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# Using Organic Manures and Fertilizers For Vegetable Crops in Kentucky

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Animal manures contribute more to the soil than just the nutrients nitrogen, phosphorus, and potassium. Continued use of manures builds organic matter in soils and improves soil structure. This modification of soil structure helps improve water holding capacity, aeration, friability, and drainage. In addition, many trace nutrients needed for optimum plant growth are available from manures. Plant nutrients are released more slowly and over a longer period of time than from most commercial fertilizers.

Disadvantages of using manures are handling and transportation problems associated with the large amount of manure required to obtain sufficient quantities of nutrients for vegetables. The use of fresh manure may also introduce new weeds into gardens and fields previously free of that species since certain weed seeds maintain their viability after passage through animals.

## GENERAL CONSIDERATIONS IN USING ANIMAL MANURES

### Fresh vegetables, not fresh manure.

Manure should not be used fresh (raw) if you intend to plant directly into it. Composting results in a more readily usable form and destroys many weed seeds that could otherwise be introduced into new fields or gardens. If fresh manure is used on the soil, it should be worked in as soon as possible. No fresh manure may be used during the year of harvest for certified organic production so you may want to plant a green manure or cover crop on this ground for the first year. If you are not concerned with organic certification you must still allow at least one- or two-months to pass before planting after fresh manure applications. This allows the decomposition process to start.

Remember that some types of animal manures have higher nitrogen contents than others (see Tables 1 and 2). These include horse, sheep, chicken, and rabbit manures. These are sometimes referred to as "hot" and are best used after composting. Cow manure is considered "cold" because of lower nitrogen levels.

**Application.** Composted manures can be broadcast and worked into fields or worked into rows and beds for various vegetable crops. For crops such

as melons, squash, and cucumbers, composted manure can be worked directly into planting hills and mixed thoroughly with the soil.

**Nutrient contents.** It is important to remember that nutrient contents in manures vary widely according to age of the animals, feed used, moisture content, degree of rotting, and the amount of litter or bedding material mixed in the manure. The only really accurate way of determining the nutrient content of the manure you are using is through laboratory analysis. You may need to adjust your application rates up or down according to what you learn through the U.K. Soil Testing Laboratory about your specific sample.

When buying or getting ready to spread manure, remember that moisture content greatly affects the total pounds of nutrients in a ton of material. For example, broiler manure 25-30% moisture when removed from the house will contain about 34 lbs. of nitrogen, 37 lbs. of phosphate, and 31 lbs. of potash per ton. But a ton of fresh manure at 75% moisture will contain only 27, 28, and 14 lbs. of these nutrients, respectively. At 75% moisture you will be hauling around 15000 lbs. of water and only 500 lbs. of solid material. Not all nutrients in manures are available to crops during the season of application. In poultry manure, for example, 90% of the nitrogen, most of the potassium, *but only half of the phosphorus* becomes available in the first year.

Since **phosphorus** in manure must decompose before it becomes available and since it is not very mobile in soil, broadcasting fresh manure is not considered a very efficient way of applying this element for establishment of vegetable crops. Phosphorous is released as the litter decomposes.

Further information on using manures can be obtained from your Kentucky Cooperative Extension Service County Office. Two publications you may wish to request are AGR-165, *The Agronomics of Manure Use for Crop Production* by Dr. Kenneth Wells; and aGR-146, *Using Poultry Litter on Agricultural Land* by Drs. Monroe Rasnake, Lloyd Murdock and William Thorn.

Tables 1 and 2 that follow are used to be used as guidelines only. Nutrient contents for various manures below are averages from a range of values.

## USING N, P<sub>2</sub>O<sub>5</sub>, AND K<sub>2</sub>O RECOMMENDATIONS IN UK'S HORTICULTURE PUBLICATIONS

Plant nutrient requirements provided in several U.K. horticultural publications are expressed in terms of the amounts of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O required by the crop; amounts of phosphorus and potassium recommended vary according to what may already be present in the soil. For this reason it is always advisable for both conventional and organic growers to have their soil tested for these nutrients, preferably in the fall or early spring.

