Value of Animal Waste Calculator

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The spreadsheet can be downloaded for free at www.agecon.okstate.edu/faculty/publications.asp
Search for Author: Devuyst and Type: Spreadsheet

This spreadsheet was developed to help producers estimate the value on animal waste in comparison to commercial fertilizers. The results should be interpreted as the economic advantage (or disadvantage, if negative) of using animal waste instead of commercial fertilizer. Before using the spreadsheet, producers are encouraged to have their pasture or field soil tested, and to have animal waste test results ready. The spreadsheet requires nutrient recommendations based on soil test results and yield goal. Contact your county Cooperative Extension Service office or Oklahoma State University Soil, Water and Forage Analytical Laboratory (http://www.soiltesting.okstate.edu/) if you have questions regarding soil and animal waste testing.

The spreadsheet has six pages: manure info, soil and economic info, $ per unit, $ per acre, breakeven, and additional nutrients needed. Click on the tabs on the bottom left of the spreadsheet to navigate among the pages.

User supplied information

To value animal waste, users are required to enter information regarding nutrient requirements, soil pH, nutrient composition and nitrogen availability of animal waste, and cost information.

Manure Info

First, the Manure Info page requires the user to enter the type of animal waste (Table 1). A drop-down menu under waste type provides the types available, i.e. poultry litter, lagoon sludge, lagoon effluent, feedlot manure, and dairy slurry. You may enter values for nutrient composition form. Default nutrient composition and nitrogen availability can be loaded by clicking on the "load" button. Caution: clicking on "load" will overwrite any previously entered nutrient data and cost information. These data cells can be changed to reflect animal waste test results.

Table 1. Litter Nutrient Composition. (lbs/ton)

N	P_2O_5	K_2O
60	60	50

Users next provide an estimate of nitrogen availability over time from animal waste (Table 2). As some nitrogen is tied up in organic form, not all nitrogen from animal waste is available during the first growing season. Over time, nitrogen is converted in the soil from its organic form to forms available to plants. Additionally, some nitrogen will be lost due to volatilization or run-off. As a result, only a fraction of nitrogen applied as animal waste will be available to plants in the first growing season. Note that incorporating animal waste into the soil will increase N availability slightly compared to surface application. More information on nutrients in animal waste can be found at the OSU Manure and Animal Waste Management Web site: http://www.animalwaste.okstate.edu/.

Table 2. Nitrogen Availability.

Year	*Surface Applied*	*Incorporated*
1	50%	60%
2	15%	15%
3	6%	6%

If the user wants to find the total nutrient value disregarding the availability factor, enter 100 percent in year one and 0 percent for future years.

On the second page, Soil and Economic Info, the user enters nutrient recommendations and soil pH level from soil test reports (Table 3). More information on soil test interpretation can be found at http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1490/PSS-2225web.pdf

Users are required to enter prices for commercial fertilizers including urea (46-0-0), DAP (18-46-0) and potash (0-0-60). These should be the price paid to the fertilizer dealer plus delivery and application cost on a per ton basis. The spreadsheet will compute the price per pound of actual N, P_2O_5 and K_2O based on these prices (Table 4). Note: OSU does not maintain a list of commercial fertilizer prices. Users will need to contact a local fertilizer dealer to get nearby prices and add reasonable delivery and application costs.

Table 3. Nutrient Recommendations and Soil pH. (lbs/acre)

N	*P_2O_5*	*K_2O*	*pH*
80	45	40	5

Table 4. Commercial Fertilizer Prices.

	$/ton	*Implied Price*	*$/lb*
46-0-0	914	N	0.99
18-46-0	1,250	P_2O_5	0.97
0-0-60	800	K_2O	0.67

For some soils, poultry litter has been found to maintain or slightly increase soil pH. An estimate of the liming value of animal waste can be credited if soil pH is less than 6. A default value of $2 per ton liming value is based on the opinion of several OSU waste management and soil fertility researchers (Table 5). Note this table will not be visible for wastes other than poultry litter and a liming value of $0 is assigned automatically to all other animal waste sources.

