How to Convert an Inorganic Fertilizer Recommendation To an Organic One

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The success of any garden begins with the soil. A fertile, biologically active soil provides plants with enough nutrients for good growth. Fertilizers supplement or renew these nutrients, but they should be added only when a soil test indicates the levels of available nutrients in the soil are inadequate.

In the garden, whether you are growing annuals or perennials, vegetables or flowers, most of the crops have a few short months to grow and develop flowers and fruits. The soil must provide a steady, uninterrupted supply of readily available nutrients for maximum plant growth. Fertilizer form, particle size, solubility, and potential uptake are extremely important in fertility programs for gardening.

Organic gardeners place great emphasis on using natural minerals and organic fertilizers rather than manufactured ones in order to build their soil. If you use organic materials as all or part of your fertilization program, this bulletin will help you calculate the proper amount to use from the guidelines recommended by a soil test. Most organic materials must be used in combination since many do not have a balance of N-P-K; you should become familiar with the attached list of fertility values of organic sources of nutrients (Table 1, page 4).

Organic Matter

Organic matter is the varied array of carbon-containing compounds in the soil. Organic matter is created by plants, microbes and other organisms that live in the soil. Organic matter provides energy for biological activity. Many of the nutrients used by plants are held in organic matter until the organisms decompose the materials and release them for the plants' use. Organic matter also attracts and holds plant nutrients in an available state, reducing the amount of nutrients lost through leaching. It improves soil structure, so that air reaches plant roots and the soil retains moisture. The organic matter and the organisms that feed on it are central to the nutrient cycle.

Fertilizer Labels – What They Mean

Georgia law requires fertilizer producers to display the guaranteed analysis (grade) on the fertilizer container. A fertilizer grade or analysis that appears on the bag is the percentages of nitrogen (N), phosphorus (P_2O_5) and potassium (K_2O) in the material. A 5-10-15 grade fertilizer contains 5 percent N, 10 percent P_2O_5 and 15 percent K_2O. A 50-pound bag of 5-10-15 fertilizer contains 2.5 pounds of N (50 x 0.05 = 2.5), 5 pounds of P_2O_5 (50 x 0.10 = 5), and 7.5 pounds of K_2O (50 x 0.15 = 7.5), for a total of 15 pounds of nutrients. The other 35 pounds of material in the bag is filler or carrier.

The fertilizer ratio is the ratio of the percentages of N, P_2O_5 and K_2O in the fertilizer mixture. Examples of a 1-1-1 ratio fertilizer are 10-10-10 and 8-8-8. These fertilizers have equal amounts of nitrogen, phosphorus, and potassium. An example of a fertilizer with a 1-2-3 ratio is 5-10-15. This fertilizer would have twice as much phosphorus and three times as much potassium as nitrogen.

Fertilizer Recommendations

It is difficult to recommend a specific fertilizer type or amount of fertilizer for any given situation. All fertilizer recommendations should take into consideration soil pH, residual nutrients, and inherent soil fertility. Fertilizer recommendations based on soil analyses are the very best chance for getting the right amount of fertilizer without over- or under-fertilizing.

Fertilizer recommendations based on soil tests result in the most efficient use of lime and fertilizer materials. This efficiency can occur only when valid soil sampling procedures are used to collect the samples submitted for analyses. To be beneficial, a soil sample must reliably represent the field, lawn, garden or "management unit" from which it is taken. If you have questions about soil sampling, please contact your local county extension office for information.

Soil pH

An underlying cause of poor fertility in Georgia is acidic soil. Raising the pH near 6.5 stimulates the activity of microorganisms that helps decompose organic matter and unlocks nutrients bonded to the soil particles.

Soil pH ranges are essential considerations for any

fertilizer management program. The soil pH strongly influences plant growth, the availability of nutrients, and the activities of microorganisms in the soil. It is important to keep soil pH in the proper range for production of the best yields and high quality growth.

The best pH range for most plant growth in the garden is 6.0 to 6.5. Soils deficit in calcium or other alkaline substances are or can become too acidic. For example, Coastal Plain soils become strongly acid (pH 5 or less) with time if lime, a primary source of needed calcium, is not applied. A soil test, essential for determining how much lime should be applied, should be done every two years.

Calcium will not spread quickly throughout the soil profile. It must be thoroughly incorporated before planting; therefore, lime should be broadcast and thoroughly incorporated to a depth of 6 to 8 inches to neutralize the soil acidity in the root zone. To allow adequate time for neutralization of soil acidity (raising the pH), lime should be applied and thoroughly incorporated two to three months before seeding or transplanting. However, if application can not be made this early, liming will still be very beneficial if applied and incorporated at least one month prior to seeding or transplanting.

