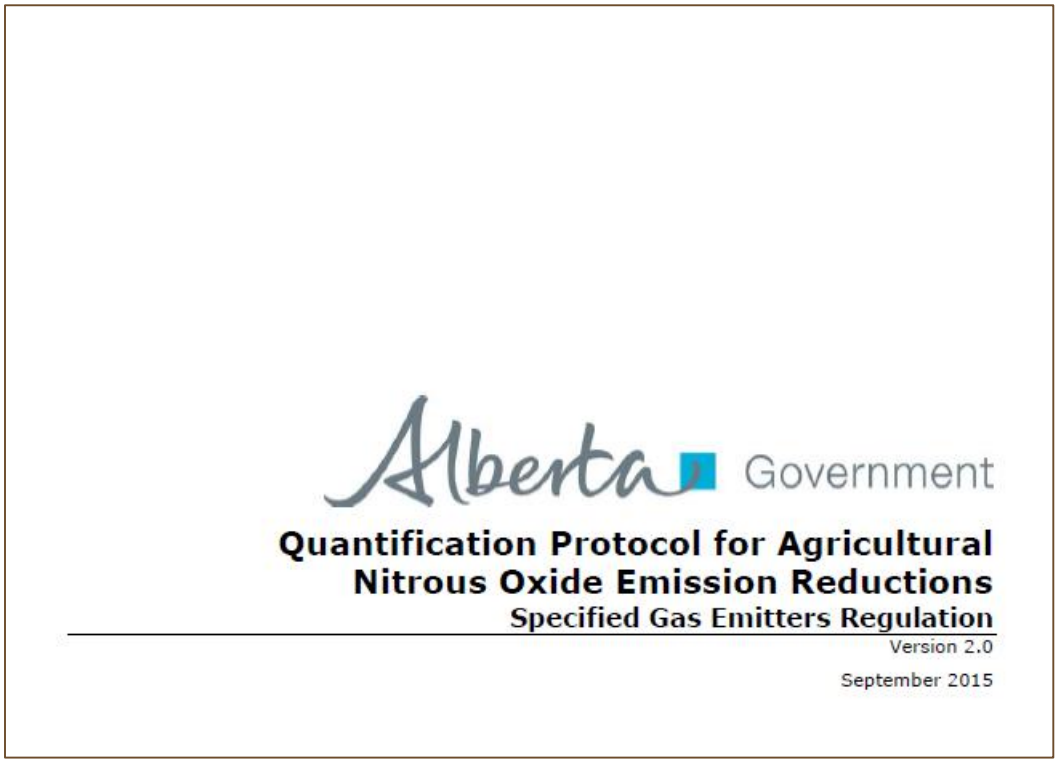
“Up to 95 per cent of applied fertilizer isn’t delivered to the plant,” she said. Instead microbes start chewing on the fertilizer releasing nitrous oxide into the environment. The new discovery could help mitigate this problem.

She said remedying the problem will involve changing behaviours, such as over fertilization in the agricultural industry.

“You can’t just change the microbes and expect the earth to be all right, you have to stop the feeding.”

Lisa Stein, Professor of Biology, University of Alberta

Fertilizer N lost as N_2O



http://aep.alberta.ca/climate-change/guidelines-legislation/specified-gas-emitters-regulation/documents/ProtocolNitrousOxideReductions-Sep2015.pdf