To calculate the amount of manure required for application on sweet corn, for example, first find the recommended nutrient application rates in ID-36, **Commercial Vegetable Crop Recommendations**. This information is usually presented in a table under the specific crop heading. **Warning:** *manure applications should never exceed the total nitrogen requirements of a crop in an attempt to satisfy the phosphorus and potassium requirements -- burning of the roots and leaves could occur.*

We will choose nitrogen as our "priority" nutrient which will be used to limit the rate of manure to be used, i.e., we will calculate the manure requirements based only on the nitrogen recommendation. This may require that some of our phosphorus and potassium be obtained from other sources. Since soil and plant nitrogen tests are not used in Kentucky and since much of the nitrogen in soils is used or lost from one season to the next, UK makes a blanket recommendation of 2.5 pounds actual nitrogen per

1000 square feet for sweet corn. When commercial fertilizers are used, this amount is applied before planting and is supplemented by a side-dressing of one pound actual nitrogen per 1000 square feet when plants are knee high.

Now consider the source, moisture contents, and quality of the manure or organic material to be used. If we are using a dry or composted material containing little or no moisture, we should use Table 2 to make the necessary calculations. If we use fresh manure, the figures in table 1 should be used.

We have found a source of composted poultry manure and plan to use it as our nutrient source. To calculate the manure required to provide the 2.5 pounds of nitrogen,

Look at Table 2 under poultry; the N content is 3.2%. Now divide the 2.5 pounds by .032 = 78 pounds. This is the amount of poultry manure required to obtain the recommended 2.5 pounds per 1000 square feet.

The amount of P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O are calculated for the 78 pounds of manure by multiplying 78 by the appropriate percentages in Table 2. The amount of P<sub>2</sub>O<sub>5</sub>, for example, is 78 pounds x .052 = 4.056 pounds. For the amount of K<sub>2</sub>O, multiply 78 pounds x .018 = 1.38 pounds. In this example we will have obtained 2.5 pounds of nitrogen together with 1.38 lbs. of P<sub>2</sub>O<sub>5</sub>, and 4.05 lbs. of K<sub>2</sub>O for the 1000 square feet garden.

Now suppose the soil is very low in phosphorus and the soil test suggests applying 4 pounds per 1000 square feet of phosphorus. We have obtained 4.056 pounds of phosphorus from the poultry manure and need no additional phosphorus.

**Table 1. Average primary nutrients in FRESH animal manure.**

		Average nutrient composition (percent of fresh weight)		
Source	Water Content	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Beef	80	0.0	0.45	0.55
Dairy	84	0.60	0.25	0.60
Horses	60	0.60	0.25	0.45
Hogs	75	0.50	0.35	0.65
Sheep	65	1.05	0.35	0.95
Laying hens	75	1.00	1.25	0.05
Broilers (litter) <sup>1</sup>	30	2.95	2.75	1.85

<sup>1</sup>If there is a question about the quality of the manure or litter it is best to have it tested for nutrient content and screened for the presence of carryover pharmaceutical products.

In a situation where more phosphorus was required, look at Table 2 and decide how to supply the phosphorus. Using raw bone meal which is 22% P<sub>2</sub>O<sub>5</sub>, and 3% nitrogen is one option. Calculate how much is needed by using similar steps to those above, using pounds of actual element needed and percent of that element found in the organic product.

**Table 2. Average primary nutrient contents of DRY manures and organic fertilizer materials.**

Source	Average nutrient Composition (percent dry weight)		
	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Dairy	1.3	0.9	3.0
Feedlot	1.7	1.2	3.0
Horse	2.3	0.9	1.7
Poultry	3.2	5.2	1.8
Sheep	3.5	1.4	3.5
Hogs	3.5	0.5	0.7
Goat	1.5	1.5	3.0
Rabbit	2.4	1.4	0.6
Tobacco stems*	1.5	0.5	7.0
Bat guano	10.0	4.0	2.0
Blood	13.0	2.0	1.0
Bone meal, raw	3.0	22.0	--
Bone meal, steamed	1.0	15.0	--
Cottonseed meal	6.0	3.0	1.5
Fish meal	10.0	6.0	--
Sewage sludge*	1.5	1.3	0.4
Sewage sludge activated*	6.0	3.0	0.2
Soybean meal	7.0	1.2	1.5

Tankage*	7.0	10.0	1.5
Greensand	--	--	7.0
<b><i>*Not cleared for certified organic production. Use of sewage sludge not recommended for vegetable crops because of possible heavy metal contamination.</i></b>			