



## Agribusiness Management Series

# Valuing Poultry Litter in Meeting Soil Fertility Requirements

### The Oklahoma Cooperative Extension Service *Bringing the University to You!*

The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state, and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state, and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective, and research-based information.

- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government, and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations, and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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#### Poultry litter management spreadsheet instructions.

The spreadsheet can be downloaded for free at [www.agecon.okstate.edu/faculty/publications.asp](http://www.agecon.okstate.edu/faculty/publications.asp)

This spreadsheet was developed to help producers place a value on poultry litter in comparison to commercial fertilizers. Prior to using the spreadsheet, producers are encouraged to have their pasture or field soil tested. The spreadsheet requires nutrient recommendations from a soil testing laboratory. Contact your county Oklahoma Cooperative Extension Service (OCES) office or OSU Soil, Water and Forage Analytical Laboratory (<http://www.soiltesting.okstate.edu/>) if you have questions regarding soil testing.

The spreadsheet has four pages, "Inputs," "\$ per ton," "\$ per acre," and "Additional nutrients needed." Click on the tabs on the bottom left of the MS Excel spreadsheet to navigate between the pages.

#### User supplied information

In order to value litter, users are required to enter information regarding nutrient requirements, pH, nutrient composition and availability of litter and cost information. This information is divided into five areas on the **Inputs** tab.

First, the **Inputs** page requires that the user enter nutrient recommendations from soil test results and soil pH level as in Table 1. More information on soil test results and interpretation can be found at <http://pods.dasnr.okstate.edu/docushare/dsweb/Get/Document-1490/PSS-2225web.pdf>

**Table 1. Nutrient Recommendations and Soil pH.**  
(lbs/acre)

N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	pH
80	45	40	5

Second, users are required to enter prices for commercial fertilizers including urea (46-0-0), DAP (18-46-0) and potash

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<http://osufacts.okstate.edu>

(0-0-60). These should be the price paid to the fertilizer dealer plus delivery and application cost on a per ton basis (see Table 2). The spreadsheet will impute the price per pound of actual N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O based on these prices entered by the user. Note, OSU does not maintain a list of commercial fertilizer prices. Users will need to contact a local fertilizer dealer to get nearby prices.

**Table 2. Fertilizer Prices.**

	\$/ton	Implied Price	\$/lb
46-0-0	914	N	0.99
18-46-0	1250	P <sub>2</sub> O <sub>5</sub>	0.97
0-0-60	800	K <sub>2</sub> O	0.67

Third, users enter the pounds of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O contained in one ton of litter (see Table 3). Sellers of litter may be able to provide this information or purchasers can have samples analyzed. Again, your county OCES office or OSU Soil, Water and Forage Analytical Laboratory can assist with obtaining a litter nutrient analysis.

**Table 3. Litter Nutrient Composition.**  
lbs/ton

N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
60	60	50

Fourth, users provide an estimate of nitrogen availability over time from litter as in Table 4. As nitrogen is tied up in organic form, not all nitrogen from litter is available during the first growing season. Nitrogen is gradually 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 poultry litter (or other animal waste) will be available to plants in the first growing season. Note, that incorporating litter into the soil will decrease the amount nitrogen lost to volatilization or run-off. More information on nutrients in animal waste can be found at the OSU Manure and Animal Waste Management website: <http://www.animalwaste.okstate.edu/>. An estimate of the liming

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value of litter is also required if soil pH is less than 6. A default value of \$2 per ton is based on the opinion of several OSU waste management and soil fertility researchers.

**Table 4. Nitrogen Availability.**

Year	Surface Applied	Incorporated
1	50%	60%
2	15%	15%
3	6%	6%
<b>Liming value</b>	\$/ton	2.00

The fifth set of inputs (Table 5) address costs, interest rate and frequency of application. Costs include the **Purchase, Loading, Application**, and transportation costs. Purchase, loading and application costs are *per ton* values. 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**). 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 litter to future growing seasons. **Years between applications** is used to determine the amount of P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O available after the first growing season.

**Table 5. Costs.**

Purchase	\$/ton	10.00
Loading	\$/ton	5.00
Application	\$/ton	4.00
Hauling Cost per loaded mile	\$/mile	4.00
Hauling Distance	miles	50.00
Tons per load	tons	25.00
Operating Note Interest Rate		7.00%
Years between applications		2

## Reports

The spreadsheet reports results on three separate pages, **\$ per ton**, **\$ per acre**, and **Additional nutrients needed**.

The spreadsheet computes the amount of litter needed to meet 1) N requirements, 2) P<sub>2</sub>O<sub>5</sub> requirements and 3) K<sub>2</sub>O requirements. When balancing on either P<sub>2</sub>O<sub>5</sub> or K<sub>2</sub>O, up to three years of P<sub>2</sub>O<sub>5</sub> or K<sub>2</sub>O will be applied based on the value entered by users on the Inputs tab. **Years between application** is used to determine how many year's requirement of P<sub>2</sub>O<sub>5</sub> or K<sub>2</sub>O will be applied. For example, entering a "3" in the Years between application generates an application rate that will supply three year's requirements of P<sub>2</sub>O<sub>5</sub> (if balancing on P<sub>2</sub>O<sub>5</sub>) or K<sub>2</sub>O (if balancing on K<sub>2</sub>O).