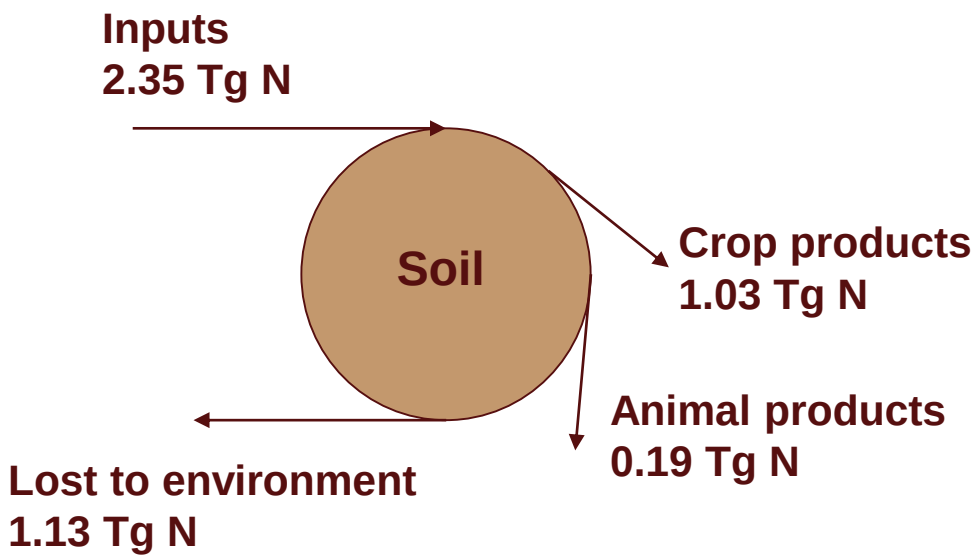
Fertilizer N lost as N_2O

- **Nitrous oxide reduction protocol**
  - **"Ecodistrict", precipitation/evapotranspiration factors**
  - **Low of 0.295%, High of 1.395% fertilizer N lost as N_2O-N**
  - **Irrigated lands all 1.7% fertilizer N lost as N_2O-N**
- **Latest estimates*:**
  - **0.33% fertilizer N lost as N_2O-N (Black soil)**
  - **0.16% fertilizer N lost as N_2O-N (Brown and Dark Brown)**

N_2O losses from fertilizer <<<< 95% of application

*Philippe Rochette, Chang Liang, David Pelster, Onil Bergeron, Reynald Lemke, Roland Kroebel, Douglas MacDonald, Weikai Yan, Corey Flemming, 2018. Soil nitrous oxide emissions from agricultural soils in Canada: Exploring relationships with soil, crop and climatic variables, Agriculture, Ecosystems & Environment, Volume 254, 15 February 2018, Pages 69-81, ISSN 0167-8809, https://doi.org/10.1016/j.agee.2017.10.021. (https://www.sciencedirect.com/science/article/pii/S016788091730467X)

Over fertilization?

