Economics of Manure Management and Application

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The increasing price of commercial fertilizer has heightened interest in the use of livestock manure for supplying crop nutrients and has significantly increased the value of manure as a nutrient source.

More producers are looking at the contribution of manure value to cash flow in livestock operation budgets, and seeking a market value in exchange situations between livestock producers and crop producers. Also, more crop producers appear to be seeking livestock manure as a major nutrient source.

Determining the economic value of the nutrients in livestock manure can be tricky. Nutrients in commercial fertilizer are acquired by paying for the nutrients and a small application charge. With manure you, in effect, "acquire" nutrients by paying for the cost of application, even if you already have ownership of the manure in a storage structure.

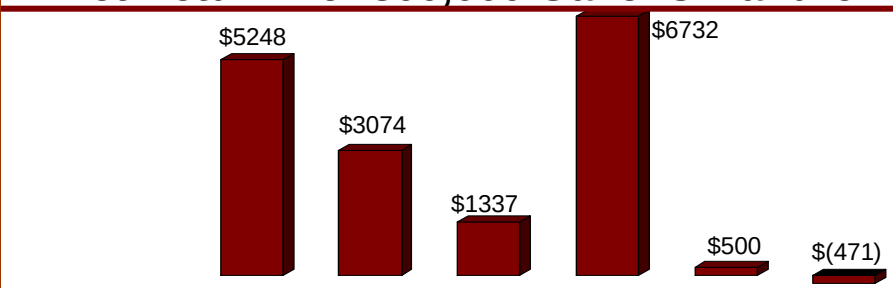
Additionally, commercial fertilizer supplies the amount and ratio of nutrients you need or ordered. With manure, you get the amount and ratio of nutrients that it contains which complicates the determination of a value. Even when a rate that supplies the correct amount of nitrogen is applied, the amount of phosphorous and potash applied may not match what you would have purchased commercially, and amounts applied above crop need probably have no value.

In the past, manure application costs often exceeded the value of the nutrients applied. Now, in many situations, the nutrient value in the manure exceeds the cost of application.

A formula that estimates manure value can be described by: Net Economic Impact of Manure = Value of Year 1 Fertilizer & Application Costs Replaced + Residual Value (Mostly Year 2 if any) +/- Non- NPK Yield Response – Manure Application Costs.

Manure value can be calculated on a per acre applied basis, per unit of weight or volume, per storage unit, or per operation. The value will vary widely, influenced by factors such as the amount N, P_2O_5, and K_2O required per acre by the crop, manure nutrient concentration in the manure, application rate, potential yield response attributed to manure beyond N-P-K application, and application cost per ton or gallon.

The following table shows how widely the economic contribution of manure application can vary based on differing crop need, manure nutrient concentration, application cost per gallon, estimated residual value, and estimated yield impact.



Crop Need	180-75-80	180-75-80	180-75-80	140-40-40	140-0-0	140-0-0
Manure Test	60-40-40	60-40-40	25-25-24	60-40-40	60-40-40	25-25-24
App. Rate, gal./acre	3750	5500	9000	1250	3000	7000
App Cost/ Gal., $	0.010	0.0085	0.0070	0.015	0.011	0.007
Residual Value, $/a	9.00	9.00	9.00	0	0	0
Yield Impact, $/a	10.00	10.00	10.00	10.00	0	0
# Avail. N Applied/a	180	264	180	60	144	140
# Avail. P_2O_5 Applied/a	120	176	180	40	96	140
Acres Covered	80	55	33	240	100	33

Above calculations assume a commercial fertilizer value of $0.25 per unit of nitrogen, $0.30 per unit of P_2O_5, and $0.17 per unit of K_2O with first year availability of 80% for nitrogen, 80% for P_2O_5 and 90% for K_2O. Manure application costs are estimated based on application rate. Estimates for positive yield impacts shown may be conservative for some situations.

A variety of situations are shown above to display possibilities. For instance, very few producers have access to the equipment, or have the time available, to apply at a P_2O_5 based rate (1250 gallons/acres in this example). However, a few have used this approach to extend the non N-P-K benefits to a maximum number of acres per volume of manure, gaining economic benefit even though application cost per gallon is higher at very low rates and commercial nitrogen must also be applied. Also, the high crop need scenarios shown above would apply only on soils testing low for P and K.

Note that in a high crop need situation (180-75-80), where 3750 gallons per acre supplies the crop nutrient need, applying 5500 gallons per acre results in over $2000 less economic contribution from the 300,000 gallons of swine finishing manure ($5248 compared to $3074). This is true even with the assumed higher cost of application with the lower rate ($0.010/gal. at 3750 gallons, compared to $0.0085/gal. at 5500 gallons).

Also, note that the examples using manure with low nutrient concentration (25-25-24), which is more typical of sow units or systems that lose more water to the pit resulted in considerably less economic value. The high crop need scenario had a positive return over application of $1337. The lower crop need situation (140-0-0) did not cover the cost of application. Low concentration liquid manure will seldom show a positive net return in most situations typical on Minnesota farms.

Determining the cost of application can be complex. The fourth line of the table, labeled "App Cost/gal., $" shows some example per-gallon costs for the different application rates shown. A lower application rate increases the acreage that must be covered to apply a given volume of manure, so the added operating time involved with lower application rates will generally increase the per-gallon cost. Worksheets and spreadsheets exist to help producers and custom applicators to estimate how the application rate and other factors affect the per-gallon cost. Investment in manure equipment, allocation of cost for tractors that are used for other purposes, expected equipment life, repairs, time and labor cost, and gallons pumped annually are among the factors that influence a final unit cost.

Producers should use their own situation and assumptions when making decisions for their operations. A spreadsheet that considers these factors will calculate manure value for interested producers, consultants, etc. It is available at http://swroc.coafes.umn.edu/Bob/koehler_main_page.html

In summary, some observations on determining manure value include:

- Increased *fertilizer prices* have increased the value of manure
- Manure value cannot be maximized unless *sufficient acres* are available to use it efficiently.
- Manure with *high nutrient concentration* (usually swine finishing manure) has more potential for a high net value.
- *Higher crop need per acre* increases potential for a high net value (such as for corn on soils with low P and K levels).
- The added per acre application costs of applying at rates above crop need increase the total cost of applying needed nutrients.
- Low rate application extends the non-NPK yield benefits to more acres if those acres are available.
- Low rate application introduces risks with uniformity of application and the impact of inaccurate nutrient availability estimates
- Under conditions of high crop need and high-density manure, cost-effective hauling distances are greater than commonly believed. Application time is probably more constraining.