Impact of Manure Timing on Nutrient Availability and Nitrogen Loss
(Oxford SCIA 2008 Major Grant)

Purpose:

To assess the nutrient availability (yield) and nitrogen loss from manure and commercial nitrogen applied to winter wheat crops in early spring.

Manure application to various crops in the rotation is an alternative to applying all manure ahead of a corn crop. Potential nutrient loss, compaction, labour, time and/or equipment limitations as well as land availability and manure storage requirements make manure application to crops other than corn an economic alternative.

There are many questions that remain about nutrient availability based on time of application and about potential nitrogen loss based on method of application, incorporation and weather conditions.

Predicting manure nutrient availability has traditionally been based on nutrients available for a corn crop (mid June to mid August uptake), but when applied to winter wheat (mid May to late June uptake) availability appears to be lower. This is likely due to cooler soil conditions, but may also be associated with ammonia loss. This project will focus on manure nutrient availability compared with nitrogen ammonia loss when various types of manure are applied to winter wheat in early spring.

Methods:

- 2 replicate randomized field scale plots
- Manure was applied to winter wheat at 4 locations and various forms of commercial nitrogen (including ESN) was applied at 1 location.
- Manure types applied included solid poultry (layer and broiler), liquid hog, liquid dairy
- Surface applied manure application was compared to surface applied commercial nitrogen (applied as close together as possible) at rate that would provide the same total nitrogen. As well each site had a two-thirds manure 1/3 commercial N treatment.
- Nitrogen loss was measured at application using dosimeter tubes (ammonia traps) while nutrient uptake was measured based on yield. Crop quality was also assessed by wheat quality samples and field lodging
- Ammonia traps – dosimeter tubes, set 1 ft above the surface attached to rebar and covered with a somewhat perforated white pail (12 to 14 per field) were set up seconds after manure and/or nitrogen application to each treatment. Tube readings were taken every day for 10 days after application.

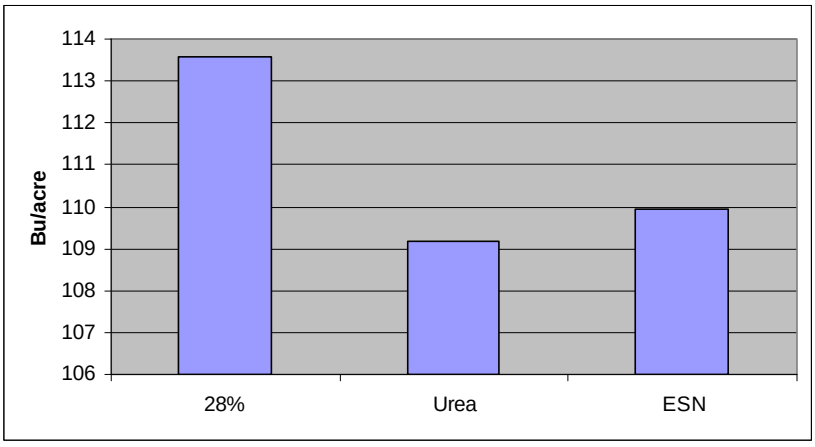
Replicated treatments at each site included:

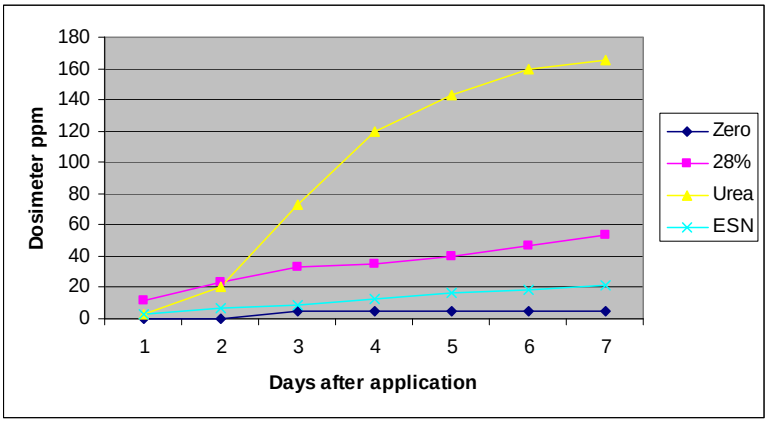
- 90 lbs N as manure
- 90 lbs N as commercial N
- 60 lbs N as manure, 30 lbs as commercial N
- No manure or commercial N