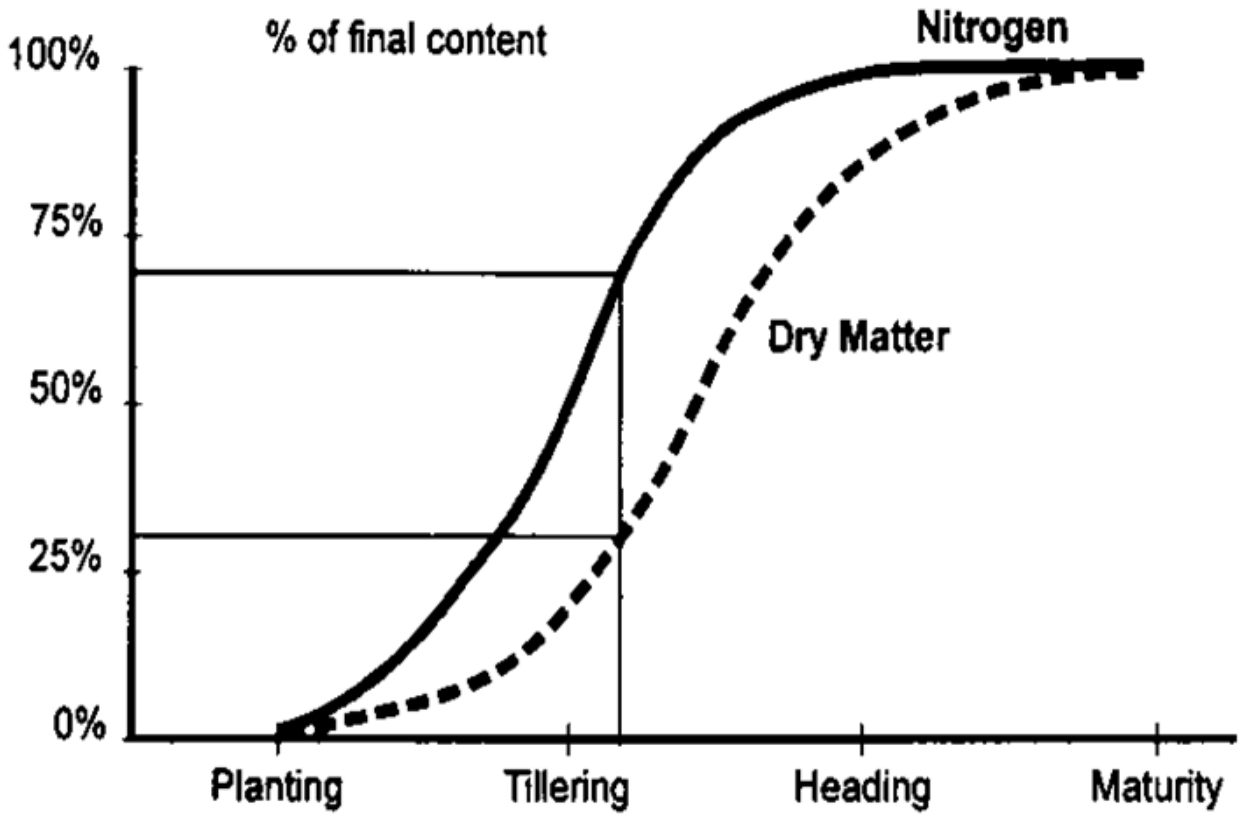


Janzen, H. H., Beauchemin, K. A., Bruinsma, Y., Campbell, C. A., Desjardins, R. L., Ellert, B. H., & Smith, E. G. 2003. The fate of nitrogen in agroecosystems: An illustration using Canadian estimates. *Nutrient Cycling in Agroecosystems*, *67*(1), 85-102.

Crop N uptake and potential for loss

- The longer N is sitting in soil as nitrate waiting for crop uptake, the greater the potential for loss
- In theory, if you can deliver N so it is available for uptake when the crop needs it, you should minimize loss potential and maximize N recovery

