



Valuing Manure N, P, and K Applications

Calculating Fertilizer Replacement Value

High fertilizer and fuel prices have heightened interest in determining how to price manure for sale. The value of manure is influenced by many factors including how and when it is applied, if it is used as a fertilizer replacement for some combination of nitrogen (N), phosphorus (P), potassium (K), and micronutrients, and/or valued as a source of organic matter, or to increase the water holding capacity and microbial activity of the soil. Accurately determining manure value is important for calculating break-even hauling distance and pricing manure for export. Some of the benefits of manure are much easier to quantify than others. In this factsheet we focus on calculating the N, P and K fertilizer replacement value of manure in three steps.

Step #1 → Gather Accurate Manure Data

Determining the N, P, and K value of a manure application starts with an accurate manure analysis of ammonium-N, organic N, P and K content, as well as a measurement of total solids content (see example). Although book values for the composition of manure exist, not all manures are created equal. The actual N, P and K content of any particular manure source is greatly impacted by feed rations, bedding use and manure handling and treatment systems. Thus it is essential to take a representative manure sample to determine the value of the manure. For sampling methods recommended to obtain the most accurate manure analysis, see [Factsheet #38: Manure Sampling and Analysis](#).

| Example: | |
|--|------|
| Pounds/1000 gallons | |
| Ammonium-N | 13.0 |
| Organic-N | 7.2 |
| P ₂ O ₅ equivalent | 7.1 |
| K ₂ O equivalent | 21.2 |
| Total solids (%) | 3.4 |
| Density (lbs/gal) | 8.3 |

Step #2 → Gather Current Fertilizer Costs

A dollar value of the fertilizer components based on current fertilizer prices is required to estimate the fertilizer value of the manure. The N, P and K values can differ depending on the types of materials fertilizer suppliers have

access to and therefore are specific. To calculate the N, P and K value, regional fertilizer values should be used.

| Example: | Cost/pound |
|-------------------------------|------------|
| N | \$ 0.50 |
| P ₂ O ₅ | \$ 0.60 |
| K ₂ O | \$ 0.70 |

Step #3 → Determine Nutrient Loss

Nitrogen

Not all N in the manure is plant available so discounts need to be applied. Plant available organic N varies by animal type and depends on the solids content of the manure. Ammonium-N credits also vary by species and depend on how and when the manure is applied. To determine the N credits from manure, see [Factsheet #4: Nitrogen Credits from Manure](#).



Figure 1: Spring injection of manure increases the nitrogen fertilizer replacement value of the manure.

Phosphorus and Potassium

In some situations manure may be applied to meet crop N needs. When this is the case it is likely that P and K applied will exceed crop removal that year. Crop rotations may be planned such that extra P and K build soil test levels to be used later in the rotation. When P and K soil tests are already very high, and the extra P and K in the manure are not needed, their value should not be considered when calculating the economic value of the manure. Manure applications to fields that need P and K as well as N have the highest economic return on the resources it takes to spread manure, especially if the manure is purchased.

Example Calculation

Cow manure with the nutrient analysis listed previously is applied in the spring and incorporated in one day. The recommended N application is 110 lbs of N per acre and soil test results suggest an application of 20 lbs P₂O₅ and 25 lbs K₂O per acre. In this example (Table 3), the manure application is worth \$24.62/1000 gallons when extra P and K (beyond current year crop needs) are credited toward future crop years. The value of the manure diminishes substantially (to \$8.32/1000 gallons in this particular example) when only the current-year nutrient requirements are considered.

Table 3: Fertilizer replacement value of manure if the field requires 110 lbs N, 20 lbs of P₂O₅ and 25 lbs of K₂O per acre and the excess P and K is credited toward future fertilizer replacement.

| Example: | Manure nutrient (lbs / 1000 gallons) | | Fertilizer (\$ / pound) | | Credit | Manure value (\$ / 1000 gallon) |
|--|---|---|------------------------------|---|--------|------------------------------------|
| Ammonium-N | 13.00 | * | \$ 0.50 | * | 65% = | \$ 4.23 |
| Organic-N | 7.24 | * | \$ 0.50 | * | 35% = | \$ 1.27 |
| P ₂ O ₅ equivalent | 7.13 | * | \$ 0.60 | * | 100% = | \$ 4.28 |
| K ₂ O equivalent | 21.21 | * | \$ 0.70 | * | 100% = | \$ 14.85 |
| TOTAL Value | | | | | = | \$ 24.62 |
| TOTAL Value | | | 10,000 gallons per acre rate | | = | \$ 246.22/acre |
| TOTAL Value | | | 5000 gallon spreader | | = | \$ 123.11/load |

Manure Value for Break-Even Analysis

As fertilizer prices increase manure can be hauled greater distances. An economic break-even distance can be determined by comparing the value of a manure application with the variable cost of hauling manure based on distance. Break-even distances increase when nutrients from one manure application are credited toward fertilizer replacement over multiple years of the rotation.

Manure Value for Export Negotiations

Manure transfers from dairy to crop farms are becoming more common due to increased fertilizer and fuel prices and heightened awareness of the soil conditioning benefits of manure. The manure fertilizer replacement value can be compared to the operational costs and/or ownership costs of manure applications for manure import/export negotiations.

Tools for Calculating Manure Value

A [Manure Value and Cost Calculator](#) is available to help calculate the value of a manure application and field/farm operating and ownership costs for manure applications (see link in **Resources** section). The calculator provides printable reports useful for farm management decisions and negotiations.

Summary

Knowing the fertilizer replacement value of a manure application is essential to determining break-even hauling distances. The value of the

manure as a fertilizer replacement for N, P and K can be compared with manure handling operational and ownership costs to negotiate the terms of a manure export agreement.

Resources

- Factsheet #38 Manure Sampling and Analysis nmsp.cals.cornell.edu/guidelines/factsheets.html
- Factsheet #4: Nitrogen Credits from Manure nmsp.cals.cornell.edu/guidelines/factsheets.html
- Manure Cost, Value and Time Management Calculator nmsp.cals.cornell.edu/software/calculators.html

Disclaimer

This fact sheet reflects the 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 particular discharge levels from agricultural land.

For more information



Cornell University
Cooperative Extension

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

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