

# Home and Market Garden Fertilization

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Vegetable gardening has become so popular in recent years that about half the nation's homeowners now grow some vegetables. In particular, New Mexico has experienced a tremendous increase in vegetable gardening.

Success in gardening depends much upon soil fertility. If soil lacks fertility, gardeners must add plant nutrients in the form of fertilizer. This guide will help gardeners select and use fertilizers to obtain high yields of good quality vegetables.

## Soil Tests

Having your soil tested is an excellent way to know the fertility level of soil and how much fertilizer to add. Extension agents located in every New Mexico county can provide information about how to have soil tested.

## Major Plant Nutrients

The major plant nutrients are nitrogen (N), phosphorus (P), and potassium (K). New Mexico soils are often deficient in nitrogen and phosphorus, but potassium usually is adequate when first brought into production.

Commercial fertilizer labels usually indicate, in percentages, the amount of actual nitrogen (N), phosphorus as available phosphoric acid ( $P_2O_5$ ), and potassium as potassium oxide ( $K_2O$ ) contained in the products. Fertilizer recommendations sometimes are given in terms of N, P, and K.

Phosphorus recommendations usually are given as pounds of  $P_2O_5$  per thousand square feet. To convert a recommendation for P into the  $P_2O_5$  form multiply the P value by 2.29. Similarly, if pounds of K are given instead of  $K_2O$ , then multiply the K value by 1.2 to obtain the recommended amount of  $K_2O$  to apply. Thus, a 20-20-20 (N-P-K) recommendation would mean the fertilizer would need to supply 20 percent of nitrogen, 45.8 percent of  $P_2O_5$ , and 24 percent of  $K_2O$ .

## Amounts for Small Areas

Fertilizer recommendations often are made in terms of pounds per acre. However, most gardeners plant areas much smaller than an acre. Table 1 shows the nitrogen and phosphorus requirements of some common garden vegetables for 1,000 square feet. Table 2 shows the requirements for the same vegetables for each 10 feet of row.

Table 1. Nitrogen and phosphorus requirements of some common garden vegetables.

Vegetable	Nitrogen Pounds N per 1,000 sq. ft.	Phosphorus Pounds $P_2O_5$ per 1,000 sq. ft.
Beans, green	0.5	1.4
Beans, pinto	0.5	1.0
Broccoli, cabbage, cauliflower	5.0	2.0
Carrots	2.8	1.4
Chile	1.8	1.0
Corn (sweet)	4.5	1.8
Cucumbers	2.3	1.8
Lettuce, onions	4.5	2.3
Melons	4.5	4.1
Potatoes	3.7	3.4
Tomatoes	1.8	1.8

**Table 2. Nutrient requirements of some common garden vegetables when fertilizing 10 feet of row at different row spacings.**

Vegetable	2 feet between rows		3 feet between rows	
	Nitrogen	Phosphorus	Nitrogen	Phosphorus
	ounces / 10 feet		ounces / 10 feet	
Beans, green	0.02	0.75	0.25	0.67
Beans, pinto	0.02	1.33	0.25	0.50
Broccoli, cabbage, cauliflower	1.67	0.67	2.50	1.00
Carrots	0.88	0.50	1.33	0.67
Chile	0.63	0.33	0.88	0.50
Corn, sweet	1.50	0.88	2.25	0.63
Cucumber	0.08	0.88	1.13	0.63
Lettuce, onion	1.50	0.50	2.25	1.13
Potatoes	1.50	0.33	2.25	2.00
Tomatoes	1.17	1.13	1.63	1.67
Melons	0.63	0.63	0.88	0.88

**Table 3. Nutrient content of selected commercially available fertilizers and the proportion of each needed for one unit of nitrogen (N) or phosphoric acid (P<sub>2</sub>O<sub>5</sub>).**

Fertilizer	Nutrient Content		Fertilizer Pounds Needed for 1 Pound of Nutrient*	
	Percent N	Percent P <sub>2</sub> O <sub>5</sub>	N	P <sub>2</sub> O <sub>5</sub>
Ammonium nitrate	33.5-34.0	0	2.94-2.99	0
Ammonium sulfate	21	0	4.76	0
Calcium nitrate	15.5	0	6.45	0
Diammonium phosphate	16-18	46-48	6.25-5.56	2.08-2.17
Monoammonium phosphate	11	52-55	9.1	1.82-1.92
Urea	45-46	0	2.17-2.22	0
Single superphosphate	0	18-20	0	5.0-5.56
Triple superphosphate	0	45-46	0	2.17-2.22
5-10-10	5	10	20	10
6-6-6	6	6	16.7	16.7
8-8-8	8	8	12.5	12.5
10-10-10	10	10	10	10
12-6-4	12	6	8.33	16.7
16-20-0	16	20	6.25	5.0
18-12-6	18	12	5.56	8.33
20-20-20	20	20	5.0	5.0