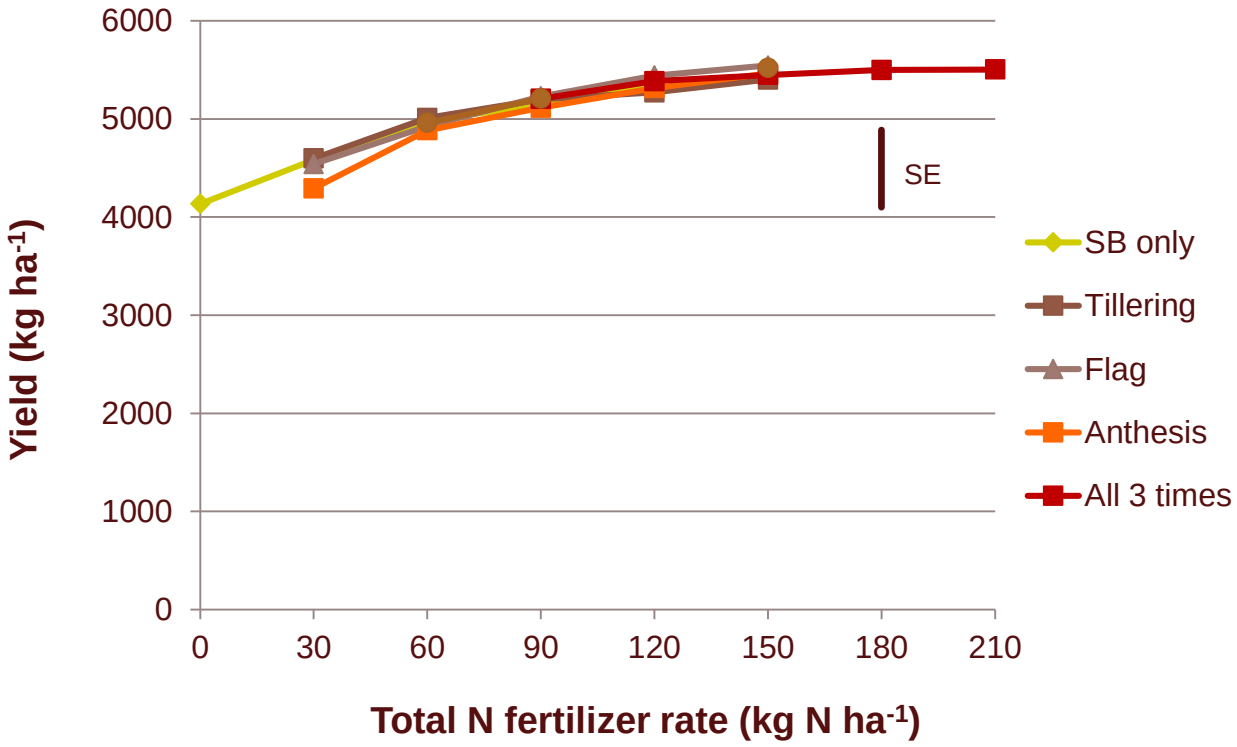
Nitrogen uptake and dry matter accumulation in cereals



Wheat and canola response to fertigation

- Base fertilization: 0, 30, 60, 90, 120 kg N/ha side-row banded at seeding
- ESN mid-row banded at 60 kg N/ha
- 30 kg N/ha fertigation applied with 12 mm water at 1 of 3 times or all 3 times

