Reading and Interpreting Dairy Manure Analyses

Introduction

Dairy manure contains all 17 essential nutrients for crop growth and has additional yield enhancing properties. The use of manure as a fertilizer can reduce reliance on synthetic fertilizer, increase soil productivity, enhance yield stability over time, and contribute to increased economic efficiency of dairy farming. However, over-application of manure can have negative impacts on water and air quality.

A manure analysis gives a detailed understanding of the characteristics and value of this resource. This can allow manure use to be optimized, and undesirable environmental impacts minimized (Figure 1). Agronomy Fact Sheet #38 outlines guidance for manure sample collection and submission. In the current factsheet we list what is commonly included in a manure analysis report and explain how to interpret that information.

Manure Analysis

Manure analysis reports should, at a minimum, include organic nitrogen (N), ammonium or inorganic N (NH_4-N), total N (organic + inorganic N, sometimes referred to as total Kjeldahl nitrogen or TKN), total phosphorus (P), and total potassium (K). This distinction in N forms is important because organic and inorganic N behave differently in soil and contribute differently to crop growth (additional information on manure nutrient crediting can be found in Agronomy Fact Sheet #4).

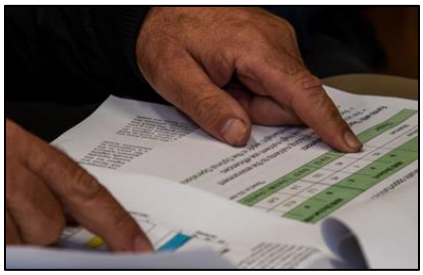

Fig. 1: Analyzing different manure sources on a farm is essential for determining cropland manure application rates.

Most laboratories offer additional testing. See the *Recommended Methods of Manure Analysis* for standardized methods for sampling, processing, and analysis of manure samples.

Interpreting Reports

Dairy manure can be categorized as a solid, slurry, or liquid based on the proportion of solids versus liquid in the manure. Manure analysis reports will report either percent solids or percent moisture. A manure sample with 12% solids has 88% moisture, and vice versa. The terms "as-received", "wet basis", and "as is" all refer to manure as it was received by the laboratory.

Nutrient content of manure can be reported as a percentage (%), pounds per ton (lbs/ton), pounds per 1000 gallon (lbs/kgal), or parts per million (ppm). Pounds per 1000 gallons is used for liquid and slurry manure (less than 10%

Table 1: Common conversions of units reported in manure analysis (adapted from Recommended Methods of Manure Analysis).

Conversion	Converting back
Percent (%) x 83.4 = lbs/1000 gal	lbs/1000 gal ÷ 83.4 = Percent (%)
Percent (%) x 20 = lbs/ton	lbs/ton ÷ 20.00 = Percent (%)
Percent (%) x 10,000 = ppm	ppm ÷ 10,000 = Percent (%)
ppm x 0.00834 = lbs/1000 gal	lbs/1000 gal ÷ 0.00834 = ppm
ppm x 0.002 = lbs/1000 gal*	lbs/1000 gal ÷ 0.002 = ppm
US ton x 2000 = lbs	lbs ÷ 2000 = US ton
Nitrate N x 4.43 = Nitrate	Nitrate ÷ 4.43 = Nitrate N
Ammonia N (NH_4-N) x 1.22 = Ammonia (NH_4)	Ammonia (NH_4) ÷ 1.22 = Ammonia N (NH_4-N)
Phosphorus (P) x 2.29 = P_2O_5	P_2O_5 ÷ 2.29 = Phosphorus (P)
Potassium (K) x 1.20 = K_2O	K_2O ÷ 1.20 = Potassium (K)

*assuming an average density of 8.34 lbs/gal

Table 2: Typical values for dairy manure in New York.

Manure type	Nutrient	Median	Lower range	Upper range
Liquid (lbs/1000gal) <4% solids	Total N	**15**	11	19
	NH_4N	**9**	6	11
	Organic N	**6**	5	8
	P_2O_5	**5**	2	8
	K_2O	**18**	13	23
Slurry (lbs/1000gal) 4-10% solids	Total N	**20**	18	24
	NH_4N	**10**	9	12
	Organic N	**10**	9	12
	P_2O_5	**8**	6	10
	K_2O	**22**	18	27
Semi-solid (lbs/ton) 11-20% solids	Total N	**6**	5	7
	NH_4N	**2**	2	3
	Organic N	**4**	3	4
	P_2O_5	**3**	2	3
	K_2O	**5**	5	7
Solid (lbs/ton) >20% solids	Total N	**7**	6	10
	NH_4N	**2**	1	3
	Organic N	**6**	5	7
	P_2O_5	**3**	2	6
	K_2O	**7**	6	8

solids). Pounds per ton is used for semi-solid and solid manure (more than 10%). Parts per million is commonly used to report micronutrient content of a manure source. Some laboratories report phosphorus as P and as P_2O_5, and potassium as K and K_2O. Use the P_2O_5 and K_2O values when deriving a manure application rate to meet all or a portion of crop nutrient needs. Table 1 shows useful conversions between different ways that manure analyses are reported. For some conversions, the density of the liquid and slurry manure is required. If this is not given in the report, an average density of 8.34 lbs per gallon for liquid dairy manure can be used.

Typical Ranges

Typical manure nutrient values for 240 New York dairy manure samples submitted to DairyOne are shown in Table 2. This table shows that untreated liquid manure (4-10% solids) had a median of 8 lbs P_2O_5 per 1000 gallons.

In Summary

Manure analysis is essential to understand the nutrient composition of a manure sources, and for planning appropriate application rates. It is important to understand how results are reported by a laboratory (as is or on DM basis), and what units and metrics are used (P or P_2O_5, etc.) to utilize results.

Additional Resources

- Recommended Methods of Manure Analyses: https://conservancy.umn.edu/handle/11299/227650
- Cornell Agronomy Fact Sheet Series: http://nmsp.cals.cornell.edu/guidelines/factsheets.html

Disclaimer

This fact sheet reflects the current (and past) authors' best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of discharge levels from agricultural land.

For more information

Cornell University Cooperative Extension

Nutrient Management Spear Program
http://nmsp.cals.cornell.edu

Molly Mueller, Olivia Godber, Juan Carlos Ramos, Kitty O'Neill, Kirsten Workman, Patty Larkin, and Quirine Ketterings

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