Table 5. Default Value of Liming.

Liming value	$/ton	2.00

The next set of inputs address costs, interest rate and frequency of application (Table 6). Costs include the purchase, loading, application and transportation costs for animal manure waste. Purchase, loading and application costs are entered in $ per ton or $ per 1,000 gal. Transportation costs are computed using Hauling Cost per loaded mile multiplied by the Hauling Distance (miles) and divided by the loaded weight (Tons per load) or volume (1,000 gal. per load). Enter Operating Note Interest Rate as a percent. This value will be used to discount the value of nutrients supplied by a current application of waste to future growing seasons. Years between applications is used to determine the amount of phosphorus and potassium available after the first growing season.

Reports

The spreadsheet reports results on four separate pages: $ per unit (Table 7), $ per acre (Table 8), breakeven (Table 9) and additional nutrients needed (Table 10). The spreadsheet computes the amount of animal waste needed to meet 1) N requirement, 2) P_2O_5 requirement, and 3) K_2O requirement. When balancing on either P_2O_5 or K_2O, up to three years of P_2O_5 or K_2O requirements will be applied based on the value entered by users on the Inputs tab. Years between applications are used to determine how many years requirement of P_2O_5 or K_2O will be applied. For example, entering a "3" in the years between applications generates an application rate that will supply three years' requirements of P_2O_5 (if balancing on P_2O_5) or K_2O (if balancing on K_2O).

The first set of results is reported in $ per unit (tons or 1,000 gal.). The table reports units (tons or 1,000 gal.) of animal waste to apply per acre if balancing on N, P_2O_5 or K_2O. However, the recommended application rate is constrained to comply with Oklahoma regulations on the amount of P_2O_5 allowed. The spreadsheet will not allow a P_2O_5 equivalent in excess of 200 pounds per acre surface applied or 400 pounds per acre incorporated.

The values of N, P_2O_5 and K_2O are reported separately for surface applied and incorporated animal waste. The values vary depending on the nutrient that is used for balancing. Liming value is included for poultry litter if pH is less than 6 and the user provided a nonzero value on the Inputs page. Gross value sums the values for each of the three nutrients and liming value. Costs are the sum of purchase, loading, application and hauling costs. Net value is the value of animal waste per unit in comparison to commercial fertilizer. In other words, net value is the cost advantage (or disadvantage) over (under) commercial fertilizer given the values that the user entered.

The values of N, P_2O_5 and K_2O available after the first growing season are discounted to present value using the operating note interest rate as the discount rate.

The next page or tab, $ per acre, multiplies the values from the $ per unit page by the number of units applied per acre. Thus, all values are reported in $ per acre. The third report is a table of Breakeven hauling distances. The values are the maximum distance that animal waste should be transported given the user-supplied information. At distances beyond these values, commercial fertilizer is lower cost than animal waste.

Table 6. Costs, Interest Rate and Frequency of Application.

Purchase ($/ton)	*Loading ($/ton)*	*Application ($/ton)*	*Hauling Cost ($/loaded mile)*	*Hauling Distance (miles)*	*Tons per load (tons)*	*Operating Note Interest Rate (%)*	*Years Between Applications*
10.00	5.00	4.00	4.00	50.00	25.00	7.00	2

Table 7. Price per Ton.