The preferred liming material for Georgia gardeners is dolomitic limestone. In addition to calcium, dolomitic limestone also contains 6 to 12 percent magnesium in which all Georgia soils routinely become deficient.

Environmental Effects on Organic Nutrient Uptake

1. **Temperature/Soil Temperature** - Early spring in Georgia is cool and soil temperatures rise slowly to the point where microorganisms are active. Until the soil warms sufficiently and the fertilizer materials are broken down into their useable form, organic fertilizers may not successfully stimulate plant growth. This may cause stunting of growth early in the season when using organic fertilizers.
2. **pH** - Too low or too high a pH in the soil profile can cause the nutrients to become unavailable. Most plants grow well at a pH of 6.0 - 7.0. The exceptions are Irish potatoes which are grown at a pH of approximately 5.5. Potatoes are grown at this pH to reduce the incidence of scab disease (*Streptomyces* spp.). Also, blueberries grow at a pH of less than 5.0, while the rhododendron family grows well around 5.5.

To replace the inorganic fertilizer recommendations from the Soil Test Report with organic fertilizer:

Organic Fertilizer for 1000 Square Feet of Garden Space

1. Calculate the nitrogen (N) recommendation first.

Example:

Soil test results recommend 20 lbs. of 5-10-15 plus 1.0 lb of ammonium nitrate (34-0-0) per 1,000 sq. ft. of garden. Use blood meal (12-1.5-0.6) for your nitrogen source of fertilizer. Divide the nitrogen number of the inorganic source (5) by the nitrogen number of the blood meal (12). Multiply this answer times the lbs. of inorganic fertilizer recommended.

5 ÷ 12 = .41 x 20 lbs. =
8.2 lbs. of blood meal per 1,000 sq. ft.

For the 1.0 lb. of ammonium nitrate (34-0-0) called for using blood meal calculate:

34 ÷ 12 = 2.8 x 1.0 lb. = 2.8 lbs. of blood meal extra

Total organic nitrogen = 11 lbs. of blood meal (8.2 lbs. + 2.8 lbs.)(The 1.5 phosphorus and 0.6 potassium is not significant enough to be counted.)

2. Calculate the phosphorus ($P_2 0_5$) recommendation next.

Example:

Use steamed-bone meal (approx. 1-11-0) for the phosphorus source. Divide the phosphorus number (10) by the organic phosphorus number (11) and you get 0.91. Multiply 0.91 times the 20 lbs. needed for a total of 18.2 lbs. of steamed-bone meal required for 1000 sq. ft.

Total organic phosphorus = 10 ÷ 11 =0.91 x 20 lbs.
= 18.2 lbs. of steamed-bone meal per 1,000 sq. ft.

3. Calculate the potassium ($K_2 0$) recommendation next.

Example:

Sulfate of Potash Magnesia or Sul-Po-Mag (0-0-22) is recommended for the potassium requirements. Dividing the potassium number recommended (15) by the potassium number of the Sul-Po-Mag (22) equals 0.682. Multiplying 0.682 times 20 lbs. of fertilizer needed results in 13.6 lbs of Sul-Po-Mag per 1,000 sq. ft.

Total organic potassium = 15 ÷ 22 = 0.682 x 20 lbs.
= 13.6 lbs. of Sul Po Mag per 1,000 sq. ft.

NOTE - If you use wood ashes, it is recommended that no more than 10-12 lbs. be used per.1,000 sq. ft./year due to its high salt concentrations.

Assuming blood meal, bone meal, and Sul-Po-Mag are used, the equivalent to 20 lbs. of 5-10-15 plus 1.0 lb of ammonium nitrate per 1,000 sq. ft. of garden is 11 lbs. of blood meal, 18.2 lbs. of steamed bone meal, and 13.6 lbs. of Sul-Po-Mag.

Organic Fertilizer for 100 Feet of Row

To replace inorganic fertilizer recommendations with organic fertilizer per 100 linear feet of row

1. Calculate the nitrogen recommendation first.

Example:

Soil test results recommends 7 lbs. of 5-10-15 plus 0.5 lbs. of ammonium nitrate per 100 linear feet of garden row. Using blood meal (12-1.5-0.6) for your nitrogen source of fertilizer, divide the nitrogen number of the inorganic source (5) by the nitrogen number of the blood meal (12). Multiply this answer times the lbs. of inorganic fertilizer recommended.