\* To calculate the amount of fertilizer to apply, multiply this number by the appropriate nutrient recommendation listed in table 1 or table 2.

For easy measuring, use the following equivalents, which are accurate with most granular fertilizers:

1 pint = 1 pound  
 1 cup = 8 ounce  
 1 tablespoon = 0.5 ounce

### Matching Nutrient Needs and Fertilizers

Commercial fertilizer comes in many different formulations that supply different amounts of nutrients. Therefore, calculations are necessary to determine how much product is required to supply needed nutrients. Table 3 shows some fertilizer formulations and the proportion of fertilizer needed for one pound of nitrogen (N) or phosphoric acid ( $P_2O_5$ ). Use table 3 to calculate how much fertilizer to supply a certain nutrient requirement (see examples below).

**Example 1:** A gardener has planted chile. Table 1 lists the nitrogen requirement for chile as 1.8 pounds per 1,000 square feet. The gardener plans to use urea (46 percent N) to fertilize. According to table 3, 2.17 is the proportion needed for one unit of N. Therefore, multiply 1.8 pounds per 1,000 square feet by 2.17.

$$1.8 \times 2.17 = 3.91$$

The gardener will need to apply 3.91 pounds of urea per 1,000 square feet for chile.

**Example 2:** For the same chile crop, the gardener needs to know how much  $P_2O_5$  to apply. Table 1 recommends applying 1 pounds of  $P_2O_5$  per 1,000 square feet. The gardener is going to use triple superphosphate (44-46 percent  $P_2O_5$ ) to fertilize. According to table 3, 2.17 is the proportion needed for one unit of  $P_2O_5$ . Therefore, multiply 1 pound per 1,000 square feet by 2.17 when using triple superphosphate.

Apply 2.17 pounds of triple superphosphate per 1,000 square feet of chile.

Too much nitrogen can burn plants. With mixed fertilizer, apply amounts according to the nitrogen requirement to avoid using too much nitrogen. For example, if you have planted potatoes the N requirement (according to table 1) is 3.7 pounds per 1,000 square feet. You have decided to use 18-12-6 fertilizer; according to table 3, the proportion needed for one unit of N is 5.56. Multiply the fertilizer recommendation (3.7) by the proportion needed (5.7).

$$3.7 \times 5.56 = 20.56$$

You will need to apply about 21 pounds of 18-12-6 fertilizer per 1,000 square feet of tomatoes.

What if you had applied the fertilizer according to the  $P_2O_5$  recommendation? According to table 1, the  $P_2O_5$  recommendation for tomatoes is 3.4 pound per 1,000 square feet. For 18-12-6 fertilizer, the proportion needed for one unit of  $P_2O_5$  is <8.33. Multiply the recommendation by the proportion needed:  $3.4 \times 8.3 = 28.32$  pounds per 1,000 square feet.

If you had figured the amount to apply by the  $P_2O_5$  recommendation, you would have applied about 28 pounds of the fertilizer, which would have provided too much nitrogen and risked burning the tomatoes (1.4 lb N per 1,000 square feet more than needed).

For vegetable gardening, do not use fertilizers that have herbicides or pesticides mixed in them, because they can easily burn plants. These fertilizers are usually labeled as “weed and feed.”

Some gardeners may want to use organic fertilizers. Table 4 shows the nitrogen and phosphorus content of selected organic materials and the proportion of each material needed for one unit of nitrogen or one unit of  $P_2O_5$ .