All manure and commercial nitrogen
was applied between April 19th and 25th under warm dry conditions (with no rainfall)

Results:

Site 1**: Commercial Nitrogen Comparison: ESN, Urea, 28% UAN, No Nitrogen**

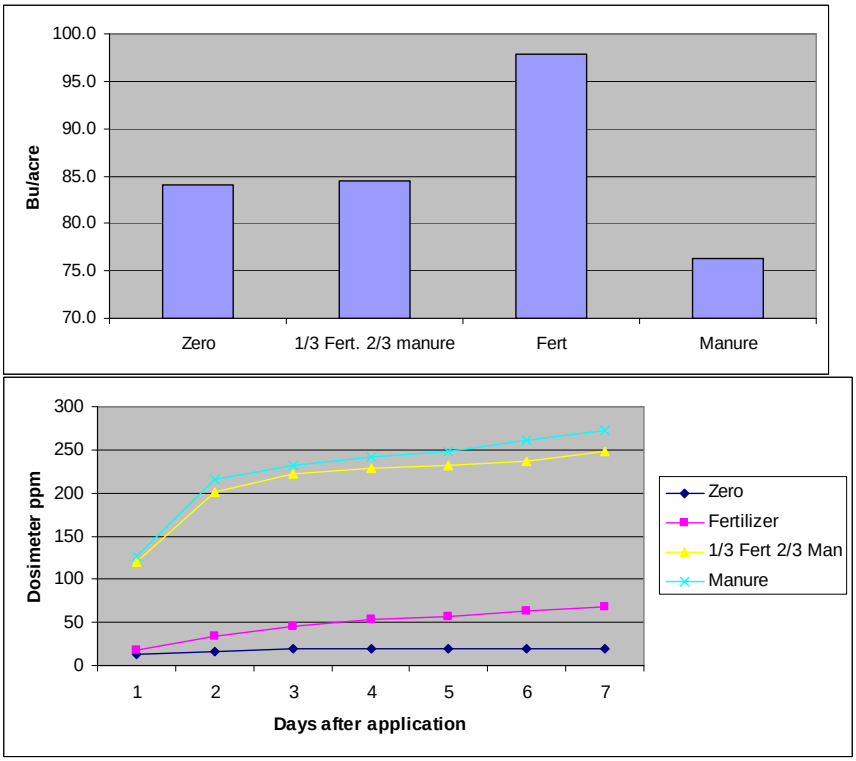




Comments:

28% gave the highest yield, consistent with previous urea vs 28% comparisons. Ammonia losses from 28% were higher than ESN, but much lower than urea. Ammonia losses from urea are surprisingly high, however final yield was equal to that of ESN.

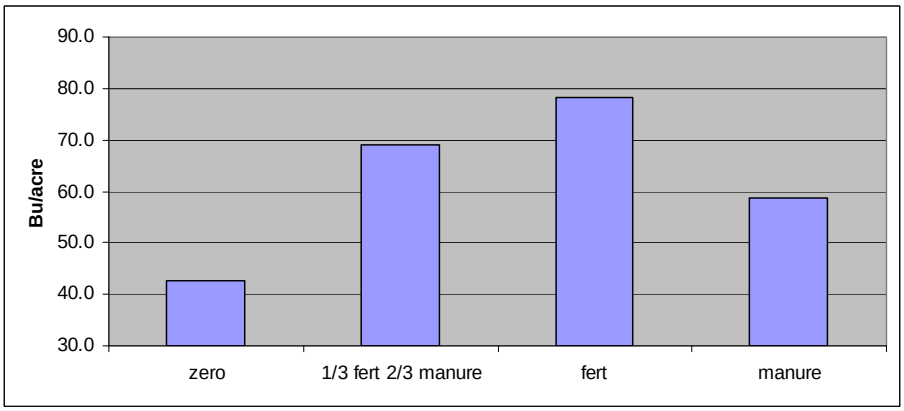
Site 2: Liquid Dairy Manure compared to 28%