5 ÷ 12 = .41 x 7 lbs. = 2.9 lbs. of blood meal per 100 linear feet of row

For the 0.5 lbs. of ammonium nitrate called for using blood meal calculate:

34 ÷ 12 = 2.8 x 0.5 lbs. = 1.4 lbs. of blood meal extra
Total Organic Nitrogen = 4.3 lbs. of blood meal per 100 linear feet of row

2. Calculate the phosphorus recommendation next.

Example:

Use steamed-bone meal (approx. 1-11-0) for the phosphorus source. Divide the phosphorus number (10) by the organic phosphorus number (11) and you get 0.91. Multiply 0.91 times the 7 lbs. needed for a total of 6.4 lbs. of steamed-bone meal required per 100 linear foot of row.

Total organic phosphorus = 10 ÷ 11 = 0.91 x 7 lbs.= 6.4 lbs. of steamed-bone meal per 100 linear feet of row

3. Calculate the potassium recommendation next.

Example:

Use Sul-Po-Mag (0-0-22) for the potassium requirements. Dividing the potassium number needed (15) by the potassium number of the Sul-Po-Mag (22) equals 0.682. Multiplying 0.682 times 7 lbs. of fertilizer needed results in 13.6 lbs of Sul-Po-Mag per 100 linear foot of row.

Total organic potassium = 15 ÷ 22 = 0.682 x 7 = 13.6 lbs. of Sul Po Mag per 100 linear feet of row

Assuming blood meal, bone meal, and Sul-Po-Mag are used, the equivalent to 7 lbs. of 5-10-15 plus 0.5 lb of ammonium nitrate per 100 linear feet of row of the garden is 4.3 lbs. of blood meal, 6.4 lbs. of steamed bone meal, and 13.6 lbs. of Sul-Po-Mag.

Table 1

Guide to the Mineral Nutrient Value of Organic Fertilizers

(Percent[1])

Materials	N	P_2O_5	K_2O	Relative Availability
Alfalfa Meal	3.0	1.0	2.0	Medium-Slow
Blood Meal	12.0	1.5	0.6	Medium-Rapid
Bone Meal (steamed)	0.7-4.0	11.0-34.0	0.0	Slow-Medium
Brewers Grain (wet)	0.9	0.5	0.1	Slow
Castor Pomace	5.0	1.8	1.0	Slow
Cocoa Shell Meal	2.5	1.0	2.5	Slow
Coffee Grounds (dry)	2.0	0.4	0.7	Slow
Colloidal Phosphate	0.0	18.0-24.0	0.0	Slow
Compost (not fortified)	1.5	1.0	1.5	Slow
Cotton Gin Trash	0.7	0.2	1.2	Slow
Cottonseed Meal (dry)	6.0	2.5	1.7	Slow-Medium
Eggshells	1.2	0.4	0.1	Slow
Feather	11.0-15.0	0.0	0.0	Slow
Fertrell - Blue Label	1.0	1.0	1.0	Slow
Fertrell - Gold Label	2.0	2.0	2.0	Slow
Fertrell - Super	3.0	2.0	3.0	Slow
Fertrell - Super "N"	4.0	3.0	4.0	Slow
Fish Meal	10.0	4.0	0.0	Slow
Fish Emulsion	5.0	2.0	2.0	Medium-Rapid
Fish Scrap (dry)	3.5-12.0	1.0-12.0	0.8-1.6	Slow
Garbage Tankage (dry)	2.7	3.0	1.0	Very Slow
Grape Pomace	3.0	0.0	0.0	Slow
Granite Dust	0.0	0.0	6.0	Very Slow
Greensand	0.0	1.0-2.0	5.0	Slow
Guano (bat)	5.7	8.6	2.0	Medium
Guano (Peru)	12.5	11.2	2.4	Medium
Hoof/Horn Meal	12.0	2.0	0.0	Medium-Slow
Kelp[2]	0.9	0.5	1.0-4.0	Slow
Manure[3] (fresh)				
Cattle	0.25	0.15	0.25	Medium
Horse	0.3	0.15	0.5	Medium
Sheep	0.6	0.33	0.75	Medium
Swine	0.3	0.3	0.3	Medium
Duck	1.1	1.4	0.5	
Poultry (75% water)	1.5	1.0	0.5	Medium-Rapid

