Introduction

- Livestock manure (FYM) is a valuable source of nutrients (e.g., N, P, K). However, these nutrients are normally unbalanced resulting in unsatisfactory increase in crop yield and potential nutrient losses.
- Continuous addition of FYM have resulted in high accumulation of phosphorus (P) in soils (Sharpley et al., 2004) and on changes the proportion of different P pools (Qian and Schoenau, 2000).
- Characterizing soil P pools provide essential knowledge to better manage P inputs, especially when mineral fertilizers are applied in combination with FYM (IPNM, integrated plant nutrient management).

Objectives

- Investigate the effect of P fertilization strategies: Depletion (No addition of P); Maintenance: application of P either as mineral fertilizer or FYM alone, and Increase: application of P fertilizer + FYM on different soil P fractions in a long-term experiment (50 years) based on a potato-rye-oat rotation.

Results and Discussion

- Variations in available P pool were related to changes in the readily available fraction (Resin-P). Stability of the HCO$_3$ fraction indicates the rapid replacement of P consumed by the crops.
- Variations in moderately available P pool were related to changes in the Al/Fe-P attached to the organic matter (NaOH-P$_o$) and the Ca-P (HCl-P) fractions.
- Application of FYM increases the Ca-P pool.
- Independently of the P fertilizer strategy used, no (absolute or relative) variations were observed in the non-available P pool (Residual).

**Material and Methods**

- Long-term potato-rye-oat rotation experiment established since 1958 on a Sandy soil (Haporthods) in Dülmen, NRW, Germany.
- Mineral, N, P and K fertilizers (crop removal) applied with and without FYM (25 t ha$^{-1}$ once every 3rd year to potato)
- Soil samples (0-30 cm) were collected in spring 2009 corresponding to the end of the 17th rotation.
- Total-P (Kjeldahl) and available-P (P$_{CAL}$) were determined.
- Phosphorus fractions were determined using a modified sequential extraction procedure (Tissen and Moir 2007).

**References**


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**Conclusion**

Application of FYM increased available P pool to adequate (C) level similar to the NPK fertilization (Balanced approach) without yield enhancement. Whereas, the integration of FYM with NK or NPK increased crop production and maintained/built up soil fertility.