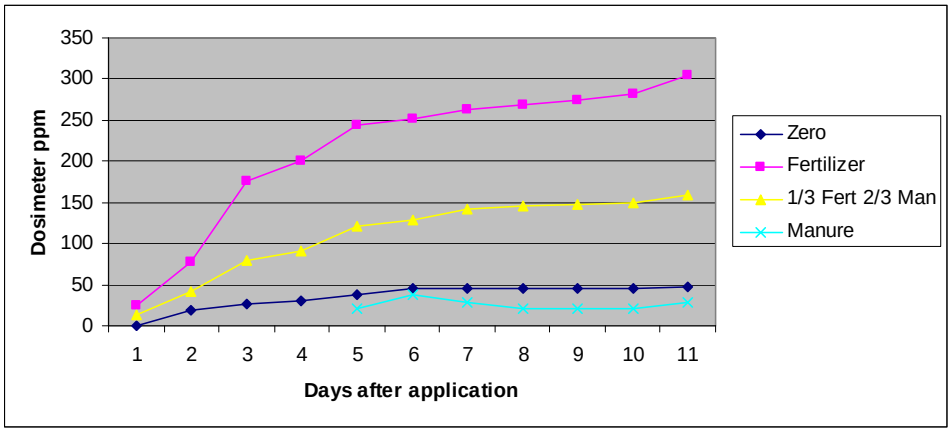


Comments: The no nitrogen control treatment was applied to only a 100 x 30 ft section of the field. The yield from this treatment may not accurately reflect a field scale yield as the other treatments were.

Site 3: Liquid Hog Manure compared to Ammonium Nitrate

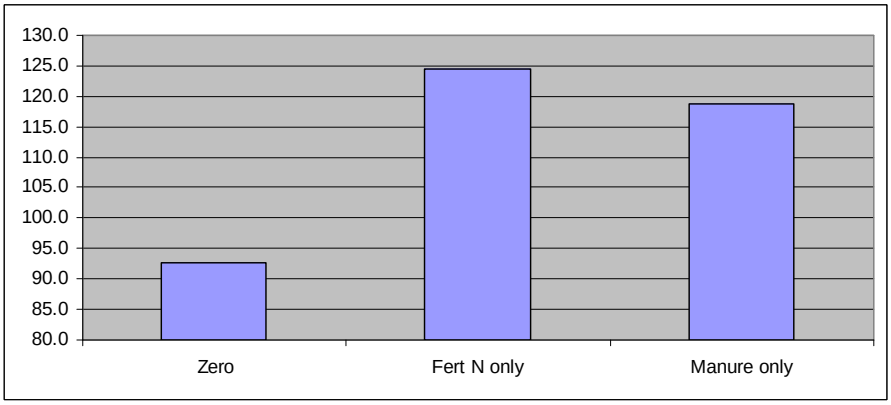
This manure was applied a few days later than the commercial N (400 lbs 34-0-15) and was more dilute than expected, therefore only about 35 lbs of available N was applied to the manure only treatments

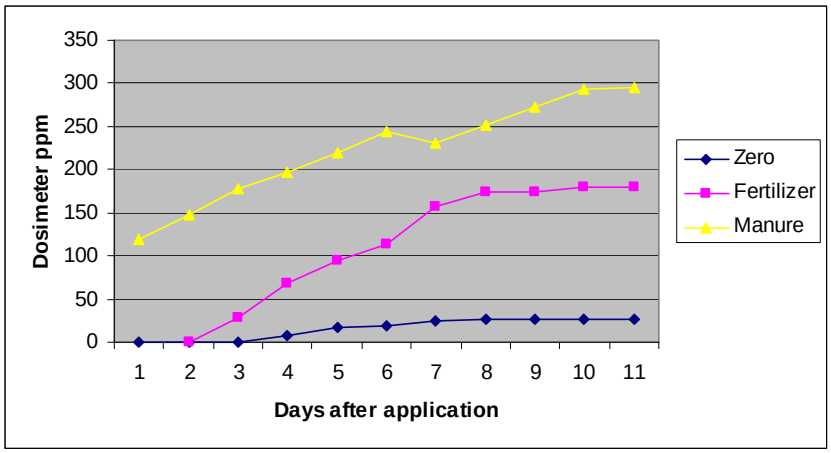




Comments: Yield response demonstrates a typical nitrogen response yield curve, assuming the 35 pounds of nitrogen in the manure was all available to the wheat crop. Most surprising is the ammonia loss from the Ammonium Nitrate, which would require some factor to drive the reaction backwards from ammonium to ammonia. High soil pH may partially explain this outcome, but it is hard to believe that this is the total reason.