Materials	N	P_2O_5	K_2O	Relative Availability
Poultry (50% water)	2.0	2.0	1.0	Medium-Rapid
Poultry (30% water)	3.0	2.5	1.5	Medium-Rapid
Poultry (15% water)	6.0	4.0	3.0	Medium-Rapid
Manure[3] (dry)				
Cricket Manure	3.0	2.0	1.0	Medium-Rapid
Goat	2.7	1.8	2.8	Medium
Dairy	0.7	0.3	0.6	Medium
Steer	2.0	0.5	1.9	Medium
Horse	0.7	0.3	0.5	Medium
Hog	1.0	0.7	0.8	Medium
Sheep	2.0	1.0	2.5	Medium
Rabbit	2.0	1.3	1.2	Medium
Marl	0.0	2.0	4.5	Very Slow
Mushroom Compost	0.7	0.9	0.6	
Sulfate of Potash Magnesia[4]	0.0	0.0	22.0	Rapid-Medium
Soybean Meal	6.7	1.6	2.3	Slow
Urea[5]	42.0-46.0	0.0	0.0	Rapid
Wood Ashes[6]	0.0	1.0-2.0	3.0-7.0	Rapid

Some of the materials may not be available because of restricted sources.

[1] The percentage of plant nutrients is highly variable; average percentages for materials are listed.
[2] Contains common salt, sodium carbonates, sodium and potassium sulfates.
[3] Plant nutrients, available during year of application, vary with amount of straw/bedding and method of storage.
[4] Also known as Sul-Po-Mag or K-Mag.
[5] Urea is an organic compound; but as manufactured sources are synthetic, it is doubtful that most organic gardeners would consider it acceptable.
[6] Potash content depends on the tree species burned. Wood ashes are alkaline, containing approximately 32% CaO.

For those who do not want to figure out the equivalent weights, here is an approximation of amounts of ingredients to use to attain the correct amounts of organic fertilizers called for in the soil test for 1,000 square feet.

Table 2
Organic Fertilizer Recommendations

Recommendations for Inorganic Fertilizers	Nitrogen [1] Needed for 5 lbs. of 5-10-15 From Organic Source	Phosphorus Needed for 5 lbs. of 5-10-15 From Organic Source	Potassium Needed for 5 lbs. of 5-10-15 From Organic Source
5 lbs. 5-10-15 (using component fertilizers)	2.0 lbs. blood meal 8.3 lbs. alfalfa meal 4.2 lbs. cotton seed meal 2.0 lbs. feather meal 2.5 lbs. fish meal 2.0 lbs. hoof meal 8.0 lbs. of cricket manure 4.0 lbs soybean meal	4.5 lbs. bone meal 1.4 lbs. colloidal phosphate	3.1 lbs. Sul-Po-Mag 15.0 lbs. greensand 15.0 lbs. granite dust 25.0 lbs. kelp
	Nitrogen Needed for 5 lbs. of 6-12-12	Phosphorus Needed for 5 lbs. of 6-12-12	Potassium Needed for 5 lbs. of 6-12-12
5 lbs 6-12-12 (using component fertilizers)	2.0 lbs. blood meal 10.0 lbs. alfalfa meal 5.0 lbs. cotton seed meal 2.0 lbs. feather meal 2.5 lbs. fish meal 2.5 lbs. hoof meal 10.0 lbs. of cricket manure 3.7 lbs soybean meal	5.5 lbs. bone meal 3.0 lbs. colloidal phosphate	2.7 lbs Sul-Po-Mag 12.0 lbs. greensand 12.0 lbs. granite dust 20.0 lbs. kelp
	Nitrogen, Phosphorus and Potassium Needed for 5 lbs. of 10-10-10		
5 lbs. 10-10-10 (for even analysis fertilizers)	33.3 lbs. of compost (1.5-1-1.5) 33.0 lbs. of 30% poultry manure (3-2.5-1.5) 50 lbs of Fertrell 1-1-1		
	Nitrogen Needed for 5 lbs. of 10-10-10	Phosphorus Needed for 5 lbs. of 10-10-10	Potassium Needed for 5 lbs. of 10-10-10
5 lbs. 10-10-10 (using component fertilizers)	4.2 lbs. blood meal 17.0 lbs. alfalfa meal 8.3 lbs. cotton seed meal 3.3 lbs. feather meal 5.0 lbs. fish meal 4.2 lbs. hoof meal 16.7 lbs. of cricket manure 7.5 lbs soybean meal	4.5 lbs. bone meal 2.8 lbs. colloidal phosphate	2.3 lbs. Sul-Po-Mag 10 lbs. greensand 16.6 lbs. of kelp

[1] Use only one of these amounts of fertilizer materials to equal 5 lbs. of nitrogen or use one-half of 2 different materials to make up the 5 lbs. of nitrogen required. The same process can be used for any other nutrient in the chart.

