Introduction

Management of manure phosphorus (P) is intensifying. One of the challenges facing manure P management is the variability of P content in liquid manure, both between and within storage structures. Management of phosphorus (P) in liquid pig manure may be enhanced if a rapid field test method is shown to be effective in estimating P concentrations.

Research conducted elsewhere has shown that the hydrometer method holds promise for estimating manure P concentrations (Zhu et al. 2003). Its potential lies in the relationships between a) manure P content and dry matter and b) specific gravity (measured using a hydrometer) and dry matter. Since manure P tends to associate with the solids fraction, a measurement that is sensitive to dry matter changes should reflect changes in P concentration as well. If strong numerical relationships can be established such that estimates of P content can be confidently obtained, manure application rates could be adjusted in the field or, at the very least, manure P loading could be monitored on-the-go and adjustments made to minimize P accumulation in soil.

Confirmation could then come in the form of laboratory test report after the manure has been applied.

Method

In early 2004, ~200 manure samples from more than fifty operations were collected by a pig industry co-operator from three types of operations: sow, nursery and finisher. Upon receipt by the lab, samples were either immediately tested or frozen until analysis could be performed. The samples were analyzed by Norwest Labs (now Bodycote Testing Group) using i) a field test kit hydrometer (Agros N Meter) to produce a standardized reading, ii) a laboratory grade hydrometer to produce a specific gravity reading and iii) the standard laboratory method to determine dry matter and P concentrations. Hydrometer readings were taken after samples were thoroughly mixed.

Results were analyzed by linear regression analysis as the distribution of the data indicated that any detectable relationship would be based on linearity.

Results and Discussion

The basis of the hydrometer test method for estimating P content of liquid manure is the tendency for manure P to associate with the solids portion. In the samples analyzed manure P concentrations were related to dry matter content (Fig. 1).

Field hydrometer readings related to manure P content as follows: for the pooled data R²=0.64 (Fig. 2), for sow manure an R² of 0.69 (Fig. 3), for nursery an R² of 0.21 (Fig. 4) and for finisher an R² of 0.76 (Fig. 5). Results for the lab hydrometer readings in relation to P content were: for sow manure an R² of 0.79, for nursery an R² of 0.85 and for finisher an R² of 0.56 (data not shown). The pooled result for this relationship was R²=0.58.

Zhu et al. (2003) found a very strong linear relationship between hydrometer readings and total P (R²=0.97), however, it was for a single source of nursery barn manure. The authors advised that individual regression equations should be derived from operation-specific data. It was also cautioned that error is likely to be larger at lower manure P levels. However, this is only likely to be the case with very dilute manure and agronomists are generally concerned with identifying high-P manure that must be more carefully managed. Other research has produced results that are more similar to those obtained in this study.

Conclusion

Accurate, in-field analysis of liquid manure for P content would greatly improve manure nutrient management where no extensive operation-specific data base is available and/or variability in liquid manure P concentrations is large during pump-out. The results of this study indicate some potential for using the hydrometer method to estimate manure P content and obtaining general guidance in managing manure. However, in order for an agronomist to confidently use the hydrometer method in managing liquid pig manure P, site-specific relationships must be established.

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References