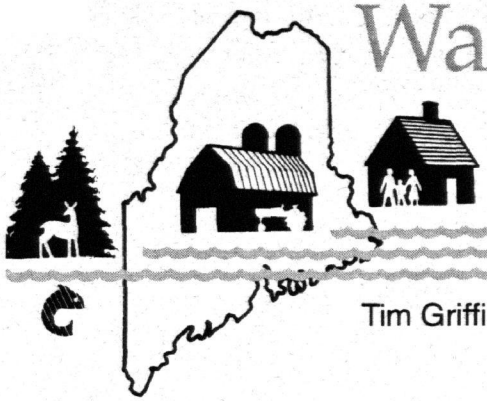

Water Quality Fact Sheet

Manure: What is It Worth on Your Farm?

Tim Griffin, Sustainable Agriculture Specialist

Bulletin #2432

Nutrients that are lost to the environment as pollution have no economic value to you, and may have a negative value to you and your community.

The general goals of managing different nutrient sources, like manure, fertilizer and crop residues are to:

- *Identify* the best use for each nutrient resource.
- *Maximize* the economic value of the resource.
- *Minimize* the environmental losses, or impacts, of nutrients.

All of these actually mean the same thing: nutrients that are lost to the environment as pollution have no economic value to you, and may have a negative value to you and your community. If you are working to maximize value, you are working to minimize loss. In this fact sheet, we are going to look at the "dollars and cents" of manure as a fertilizer. In doing this, we will start with a very simple scenario and move toward more realistic ways to assign value to manure. This also helps us find the places where we can *add value* to the resource.

Potential Value: To the Crop, Nutrients are Nutrients

Crop plants take up nutrients in certain forms. For example, nitrogen (N) is most often taken up in the nitrate (NO_3-N) form. The plant does not distinguish between sources of NO_3-N, whether from fertilizer, soil organic matter or manure. It is all just NO_3-N. So, a very simplified way to estimate the value of manure is to say that manure nutrients have the same value per pound as fertilizer nutrients. See Table 1.

Although this approach is simple, it might be too simple because it makes some assumptions that we can't justify. First, it assumes that all of the nutrients in manure are available to the crop (we will see that they are not). And second, it assumes that "manures are all alike."

Potential Value: Your Manure

On-farm manure analysis is much better than using an average or a book value. The composition of manure is affected by many factors (like nutrition, bedding, storage and handling), and large differences exist among farms. (See UMCE bulletin #2429,

Table 1: Estimating value of manure.

	lb./ton	$/lb.	$/ton
Nitrogen	10	0.31	3.10
P_2O_5	6	0.28	1.68
K_2O	11	0.18	1.98
TOTAL			**6.76**

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"Understanding a Manure Sample," for more information.)

Table 2 shows an average value (from the example shown in Table 1) compared to a specific analysis. The potential value of the "actual" is lower than that of the "average," but remember that you are not applying the "average." With a manure analysis, you can calculate the appropriate application rate and reduce the chance of under- or over-applying nutrients. In other words, the cost of the analysis ($15 to $20) *adds value* in the form of more specific information.

Table 2: Farm-specific information affects value.

	Average Manure		Actual Manure	
	lb./ton	$/ton	lb./ton	$/ton
Nitrogen	10	3.10	7	2.17
P_2O_5	6	1.68	3	0.84
K_2O	11	1.98	6	1.08
TOTAL		**6.76**		**4.09**

Table 3: Nutrient availability affects value.

	Total Nutrients		Available Nutrients	
	lb./ton	$/ton	lb./ton	$/ton
Nitrogen	13	4.03	7*	2.17
P_2O_5	5	1.40	4.5	1.26
K_2O	9	1.62	8.1	1.46
TOTAL		**7.05**		**4.89**

*Available N=0.85 (5 lb. NH_4-N) + 0.35 (5 lb. organic N)

Management and Nutrient Availability Affect Value

The availability of potassium (K_2O) and phosphorus (P_2O_5) in manure is similar to that of fertilizer nutrients *applied in the same way on the same site.* For example, manure and fertilizer P are both subject to runoff if broadcast on an erodable field without crop cover.

The N in manure is not completely available to the crop grown this year. Some of the N in manure (the *organic N fraction*) must be broken down by microbes to plant-available forms; only about 35 percent of organic N will be released from manure during the year of application if it is applied in the spring. Some of the N in manure (the NH_4-N, or *ammonium fraction*) is as available to plants as fertilizer nutrients, but is also equally subject to loss. Some of these losses, like volatilization loss of N, are fairly predictable based on management practices.

