HAMILTON COUNTY
Storm Water District

ORGANIC FERTILIZER ALTERNATIVES

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pH

pH is the most critical aspect of soil fertility. If pH is too low (acidic) or too high (alkaline) vital macro and micro nutrients may be present in the soil but nor available to plants. Most vegetable crops prefer a slightly acidic soil with a pH around 6.5 – 6.8. This range makes for happy worms and microorganisms and generally supports an abundance of readily available soil nutrients. Your soil fertility test results will list a target pH.

To lower pH, elemental sulfur or iron sulfate may be applied. It is recommended that these products be applied in the fall as it will take several months to be effective. This application must be applied every fall because the soil pH will tend to migrate back to its original level. One downside of using iron sulfate is that it could also tie up phosphorus, particularly in this case where the phosphorus soil test is on the low side.

Aluminum Sulfate is immediately effective after application, but the Aluminum can be toxic to ericaceous (acid loving) plants such as Rhododendron, Azalea and Blueberries. Peat Moss and coffee grounds will help to moderate pH, but the amount of coffee grounds required to lower pH by 1 point would prove to be toxic to the plants.

To Decrease pH: Apply 2 to 3 pounds of sulfur per 100 square feet to lower soil pH 1 point. Always read package directions

To increase pH: Apply *5 pounds of lime per 100 square feet to raise soil pH by 1 point. Always read package directions*

Organic Matter

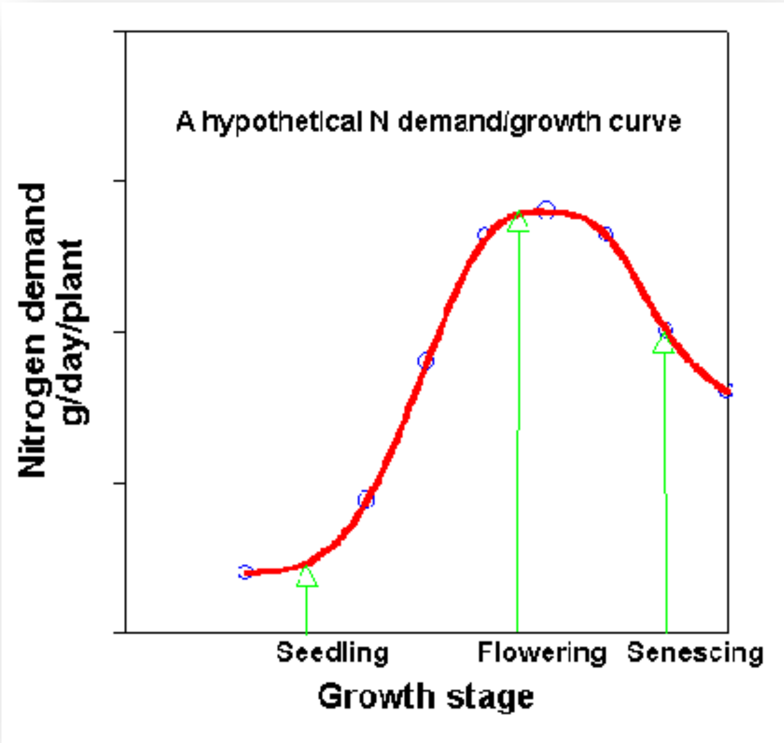
Incorporate organic matter into your soil with a locally available compost material. Mulching gardens with 2-3" of organic material annually will increase soil organic matter and reduce the amount of commercial fertilizer you need to apply. This organic material will feed the microorganisms, help to moderate soil temperature and pH, loosen compacted soil and help to retain moisture during dry periods. After 3 years, the rate of fertilizer could possibly be reduced by 1/2. This is one reason why soil fertility tests should be run every 4-5 years. It is advisable to add organic matter prior to pulling samples for a soil fertility test, not afterward.

