MASTER GARDENER
COLORADO STATE UNIVERSITY
EXTENSION

CMG GardenNotes #242

Using Manure in Colorado Gardens

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For some gardeners in Colorado, manure is readily available as a source of organic matter to build soils and add small amounts of nutrients. However, follow precautions with manure applications or they could become more detrimental than beneficial.

E. coli, a Health Issue

Due to the potential of transmission of human pathogens such as *E. coli*, animal-based manures should only be used on fruits and vegetables when specific precautions are taken. Apply non-composted (fresh) animal manures in the fall and mix it into the soil. Do not leave it on the soil surface. When applying fresh animal manure, it is best to wait three to four months from application to harvest in order to give plenty of time for the manure to break down and reduce any pathogen threats. Never apply fresh manure to growing food crops. Plant-based composts can be used safely during the growing season and does not pose the same health risks as animal manures.

Nitrogen Release Rate is Slow

Manure contains small amounts of plant nutrients and micronutrients. The nutrient composition of farm manure varies widely depending on bedding material, moisture content, exposure, and aging, even for the same species of animal. Where manure is routinely added, garden soils will likely have adequate phosphorus and potassium. Manure is a great source of micronutrients like zinc. **Table 1** gives approximate amounts of nitrogen, phosphate, and potash.

The nitrogen in manure is not all available to growing plants the first year as much of it may be tied up in organic forms. Organic nitrogen becomes available to plants when soil microorganisms decompose organic compounds, such as proteins, and then convert the released N to NH_4. This process, known as mineralization, begins almost immediately, but fully occurs over a period of years. [**Table 2**]

Table 1. Approximate Nutrient Content of Manure*			
Type	**N**	**P_2O_5**	**K_2O**
Beef:			
With bedding.	1.1%	0.9%	1.3%
Without bedding.	1.1%	0.7%	1.2%
Dairy Cattle:			
With bedding.	0.5%	0.2%	0.5%
Without bedding.	0.5%	0.2%	0.5%
Horse:			
With bedding.	0.7%	0.2%	0.7%
Poultry:			
With litter.	2.8%	2.3%	1.7%
Without litter.	1.7%	2.4%	1.7%
Rabbit:	2.0%	1.3%	1.2%
Sheep:			
With bedding.	0.7%	0.5%	1.3%
Without bedding.	0.9%	0.6%	1.3%
Swine:			
With bedding.	0.4%	0.4%	0.4%
Without bedding.	0.5%	0.5%	0.4%
Turkey:			
With litter.	1.0%	0.8%	0.7%
Without litter.	1.4%	1.0%	0.9%

*At time of land application.
Sources: CSU Extension Bulletin 552A, Utilization of Animal Manure as Fertilizer except for rabbits from Western Fertilizer Handbook of the California Fertilizer Association.

Table 2. Approximate Percentage of Organic N Mineralized in First Year After Application	
Manure Source	**Percent of Organic N Mineralized**
Beef	35%
Dairy	35%
Horse	20%
Poultry	35%
Sheep	25%
Swine	50%

Source: Nebraska Cooperative Extension Bulletin EC89-117, Fertilizing Crops with Animal Manures.

The amount mineralized in the first year depends upon the manure source, soil temperature, moisture, and handling. **In general, about 30% to 50% of the organic nitrogen becomes available the first year. Thereafter, the amount gradually decreases. A general estimate is 50% the first year, 25% the second year, 12.5% the third year, and so forth.**

In gardens low in organic matter, it is common to find nitrogen deficiencies when the gardener relies solely on manure and/or compost due to the slow-release rates. The gardener may need to supplement with a high nitrogen organic or manufactured fertilizer. As the soil organic matter builds over the years, the problems with low nitrogen levels will improve.

Salts

Salt content may be high in fresh manure and decreases with exposure to rains and irrigation as salts are leached out. **Continual and/or heavy applications of manure can lead to a salt build-up.**

To avoid salt problems associated with the use of manure or compost made with manure, limit applications to one inch per year and thoroughly cultivate the manure or compost into the soil six to eight inches deep. When cultivation is less than six to eight inches deep, lower the application rate accordingly. Have a soil test for salt content before adding large amounts.

Manure or compost made with manure containing up to 10 dS/m (10 mmhos/cm) total salt is acceptable if cultivated six to eight inches deep into a low-salt garden soil (less than 1 dS/m or 1 mmhos/cm). Manure with a salt content greater than 10 dS/m (10 mmhos/cm) is questionable. Avoid use of manure on soils that are already high in salts (above 3 dS/m (3 mmhos/cm).

Note: dS/m or mmhos/cm are the units used to measure salt content. It measures the electrical conductivity of the soil.

Other Disadvantages of Farm Manure

Other disadvantages of farm manure include:

- Potential burning of roots and foliage from high ammonia.
- Potential residual herbicide damage to crops.
- High potential for weed seeds.
- Labor and transportation necessary to apply the manure to the garden.

Horse manure is legendary in its potential to introduce a major weed seed problem into a garden. Composting the manure before application may kill the weed seeds if the pile heats to above 145ºF and the pile is turned to heat process the entire product.

Horses eating grass hay treated with broadleaf herbicides containing clopyralid and aminopyralid can convey the herbicide in their manure. If grasses were treated with these herbicides in the eighteen months prior to cutting and baling as hay, then the risk of horse manure containing the herbicide is present. Gardeners can test a small sample of the manure by mixing an amount proportional to what would be applied to soils into a large flowerpot with garden soil. Plant seeds of crops intended for that growing season in the flowerpot and observe for any signs of herbicide stress or injury such as: low germination, yellowing, twisted growth, dead leaves, stunting, or death of entire plant. These are clear signs that the herbicide is still active in the manure.

Feedlot manure is often high in salts if a salt additive is used in the livestock diet.

Poultry manure is particularly high in ammonia and readily burns if over-applied. The ammonia content will be higher in fresh manure compared to aged manure. Laying hen manure can raise soil pH due to the calcium supplements in their diet. Occasionally, gardeners may want to “fix” their soil by adding large quantities of organic matter at one time. Excessive applications of manure can lead to a reduction of plant growth due to excessive levels of nitrogen, ammonia burn, and salt damage to the roots.

Composted Manure

A growing trend in the use of manure is to compost it before application. Bagged composted manure is readily available in garden stores and nurseries. Composted manure has fewer odors. It is easier to haul and store than fresh manure because of the reduction in the weight of water and a decrease in overall volume by four to six-fold. The composting process may kill weed seeds and pathogens if the pile heats above 155ºF and the pile was turned to heat-process the entire product. Salts can be concentrated during composting as moisture is lost and volume is reduced. Many bagged manure products sold in Colorado are high in salts.

In composted dairy manure, only 5-20% of the nitrogen will be available the first year. In soils low in organic content, this can lead to a nitrogen deficiency unless an additional quick release nitrogen source is added. This could be supplied with blood meal (one to two pounds per one hundred square feet) or with a manufactured fertilizer like ammonium nitrate (2/3 cup per 100 square feet) or ammonium sulfate (one cup per 100 square feet). The ammonia content drops due to volatilization during composting, thereby reducing the burn potential.

Fresh manure without bedding materials is difficult to compost, because of the high ammonia and moisture content. To speed decomposition and minimize foul odors from anaerobic decay, add some high carbon material, such as sawdust, straw, dried leaves, or wood chips. Depending on climatic conditions, on-farm manure composting takes six to ten or more weeks if turned weekly.

Follow the same residual herbicide risk precautions with composted manure as detailed above.

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