Let's take a look at how changes in availability can affect the economic value of manure as a nutrient source. Start with the same manure analysis as we used above, but make several assumptions about availability:

- Manure P_2O_5 and K_2O are 90 percent available (compared to fertilizer).
- NH_4-N (5 lb./ton, out of 13 lb. total N/ton) is 90 percent available, because it is incorporated immediately.
- Organic N (the remaining 8 lb. N/ton) is 35 percent available during the application year.

By using good management (i.e., incorporating the manure to avoid loss of N as ammonia), we have retained 70 percent of the value of the nutrients in the year they are applied In addition, the remaining P and K (10 percent of the total) and 65 percent of the organic N is still in the soil and may be used later. See Table 3.

What happens if we use a lower level of management, like not incorporating the manure? This would change the assumption on availability of NH_4-N.

- NH_4-N (5 lb./ton, out of 13 lb. total N/ton) is completely lost.

By not incorporating the manure, the potential value is reduced from $4.89/ton to $3.59/ton (reduced by 25 percent). See Table 4. On 50 acres of silage corn, with manure applied at 20 tons/acre, *not incorporating the manure could cost you $1,300 in lost N.*

Value Based on Where Manure is Applied

As we have gone through the steps above, we get closer to establishing a realistic value for manure as a nutrient source. This is done, essentially, by using information that is more and more specific. The final step in looking at value relates to *where the resource is used.* We will do this by looking at two fields, which have different nutrient level.

From soil tests, we find the information shown in Table 5. The main difference between these two fields is their past manure history. Field #1 has received dairy manure and commercial fertilizer. Field #2 has received high rates of both dairy manure and poultry manure, with the primary goal being to supply adequate N for corn production.

To both fields, 20 tons/acre of manure are applied, supplying 140 lb. N/acre, 90 lb. P_2O_5 /acre, and 180 lb. K_20/acre. (Note that P_2O_5 and K_20 are over-applied slightly, because the application rate is calculated based on N needs. See UMCE bulletin #2429 "Understanding a Manure Sample," for details.)

The difference is striking (see Table 6 on page 4). The decision to put manure on the nutrient-heavy field (Field #2) costs you $45.60 per acre in

The Importance of Manure Analysis

There are two very good reasons to get a manure analysis. The first reason is obvious: you need to know what is in the manure if your goal is to maximize the dollar value of this resource (especially since you already "bought" the nutrients in the manure in the form of feed).

The second reason is not quite so obvious: the nutrient content of manure (N, P and K) changes drastically from one farm to the next, depending on:

- animal species;
- ration fed to animals;
- amount and type of bedding material; and
- handling and storage systems.

Table 4: Management practices affect value.

	Total Nutrients		Available Nutrients	
	lb./ton	$/ton	lb./ton	$/ton
Nitrogen	13	4.03	2.8	0.87
P_2O_5	5	1.40	4.5	1.26
K_2O	9	1.62	8.1	1.46
TOTAL		**7.05**		**3.59**

Table 5: Crop nutrient requirements from soil test results.

	Field #1	Field #2
	lb/acre	
N Needed	140	140
P_2O_5 Needed	60	0
K_2O Needed	150	0

The take-home message is clear: the value of the resource depends on not only how it is managed but also where the resource is used.

lost value. The take-home message is clear: the value of the resource depends on not only how it is managed but also *where* the resource is used.

Conclusions

Manure has obvious value as a nutrient source In addition to being an important source of N-P-K for crop production, it is also an important source of micronutrients and organic matter, adding to its economic value.

To maximize the economic value of this resource:

1. Know what you are dealing with (test the manure).
2. Use management practices that minimize nutrient loss. These same practices maximize the amount of nutrients retained for crop use.
3. Pay particular attention to where manure is applied. The value of manure used only as an N source (ie. where P and K levels are excessive) may not cover the cost of spreading.

Other fact sheets in this series are "Step 1: Getting a Manure Sample," Bulletin #2428, and "Step 2: Understanding a Manure Sample," Bulletin # 2429, are available from your county Extension office.

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Table 6: Where manure is used affects value.

	Field #1			Field #2		
	Need	Supplied	Value	Need	Supplied	Value
N	140	140	$42.70	140	140	$42.70
P_2O_5	60	90	$16.80	0	80	0.0
K_2O	150	180	$28.80	0	200	0.0
TOTAL VALUE			**$88.30**			**$42.70**

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