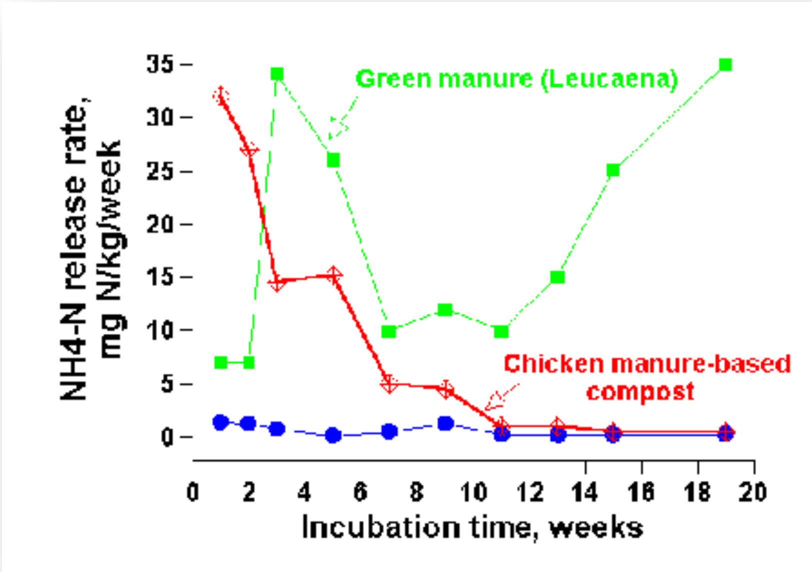
Nitrogen (N)

Total N Concentration in Common Organic Sources

Organic Source	**Total N (%)**
Poultry manure	1.5-3.0
Pig, horse, cow manure	0.3-0.6
Green manure	1.5-5.0
Compost	0.5-2.0
Seaweed meal	2.0-3.0
Sewage sludge	1.0-5.0
Fish waste	4.0-10.0
Blood (slaughter house)	10.0-12.0
Human urine/night soil	1.0-1.5

Synchronization. The need for N fertilizers would be reduced significantly if the crop's N requirement can be timed closely to the nitrogen release from organic sources.





Plants require different amounts of N at different stages of growth: seedlings and senescing plants definitely require much less N than flowering or fruiting plants. We also have known that different organic manures have different N releasing patterns. For example, the below chart shows the N release patterns three organic sources.

Nitrogen from poultry manures (non-composted) is more quickly available than N in manure from cow, and sheep. This is because poultry manure contains significant amounts of uric acid, which is readily decomposable. Also, roughage in cattle diets results in manure that is less readily decomposed due to lignin and cellulose. Horse manure is the least desirable type of manure due to the high rate of viable weed seed. Presence of bedding or litter lowers N content by dilution, but its effect on N availability cannot be easily predicted.

> Moist manure, when exposed to the air, undergoes significant loss of N as volatile NH3. Fresh manure can also burn plants. Nitrogen losses after spreading can be significantly reduced by incorporating the manure --even shallow incorporation is adequate.
>
> Nitrogen in composts is a more stable form than N in manures. Thus, there is a decreased likelihood of losing compost N from the system. On the other hand, composts containing less than 1.5% total N and supply little or no N to crops during the first few weeks after application.
>
> Green manures are fast growing catch crops like clovers, mustard, rye, radishes and vetches that are incorporated into the soil while they are still green in order to improve the soil and to supply N to the associated/subsequent crop. A properly managed legume cover crop can fix up to 3 – 4 lbs. of N/1,000ft.sq. in 3 to 6 months. (Bugg and Miller, 1991).

<u>Phosphorus (P)</u>

Total P concentration in organically acceptable sources

Source	**Total P (%)**
Rock phosphate	17-26
Bone meal	20-30
Fish meal	5-10
Wood ash	2-5
Poultry manure	0.5-1.5
Green manure	0.2-0.5
Compost	0.2-0.5
Sewage sludge	0.4-2.5

The above table shows P content of selected sources that are acceptable to organic farming community in most states. Among these, the first two, rock phosphate and bone meal, have reasonably high total P content: between 20 and 30%. However, P in these two sources is very insoluble, thus much less plant available than P in treble superphosphate. More specifically, P in rock phosphate and bone meal has the formula: $Ca_5(OH)(PO_4)_3$ which is hydroxy apatite or apatite for short. This is the same material that our bones and teeth are made of. As our teeth can attest to it, apatite is quite durable; is very hard to dissolve in water, meaning that it provides very little phosphate to your crop in the short term.

A couple of things should be mentioned about rock phosphate. First, it is a source of P for long-term soil improvement, don’t t expect any noticeable effect from it within weeks or months, unless you use huge amounts of it. Second, its solubility, and thus plant availability, depends strongly on soil pH and particle size. It is more effective in acid soils than in calcareous or alkaline soils; more effective when it is fine than coarse, and more effective in the presence of mycorrhiza than without mycorrhiza.