	Value of Nutrients Balancing on N		*Value of Nutrients Balancing on P*		*Value of Nutrients Balancing on K*	
	Surface Applied	*Incorporated*	*Surface Applied*	*Incorporated*	*Surface Applied*	*Incorporated*
Tons applied	2.54 ton/A	2.12 ton/A	1.64 ton/A	1.64 ton/A	1.78 ton/A	1.78 ton/A
	$/ton	*$/ton*	*$/ton*	*$/ton*	*$/ton*	*$/ton*
Value of N	$39.88	$46.14	$39.88	$46.14	$39.88	$46.14
Value of P_2O_5	$33.25	$39.90	$51.51	$51.51	$47.50	$47.50
Value of K_2O	$20.31	$24.38	$29.10	$29.10	$29.02	$29.02
Liming value	2.00	2.00	2.00	2.00	2.00	2.00
Gross Value of Animal Waste	$95.44	$112.41	$122.49	$128.75	$118.39	$124.65
Costs	$30.00	$30.00	$30.00	$30.00	$30.00	$30.00
Net Value	$65.44	$82.41	$92.49	$98.75	$88.39	$94.65

Notes: The value of Nitrogen available in years 2 and 3 is discounted to present values.

90 percent of P and K applied is available in years 1 through 3. The economic values are discounted to present values.

To comply with Oklahoma regulations, no more than 200 lbs. surface applied or 400 lbs. incorporated P_2O_5 equivalent is allowed.

Table 8. Price per Acre.

	Value of Nutrients Balancing on N		*Value of Nutrients Balancing on P*		*Value of Nutrients Balancing on K*	
	Surface Applied	*Incorporated*	*Surface Applied*	*Incorporated*	*Surface Applied*	*Incorporated*
Tons applied	2.54 ton/A	2.12 ton/A	1.64 ton/A	1.64 ton/A	1.78 ton/A	1.78 ton/A
	$/acre	*$/acre*	*$/acre*	*$/acre*	*$/acre*	*$/acre*
Value of N	$101.28	$97.64	$65.37	$75.63	$70.89	$82.02
Value of P_2O_5	$84.44	$84.44	$84.44	$84.44	$84.44	$84.44
Value of K_2O	$51.59	$51.59	$47.71	$41.71	$51.59	$51.59
Liming value	$5.08	$4.23	$3.28	$3.28	$3.56	$3.56
Gross Value	$242.38	$237.90	$200.80	$211.06	$210.48	$221.60
Less Costs	$76.19	$63.49	$49.18	$49.18	$53.33	$53.33
Net Value	$166.19	$174.41	$151.62	$161.88	$157.14	$168.27

Notes: The value of Nitrogen available in years 2 and 3 is discounted to present values.

90 percent of P and K applied is available in years 1 through 3. The economic values are discounted to present values.

To comply with Oklahoma regulations, no more than 200 lbs. surface applied or 400 lbs. incorporated P_2O_5 equivalent is allowed.

The final page or tab, additional nutrients needed, computes Year 1 nutrient requirements above the available amounts supplied by animal waste. These additional nutrients will need to be provided using commercial fertilizer or other sources to achieve the yield goal. Note that even if the user balances on nitrogen, additional N may be necessary. Recall that waste is limited to providing less than 200 pounds P_2O_5 surface applied and 400 pounds P_2O_5 incorporated. And, even when balancing on P_2O_5, additional phosphorous may be required as applied nitrogen from animal waste may be insufficient to meet recommended N levels.

Table 9. Breakeven Mileage.

	Balancing on N		*Balancing on P_2O_5*		*Balancing on K_20*	
Application Type	*Surface*	*Incorporated*	*Surface*	*Incorporated*	*Surface*	*Incorporated*
Gross Value Before Transport	$73.44	$90.41	$100.49	$106.75	$96.39	$102.65
(Divide by) Cost/mile/unit	$0.16	$0.16	$0.16	$0.16	$0.16	$0.16
= Breakeven Miles*	459.0	565.1	628.0	667.2	602.5	641.6

*Indicates the number of miles the animal waste can be hauled before the cost exceeds the value of commercial fertilizer.

Table 10. Year 1 Additional Nutrients Needed. (lbs/acre)

	Balancing on N		*Balancing on P*		*Balancing on K*	
	Surface	*Incorporated*	*Surface*	*Incorporated*	*Surface*	*Incorporated*
N Needed	0	0	28	18	24	13
P_2O_5 Needed	0	0	0	0	0	0
K_2O Needed	0	0	0	0	0	0

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