# Assessment of swine manure sources on nutrient losses and use efficiency under controlled environmental conditions

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## Introduction

- Canada produces approximately 180 million tons of livestock manure per year
- Livestock manure is an excellent source of N and P
- Slurry helps to improve soil health and resilience because it is a good source of organic matter to soils, which contributes to long-term soil carbon stabilization
- Improper manure management causes environmental problems
  - Greenhouse gas emission
  - Nutrient runoff
  - Water eutrophication

**Dietary modifications can lower manure N content, potentially reducing $N_2O$ emissions and lower manure P content, mitigating leaching and runoff risks**

## Objectives

- To determine the effect of dietary strategies on
  1. $N_2O$, $CH_4$ and $CO_2$ emissions from manured soil
  2. Nutrient (N & P) runoff potential from manured soil
  3. Wheat crop growth, N and P uptake and efficiencies

## Manure treatments

**1st feeding trial – N and P levels in diets**

Low N, Low P (LN-LP)
Low N, Normal P (LN-NP)
Normal N, Low P (NN-LP)
Normal N, Normal P (NN-NP)

**2nd feeding trial – Enzyme additive diets**

Positive control -Normal Soybean meal, Fat, Protein
Negative control (NC)- Low Soybean meal, Fat, Protein
NC + Protease
NC + Xylanase
NC + Protease + Xylanase
NC + (Protease + Xylanase – encapsulated)

## Proposed Methodology

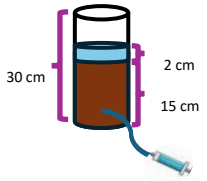
### Study 1 – Incubation experiment

Sandy soil (500g) + Swine slurry treatment

Incubate at 20°C for 6 weeks

- CRD experimental design
- Headspace gas samples collected at 12 time points (to measure $N_2O$, $CH_4$, $CO_2$, $O_2$)
- Daily $N_2O$, $CH_4$ and $CO_2$ flux rates will be calculated
- Soil samples were collected at the same 12 time points and will be analyzed for pH, EC, $NO_3^-$ and $NH_4^+$ contents

### Study 2 – Soil Column experiment




Incubate at 4°C for 6 weeks

- Soil columns were collected from the Carman research station fields
- RCBD experimental design
- Leachate will be collected with Rhizon MOM samplers at 7 time points and analysis for dissolved N & P, Total N, P & C, active/labile C

### Study 3 – Pot Experiment

- Wheat will be grown under controlled conditions
- RCBD experimental design
- Aboveground straw samples and grain samples will be weighed for yield assessment
- Straw will be analyzed for N, P, and C concentrations
- Soil samples will be collected post-harvest to measure $NO_3^-$, $NH_4^+$, Olsen-P, and pH

## Preliminary Results

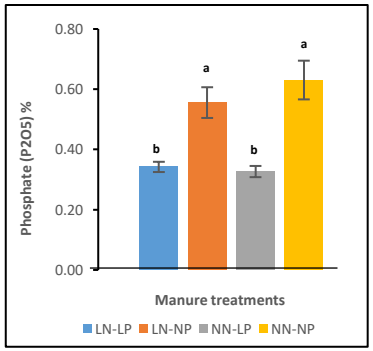



**Figure 1 : $P_2O_5$ % of manure treatments of 1st feeding trial**

- **1st feeding trial**
  - Manure $P_2O_5$ is significantly high in LN- **NP** and NN-**NP** treatments (0.56%, 0.63%) compared to LN-**LP and** NN-LP treatments (0.33%, 0.34%)
  - Manure inorganic N is not significantly different among treatments (0.42% to 0.5%)
- **2nd feeding trial** – No significant difference in either manure $P_2O_5$ (0.26%, 0.39%) or inorganic N (0.25% to 0.39%)

## References

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## Acknowledgement

Swine Innovation Porc
ManitobaPork

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