The University of Georgia
College of Agricultural and Environmental Sciences
Cooperative Extension Service

Soil Test Report

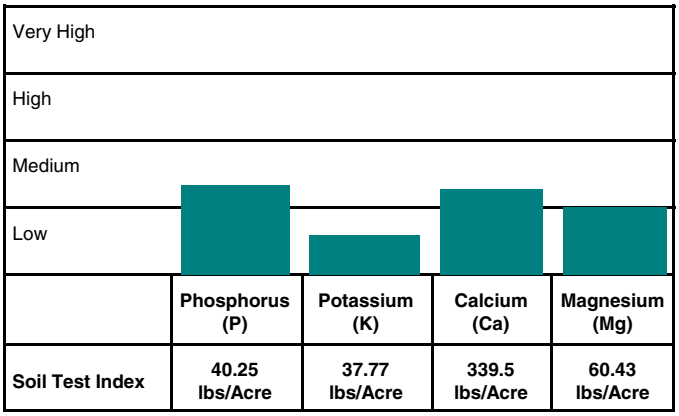
Sample ID

Soil, Plant and Water Laboratory

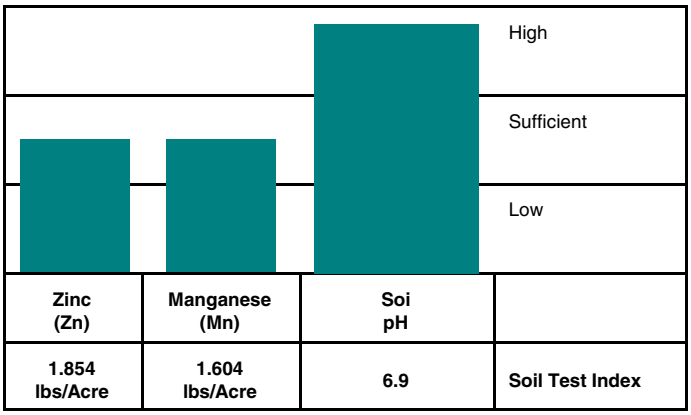
_____
(CEC/CEA Signature)

Grower Information	Lab Information	County Information
Client: **John Doe** 123 Nowhere Lane Sample: 1 Crop: Vegetable Garden	Lab #1755 Completed: 05/10/2000 Printed: 05/10/2000	**Tift County** P O Box 7548 Tifton, GA 31793

Results



	Phosphorus (P)	Potassium (K)	Calcium (Ca)	Magnesium (Mg)
Soil Test Index	40.25 lbs/Acre	37.77 lbs/Acre	339.5 lbs/Acre	60.43 lbs/Acre



	Zinc (Zn)	Manganese (Mn)	Soi pH	
	1.854 lbs/Acre	1.604 lbs/Acre	6.9	Soil Test Index

Recommendations

Limestone: 0 pounds per 1000 square feet

Broadcast 20 pounds of 5-10-15 plus 1 pound of ammonium nitrate per 1000 square feet, or apply 7 pounds of 5-10-15 plus ½ pound of ammonium nitrate per 100 linear feet of row.

The recommendation given above is for medium feeders, which include crops such as beans, beets, broccoli, cantaloupes, corn, cucumbers, eggplant, greens (kale, mustard, turnip, collards), okra, English peas, peppers, radish, squash, watermelon and sweet potatoes.

For heavy feeders such as cabbage, lettuce, onions, tomatoes and Irish potatoes, double the recommendation.

For light feeders such as southern peas, reduce the recommendation in half.

Apply 1 tablespoon of borax per 100 feet of row to broccoli and root crops such as turnips and beets. This can be applied by mixing the borax thoroughly with approximately 1 quart of soil in a container and then applying the mixture along the row; or it can be mixed with a quart of water and applied to the soil in solution.

For sweet corn, apply 1 tablespoon of zinc sulfate per 100 feet of row and sidedress with 1 to $1^{1}/_{3}$ pounds of ammonium nitrate (or equivalent amount of nitrogen) per 100 feet of row.

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Gale A. Buchanan, Dean and Director