The first set of results are reported in **\$ per ton** (as in Table 6). The table reports tons of litter to apply per acre if balancing on N, P<sub>2</sub>O<sub>5</sub> or K<sub>2</sub>O. However, the recommended application rate is constrained to comply with Oklahoma regulations on P<sub>2</sub>O<sub>5</sub>. The spreadsheet will not recommend an P<sub>2</sub>O<sub>5</sub> equivalent in excess of 200 pounds per acre surface applied or 400 pounds per acre incorporated.

The values of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O are reported for surface applied and incorporated litter. The values vary depending on the nutrient that is used for balancing. Liming value is included 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 transportation costs. Net values are the values of litter per ton 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<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O 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 ton** page by the number of tons applied per acre. Thus, all values in \$ per acre (see Table 6).

The final page or tab, **Additional nutrients required** (Table 7), computes YEAR 1 nutrient requirements above the amounts supplied by litter. These additional nutrients will need to be provided using commercial fertilizer or other sources. Note even if the user balances on nitrogen, additional N may be necessary. Recall litter is limited to providing less than 200 pounds P<sub>2</sub>O<sub>5</sub> surface applied and 400 pounds P<sub>2</sub>O<sub>5</sub> incorporated. Even when balancing on P<sub>2</sub>O<sub>5</sub>, additional phosphorous may be required as applied nitrogen from litter is also limited to plant uptake as indicated by recommended N.

**Table 6. Per Acre and Per Ton Value of Poultry Litter.**

	Value of Nutrients Balancing on N		\$/acre Value of Nutrients Balancing on P		Value of Nutrients Balancing on K	
	Surface Applied	Incorporated	Surface Applied	Incorporated	Surface Applied	Incorporated
Tons applied	2.67 tons/ac	2.22 tons/ac	1.67 tons/ac	1.67 tons/ac	1.78 tons/ac	1.78 tons/ac
	\$/acre	\$/acre	\$/acre	\$/acre	\$/acre	\$/acre
Value of N	110.09	104.99	68.81	78.74	73.39	83.99
Value of P <sub>2</sub> O <sub>5</sub>	84.44	84.44	84.44	84.44	84.44	84.44
Value of K <sub>2</sub> O	51.59	51.59	48.47	48.47	51.59	51.59
Liming value	5.33	4.44	3.33	3.33	3.56	3.56
Gross Value	251.45	245.46	205.05	214.99	212.98	223.58
Less Costs	72.00	60.00	45.00	45.00	48.00	48.00
Net Value	179.45	185.46	160.05	169.99	164.98	175.58

Notes: The value of Nitrogen available in years 2 and 3 is discounted to present values. 90% of P and K applied is available in years 1 through 3. The economic values are discounted to present values. To comply with OK regulations, no more than 200# surface applied or 400# incorporated P<sub>2</sub>O<sub>5</sub> equivalent is allowed.

	Value of Nutrients Balancing on N		\$/ton Value of Nutrients Balancing on P		Value of Nutrients Balancing on K	
	Surface Applied	Incorporated	Surface Applied	Incorporated	Surface Applied	Incorporated
Tons applied	2.67 tons/ac	2.22 tons/ac	1.67 tons/ac	1.67 tons/ac	1.78 tons/ac	1.78 tons/ac
	\$/ton	\$/ton	\$/ton	\$/ton	\$/ton	\$/ton
Value of N	41.28	47.25	41.28	47.25	41.28	47.25
Value of P <sub>2</sub> O <sub>5</sub>	31.66	38.00	50.66	50.66	47.50	47.50
Value of K <sub>2</sub> O	19.35	23.21	29.08	29.08	29.02	29.02
Liming value	2.00	2.00	2.00	2.00	2.00	2.00
Gross Value	94.30	110.46	123.03	128.99	119.80	125.76
Less Costs	27.00	27.00	27.00	27.00	27.00	27.00
Net Value	67.30	83.46	96.03	101.99	92.80	98.76

Notes: The value of Nitrogen available in years 2 and 3 is discounted to present values. 90% of P and K applied is available in years 1 through 3. The economic values are discounted to present values. To comply with OK regulations, no more than 200# surface applied or 400# incorporated P<sub>2</sub>O<sub>5</sub> equivalent is allowed.

**Table 7. Additional Nutrients Required.**

	YEAR 1					
	Additional Nutrient Requirements Balancing on N (lbs per acre)		Additional Nutrient Requirements Balancing on P (lbs per acre)		Additional Nutrient Requirements Balancing on K (lbs per acre)	
	Surface Applied	Incorporated	Surface Applied	Incorporated	Surface Applied	Incorporated
N needed	0	0	30	20	27	16
P <sub>2</sub> O <sub>5</sub> needed	0	0	0	0	0	0
K <sub>2</sub> O needed	0	0	0	0	0	0

Use of litter may not meet all nutrient requirements. Additional nutrients may be needed depending on recommendations, nutrient content of litter and whether balancing on N, P or K.