

Using Natural Fertilizers in Ground Beds in Greenhouses: Converting Chemical Fertilizer Recommendations to Organic Fertilizers

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Granular organic fertilizers and compost are becoming increasingly popular for fertilizing cut flowers, vegetables, and other crops grown in the field or in ground beds in greenhouses and high tunnels. Many growers report excellent results with these materials. Generally, organic fertilizers release nutrients slowly providing more timely nutrient release for the plants and potentially less nutrient leaching than chemical fertilizers.

When using natural fertilizers for plant nutrition, careful management of the structure and chemistry of the soil is essential. Soil pH between 6.2 and 6.8 is generally considered optimum for most crops growing in soil. A soil test will indicate whether or not the acidity should be changed. Fine ground limestone is used to raise the pH of acid soils; sulfur is used to lower the pH of alkaline soils.

It is equally important to maintain a high level of organic matter in the soil each year to maintain good soil structure - preferably at least 5% (at least 1 lb. per 1 sq. ft.). A soil organic matter test can estimate the required level to add. In greenhouses, there is a continual loss of organic matter due to cultivation, warm soil temperatures, frequent watering, and crop harvests. Animal manure-based composts should be avoided due to high nitrogen content which can lead to ammonium toxicity and high soluble salts.

An annual routine field or garden soil will provide information on what nutrients are adequate or limiting and provide a fertilizer recommendation. Visit the University of Massachusetts website for information on soil sampling and testing <http://www.umass.edu/soiltest/>. Once a soil test and fertilizer recommendation is received, the following steps and charts can be used to calculate the amounts of organic fertilizers to use for greenhouse crops grown in soil in ground beds.

If the soil test results recommend a commercial fertilizer such as 5-10-5 expressed as pounds per 100 or per 1000 sq. ft, then the first step is to convert the soil test recommendation to the number of pounds of nitrogen (N) to apply. Even though many fertilizers supply phosphorus and potassium also, N is the element most likely to be the deficient.

Step 1. Test soil and obtain fertilizer recommendation. Example: apply 30 lbs. 5-10-5 per 1000 sq. feet. The fertilizer analysis translates to 5% N (or 0.05) (The fertilizer also contains 10% phosphorus expressed as PO and 5% potassium expressed as K O).² To convert the soil test recommendation to the quantity of organic fertilizer to use, the number of pounds of N is needed (Step 2).

Step 2. Determine the number of pounds of N that is needed by multiplying the %N by the recommended rate. Example: 0.05 x 30 lbs. (recommended rate) = 1.5 lbs. nitrogen per 1000 sq. feet. (In other words 5% of 30 lbs. of 5-10-5 is 1.5 lbs. of N).

Step 3. Using Chart 1, choose the organic fertilizer you want to use instead of chemical 5-10-5 to supply the required amount of N. For example, you decide on dried blood which has an analysis of 12-0-0.

Step 4. Use Chart 2 to determine the lbs. of the organic fertilizer to apply. Look at the lbs. of nutrients desired (determined in Step 2) on the top of the chart. Follow the column down until you find the percent analysis of the natural fertilizer. Example: 1.5 lbs. N is recommended Find 1.5 at top of chart (pounds of nutrient desired) and then find 12% (percent N in dried blood) in the left column. The chart indicates 12.5 lbs of dried blood would provide 1.5 lbs of N. So, 12.5 lbs of dried blood would be applied to 1,000 sq. ft. based on the recommendation.

Chart 1. Common Organic Fertilizers

Fertilizer	Analysis N- P₂O₅-K₂O	Nutrient availability	Comments
Dried Blood	12-0-0	High	
Bone Meal	2-20-0.2	Moderate	May attract pests
Rock Phosphate	0-20-0	Low	Must be ground to fine mesh (200) owde
Fish Emulsion	4-1-1	Moderate	May attract pests
Fish Meal	10-4-0	Moderate	May attract pests
Leaf Mold	1-1-1	Moderate	
Seaweed	1.5-0.7-5	Moderate	
Cottonseed Meal	7-2.5-2	High	May contain pesticide residue
Wood Ashes	0-2-5	High	Hardwood ash preferred
Fresh garden compost	1-1-1	Moderate	Quality depends on ingredients
Composted manure (not dehydrated)			
Cow	0.5-0.25- 0.5	Moderate	
Horse	0.7-0.5-0.6	Moderate	
Rabbits	4-3-1	Moderate	
Hen	1.8-1-0.5	Moderate	
Hog	0.3-0.3-0.45	Moderate	
Sheep	1-0.35-0.5	Moderate	
Sludge	4-2.5-1	Moderate	Contains toxic metals
Granite Dust	0-1-6	Low (Nearly insoluble)	

Fertilizers in Chart 1 rated “moderate” for availability should be applied at **double** the amount needed; those rated “low” should be applied at **4 times** the amount needed. Do not use cat, dog, or human waste as a manure to prevent the spread of disease. Also, nowadays many feel that it is safer to use composted rather than fresh farm animal manure.

Note: One full bushel of compost, manure or seaweed will weigh about 40 lbs.

Chart 2. Amount of Fertilizer Needed Based on % Nutrient in Fertilizer and Number of lbs. of Nutrient Desired

Pounds of Nutrient Recommended or Desired											
% Nutrient in Fertilizer	0.5	1	1.5	2	2.5	3	4	5	6	8	10
0.2	250	500	750	1000	1250	1500	2000	2500	3000	4000	5000
0.25	200	400	700	800	1000	1200	1600	2000	2400	3200	4000
0.4	125	250	375	500	625	750	1000	1250	1500	2000	2500
0.5	100	200	300	400	500	600	800	1000	1200	1600	2000
1.0	50	100	150	200	250	300	400	500	600	800	100
1.5	33	66	100	133	166	200	250	330	400	500	660
2.0	25	50	75	100	125	150	200	250	300	400	500
2.5	20	40	60	80	100	120	160	200	240	320	400
3.0	17	33	50	66	83	100	133	165	200	266	330
4.0	12	25	37	50	73	75	100	125	150	200	300
5.0	10	20	30	40	50	60	80	100	120	160	200
6.0	8	16	25	33	40	50	66	83	100	132	166
7.0	7	14	20	28	35	40	55	70	80	110	140
10.0	5	10	15	20	25	30	40	50	60	80	100
12.0	4	8	13	17	20	25	33	42	50	66	82
15.0	3	7	10	13	17	20	25	33	40	50	66
20.0	2	5	8	10	13	15	20	25	30	40	50

Most often, fertilizer recommendations are based on the amount of N to apply. However, the information in Chart 2 and the earlier four step calculations can be used for any element. For example, a soil test might recommend an application of P, but not N and K. In this case the choice of rock phosphate would be best and so the procedure outlined here and Chart 2 would be used for P rather than N.

²Adapted from: Morehouse C. and A. Barker. 1980. Natural Fertilizers in the Home Vegetable Garden. Cooperative Extension Service, University of Massachusetts.