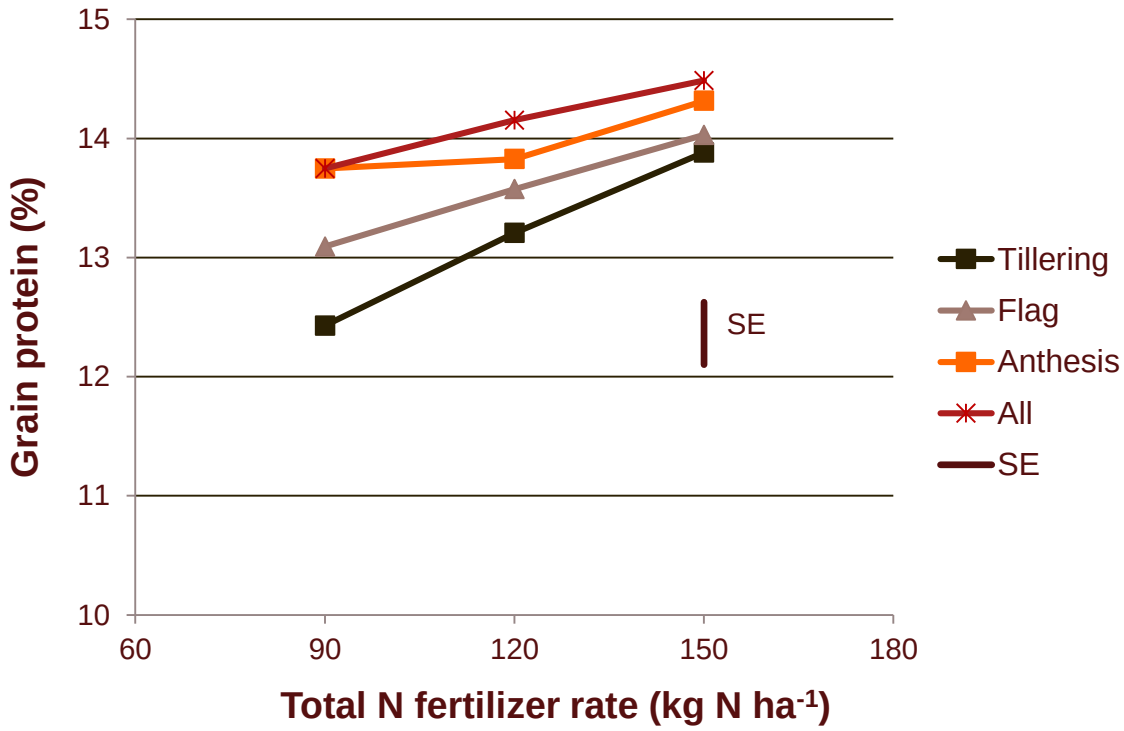
Wheat yield response to N, 2013-2016



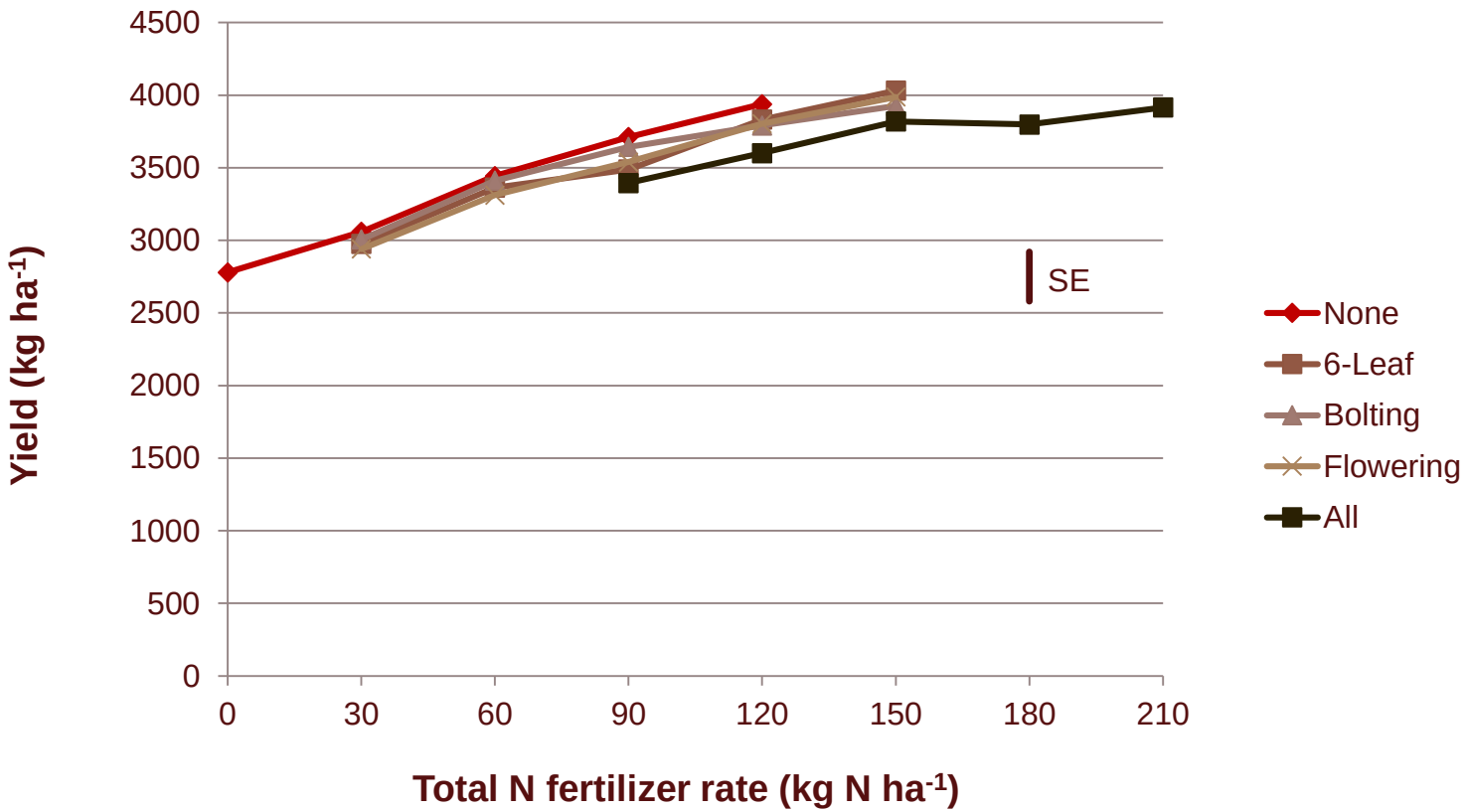
Effects of side-banded N only and single fertigations on wheat yield, protein, and N uptake averaged across 30 to 120 kg N/ha