Site 4: Solid Broiler Manure compared to Urea





Comments: Significant lodging occurred during grain fill on the manured treatments, which may explain the lower yield compared with commercial fertilizer. It is unfortunate that the 2/3rd manure 1/3rd commercial fertilizer treatment was omitted at this location.

Summary:

From this data set, application of manure on wheat gives variable results. In some instances full availability of the manure nitrogen to the wheat crop looks plausible, in other trials there appears to be almost nil contribution from manure nitrogen. Based on these results, no firm recommendations can be made.

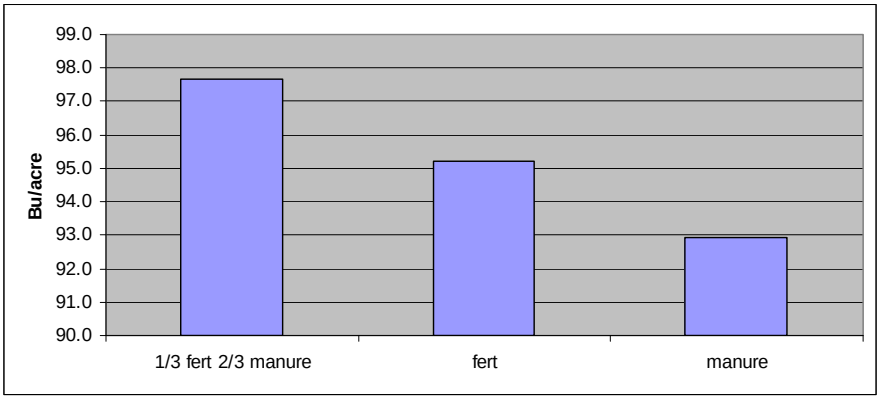
Next Steps:

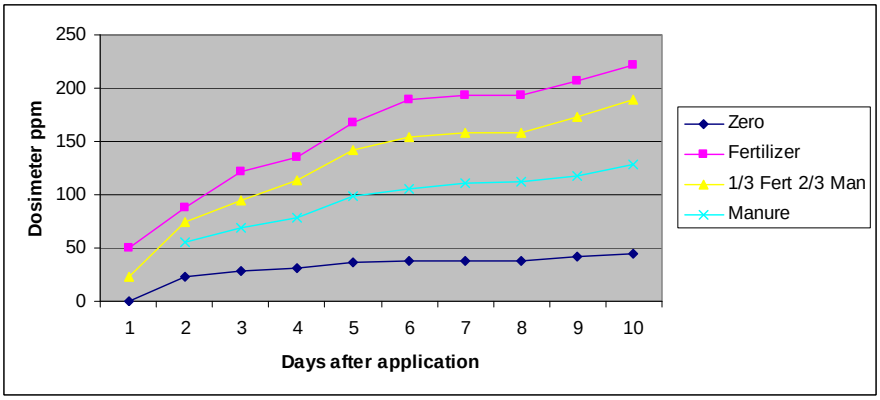
This project needs to be repeated with more sites and more data collection.

Acknowledgements:

Many thanks to all the co-operators and summer assistants Martina Pfister, Andy Schuler and Shane McClure. Thanks also to Oxford SCIA and the Ontario Wheat Producers Marketing Board for supporting this project financially.

Site 5: Solid Layer Manure compared to 28% N





Comments: Results at this site support previous field trials that show synergistic response from a combination of manure and commercial fertilizer. Ammonia loss is surprisingly high from 28% application compared to layer manure, which would be expected to have some ammonia component in the manure. Some of the fertilizer loss in this location may have been related to condensation within the pail environment, which was noted here and not at other locations. Manure ammonia loss may be reduced due to length of storage of the layer manure.

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Location of Project Final Report:

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