

# MANUREDB: CREATING A NATIONWIDE MANURE TEST DATABASE

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## ABSTRACT

Manure nutrients serve an important role in crop production, however, compared with commercial fertilizers, there is a lack of standardized information. When exact manure values are not known, manure book values have been referenced. Recent data from midwestern United States (US) laboratories indicate manure nutrient concentrations have changed from book values published by Midwest Plan Service (Lorimor et al., 2004) and American Society of Agricultural and Biological Engineers (ASABE, 2014). The recent data includes over 80,000 samples from three midwestern laboratories. Trends, similarities, and challenges arose when comparing these samples and these observations solidified the need to update manure nutrient book values. The University of Minnesota obtained an Agriculture and Food Research Initiative (AFRI) National Institute of Food and Agriculture (NIFA) grant to create a manure nutrient database (ManureDB) to update these values using FAIR principles (Findable, Accessible, Interoperable, and Reusable). Working with a stakeholder group, the Minnesota Supercomputing Institute, and Minnesota Department of Agriculture (MDA), the project team developed a database schema, sample template, laboratory data legal agreement, data upload process, and website to support the database. The project is in the laboratory data collaboration phase, looking to add more partners and data points from various regions, animal types, production systems, and time periods. Laboratories share past manure data and annual data going forward with no customer names or addresses shared to avoid privacy concerns. Eventually, a public-facing website will show aggregate summary data for a region, animal type, or time period. With changing animal genetics, feed sources, manure handling and storage systems, climatic conditions, and improved laboratory testing, having more current manure test values will improve nutrient management planning, manure storage design, prioritization of conservation programs, and agricultural modeling.

## INTRODUCTION

When land-applied, livestock manure provides nutrients for growing crops. However, these nutrients are variable depending on animal species, age, diet, management, housing, climate, and manure storage and handling. Knowing what nutrients are contained in a certain manure can aid farmers to better match manure application to field and crop needs and reduce the risk of nutrient loss to the environment. Recent data from three midwestern United States (US) labs indicates manure nutrient data has changed from book values published by Midwest Plan Service (2004) and American Society of Agricultural and Biological Engineers (2005). Some states have also pulled together their own manure nutrient estimations. While these are helpful references, some of the values were pulled from narrow regions with few samples two decades ago. Animal nutrition, genetics, housing, and manure handling and storage continue to evolve, impacting the resulting manure analysis. This manure database project will be the largest of its kind that we are aware of in the United States. Laboratories, universities, the United States Department of Agriculture (USDA), and private agricultural businesses have all expressed interest in this data.

## **METHODS**

To compare manure nutrient data spanning the last decade, the University of Minnesota obtained over 80,000 samples from three midwestern laboratories between 2012-2021 for preliminary data for this database project. With data sorted by animal type and manure consistency (solid or liquid), those medians and ranges were compared to the published manure book values.

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## **RESULTS AND DISCUSSION**

When comparing the 2012-2021 preliminary manure data medians, trends, similarities, and challenges arose and these observations solidified the need to update manure nutrient book values. For example, in Figure 1, medians for 10,869 Midwest liquid dairy manure samples were lower for total N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O and higher for NH<sub>4</sub>-N than the published MWPS book values. While this manure database resource will give better manure nutrient estimates, this should also encourage farmers to test their manure more frequently. Fertilizer prices are higher than ever, so utilizing manure nutrients where they get the most value is of fiscal importance. With many states working on nutrient reduction strategies for water quality improvements, knowing more about manure characteristics can improve those strategic plans. Animal feeding operation regulations could be improved with updated manure book values by having better estimates of how much land would be required for new animal feeding operation construction. A new barn location could be compared to available land for manure application to prevent manure overapplication in a specific area. Knowledge of what are appropriate manure application rates for agronomic and environmental reasons can assist environmental regulators in farmer education and relevant nutrient management regulation. With more interest in carbon modeling, carbon sequestration, and carbon markets, we have received queries already for estimates of manure carbon content. Having a larger database of many manure types can create a useful resource for manure carbon reference numbers. Having more realistic numbers can improve these carbon models and programs. This database can also show us improved estimates of other less studied manure components such as chloride, which has become a water quality concern in some regions.

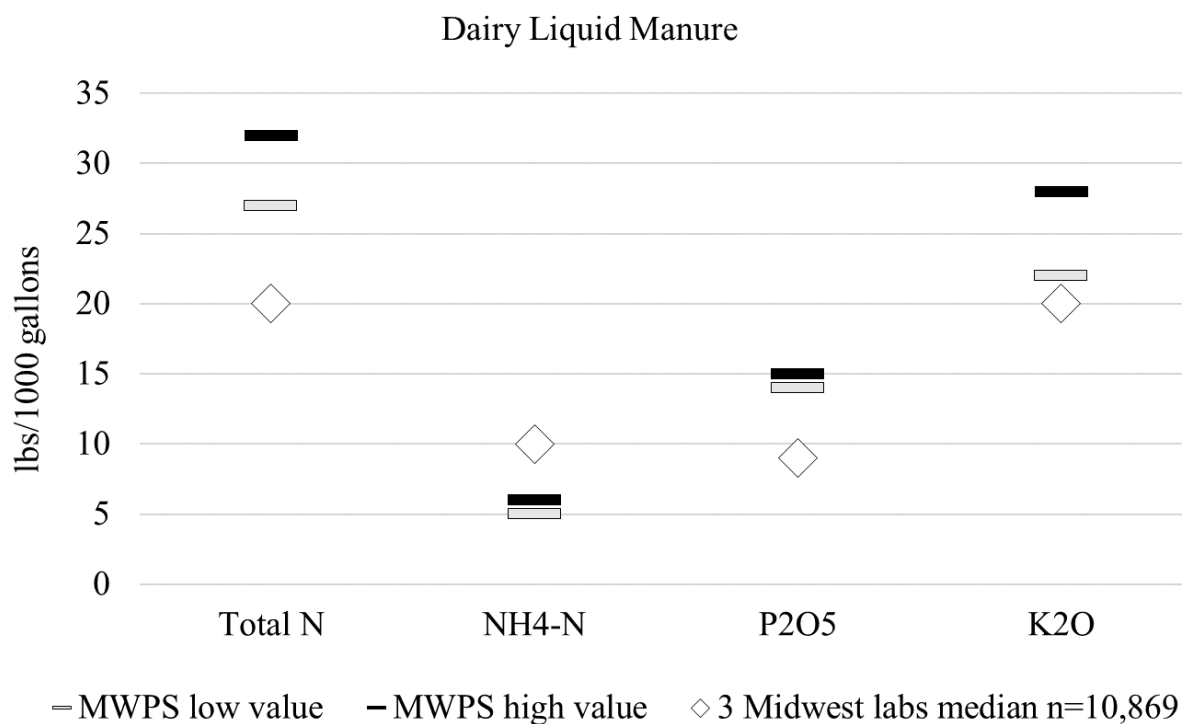


Figure 1. Comparing liquid dairy manure Midwest Plan Service book values to medians from 10,869 samples from three Midwestern laboratories between 2012-2021.

#### REFERENCES

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