Fertigation	Yield (kg/ha)	Protein(%)	N uptake in grain (kg N/ha)
None	5016	12.5 C	110
Tillering	5019	12.6 BC	111
Flag	5033	13.0 AB	115
Anthesis	4901	13.6 A	117
Standard Error	806	0.6	

Wheat protein response to 90 to 150 kg N/ha from one fertigation at three application times, or fertigation at each application time 2013-2016

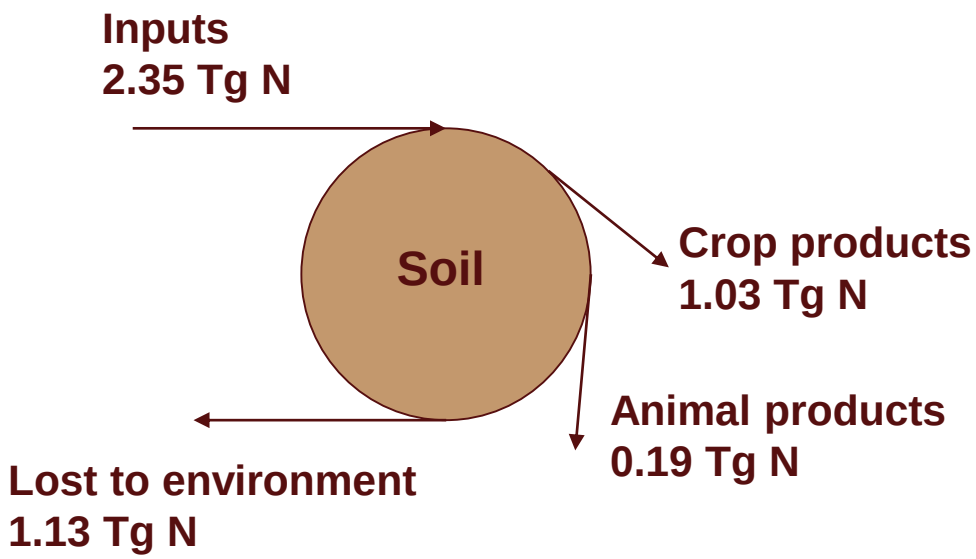


Canola yield response to N 2013-2016



UAN application timing on beans

Efficient fertilizer N and soil N utilization



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The Birch effect

- **Drought followed by rewetting produces rapid mineralization and a spike in soil NO_3**
- **Often occurs with a dry August followed by late August/early September rain**
- **Undesirably high soil NO_3 going into winter**
- **How do you manage fall irrigation?**
    - Keep soils from prolonged drying?
    - Delay irrigation until soils are cooling?
    - Post harvest irrigate but plant ground cover?

Summary/Conclusions

- Potential urban perception that agriculture uses N fertilizer inefficiently with deleterious effects on environment
- N is lost from our production systems
- N delivered to the crop as it is needed can improve fertilizer efficiencies, but many questions remain
- Fertility management is much more than fertilizer management

Acknowledgements

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