By contrast, P contents of chicken manure, compost, and sludge are relatively low, usually below 3%. Thus, large amounts would be needed to meet P requirement of the crop. Yet, pound for pound, P from these organic sources is quite available to plants; sometimes even more effective than treble superphosphate. Our recent work has shown that organic matter from the manure interacts with clay minerals and reduces P sorption by the soil, thereby enhancing P availability to plants (Hue, 1990; 1991).

POTASSIUM (K)

In plants, potassium is required for maintaining osmotic potential of cell. That is, K makes plants look turgid. Since K regulates the osmotic potential of cells, and the close or open conditions of stomata, it plays an important role in water relations in the plant. Potassium is involved in water uptake from the soil, water retention in the plant tissue, and long distance transport of water in the xylem and of photosynthates in the phloem. Potassium affects cell extension. With adequate K, cell walls are thicker, thereby improving plant resistance to lodging, pests and disease. Fruits and vegetables grown with adequate K seem to have a longer shelf life in the grocery store.

Total K concentration in selected organically acceptable sources *(Adapted from Nick and Bradley, 1994; and personal data)*

Source	**Total K, %**
Sul-Po-Mag [Mg, K, SO4]	22.0
Polyhalite [Ca, K, SO4]	10-15
Wood ash	5-10
Green sand	5-7
Green manure	2-5
Seaweed meal	2-3
Compost	0.5-2.0

Quick Tip Guide

Table 7. Average Plant Food Content of Natural and Organic Fertilizer Materials (Percentage on a Dry-Weight Basis.)					
Organic Materials	**% N**	**% P**	**% K**	**Availability**	**Acidity**
Fish Scrap	5.0	3.0	0	slowly	acid
Fish Meal	10.0	4.0	0	slowly	acid
Guano, Bat	10.0	4.0	2.0	moderately	acid
Sewage Sludge	2.0-6.0	1.0-2.5	0.0-0.4	slowly	acid
Dried Blood	12.0	1.5	0.8	mod. slow	acid
Soybean Meal	7.0	1.2	1.5	slowly	v. sl. acid
Tankage, Animal	9.0	10.0	15.5	slowly	acid
Tobacco Stems	1.5	0.5	5.0	slowly	alkaline
Seaweed	1.0	---	4.0-10.0	slowly	---
Bone Meal, Raw	3.5	22.0	---	slowly	alkaline
Wood Ashes	---	2.0	4.0-10.0	quickly	alkaline
Cocoa Shell Meal	2.5	1.0	2.5	slowly	neutral
Cotton Seed Meal	6.0	2.5	1.5	slowly	acid
Ground Rock Phosphate	---	33.0	---	very slowly	alkaline
Green Sand	---	1.0	6.0	very slowly	---
Basic Slag	---	8.0	---	quickly	alkaline
Horn and Hoof Meal	12.0	2.0	---	---	---
Milorganite	6.0	2.5	---	---	---
Peat and Muck	1.5-3.0	0.25-0.5	0.5-.10	very slowly	acid
Spent Mushroom Compost	2.0	.74	1.46	moderately	6.4

To determine % of nutrient to lbs./1,000ft square use this quick calculation.

________________ Divided by _____________ = ______________________
Amt. of Nitrogen % of Nitrogen # lbs Needed
Needed in lbs.

Example – My soil test shows the need for 1 lb. of Nitrogen and 4 lb of Potassium/1,000ft. sq.

I will use composted Poultry Manure with an analysis of 3-1-1. The percentage of N is .03.

______1______ Divided by __.03_______ = ________33_______
Amt. of Nitrogen recommended % of Nitrogen in manure # lbs Needed

I divided 1 by .03 = 33lbs of composted poultry manure needed/1,000ft. sq.

This amount of Composted Poultry Manure also contains.33 pounds of Potassium.

______33________ Times ______.01_________ = ____.33____
pound being used % of Potassium # lbs supplied

I arrived at this number by multiplying the number of pound I will be using – 33 - times the percentage of Potassium available in composted chicken manure .01 = .33

I still need 3.67 lbs. of Potassium to make up the rest of the Potassium I need, I will use Green Sand with an analysis of 0-1-6. The percentage of each element is 0-.01-.06

____3.67____________ Divided by _____.06_______ = __61.16________
Amt. of Nitrogen needed Needed in lbs. % of Nitrogen # lbs Needed

This calculation shows I will need 61.16 lbs of Green sand to make up the need for the rest of the Potassium. Note, these materials also will provide some Phosphorus, which I don't need, but it is the minimal amount from the choice of materials.

- http://www.msusoiltest.com/tools/fertilizer-calculator/ Fertilizer calculator.

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