**Table 4. Nutrient content of selected organic materials and the proportion of each needed to supply one unit of nitrogen (N) or phosphoric acid (P<sub>2</sub>O<sub>5</sub>).**

Organic Material	Nutrient Content*		Fertilizer Pounds Needed for 1 Pound of Nutrient**	
	Percent N	Percent P <sub>2</sub> O <sub>5</sub>	N	P <sub>2</sub> O <sub>5</sub>
Alfalfa hay	2.3	0.3	43	333
Blood meal	12.0	3.0	8	33.3
Bone meal	3.0	28.0	33	3.5
Compost, garden	1.0	0.2	100	500
Cottonseed meal	7.0	1.0	14	100
Fish meal	12.0	3.0	8	33
Manure - hen	1.1	0.8	98	125
Manure - horse	0.7	0.3	143	333
Manure - pig	0.5	0.3	200	333
Manure - rabbit	2.4	1.4	42	71
Manure - sheep	0.7	0.3	143	333
Manure - steer	0.7	0.3	143	333
Peanut shells	3.6	0.7	28	143
Rock phosphate	0.0	0.5	0	200
Sewage sludge	5.0	3.0	20	33
Sunflower seed oil	5.5	1.0	18	13
Wood ashes	<b>Do Not Use</b>	<b>Do Not Use</b>	<b>Do Not Use</b>	<b>Do Not Use</b>

\* Average percentages given. Actual percentages may vary.

\*\*To calculate the amount of organic fertilizer to apply, multiply this number by the appropriate nutrient recommendation listed in table 1 or table 2.

### When to Apply Fertilizers

Phosphorus becomes available to plants gradually, so it can be applied all at once before planting. Nitrogen applications, however, should be split. Provide nitrogen in two or three applications, which allows plants to feed more evenly and decreases the possibility of salt burn. As a general rule, apply no more than 1 pound of nitrogen at one time for 1,000 square feet of garden space. When the total nitrogen requirement is more than 1 pound, supply it in two or more applications.

Apply about one-third of the required nitrogen before planting, one-third when plants reach 4 to 5 inches tall, and apply the remaining one-third about a month later. This system of split applications also is good for applying fertilizers.

### Planting Vegetables by Group

Home vegetable gardeners tend to have a potpourri of vegetables in a small area, so fertilizing different crops with different amounts can be tedious. However, if the vegetables are grouped according to their fertilizer needs, then only two or three different fertilizer amounts have to be applied.

Table 5 shows vegetable groups and the amount of fertilizer per 1,000 square feet of any single crop or combination of crops within the group. Use this table to help you group vegetables according to their nutrient requirements.

**Table 5. Vegetables with similar nutrient requirements, grouped by pounds of nitrogen (N) and phosphorus (P<sub>2</sub>O<sub>5</sub>) needed per 1,000 square feet.**

4-5 lb N 2 lb P <sub>2</sub> O <sub>5</sub>	2.5 lb N 1 lb P <sub>2</sub> O <sub>5</sub>	1.5 lb N 1.5 lb P <sub>2</sub> O <sub>5</sub>	0.6 lb N 1 lb P <sub>2</sub> O <sub>5</sub>
Broccoli	Beets	Asparagus	Beans
Brussel sprouts	Carrots	Cantaloupe	Peas
Cabbage	Eggplant	Chile	
Chinese cabbage	Okra	Cucumber	
Cauliflower	Parsnips	Pumpkin	
Swiss chard	Bell peppers	Radish	
Kohlrabi	Summer squash	Sweet potato	
Lettuce	Tomato	Winter squash	
Mustard greens	Turnips	Watermelon	
Onions			
Potato			
Spinach			

### Fertilizing Small Garden Areas

If the garden area is small, you can make a compromise with your fertilizer application. Although such an application will not provide the correct amount of nutrients for each crop, it should provide enough nutrients for adequate growth and development. For most gardens and most vegetables, 3 pounds of nitrogen and 2 pounds of phosphoric acid per 1,000 square feet is suitable. Because applied phosphorus is released slowly in most New Mexico soils, the amount applied in the compromise formulation may seem high, but it should satisfy the nutrient need.

A home gardener knows that a good fertilization program will result in optimum yields from vegetable crops. A complete fertilizer is one that includes nitrogen, phosphorus, and potassium, and it should supply the plant's nutrition requirements from planting to harvest.

Unfortunately, the recommended rates of commercial fertilizers often are given on a per-acre basis. Using the following tables, you can easily convert per-acre rates into amount for small areas.

Use table 6 to convert per-acre fertilizer amounts into rates for 10 feet of row at different row spacings.

When individual plants are established and the recommended fertilizer rate has been determined on a per-acre basis, use table 7 to find the amount of fertilizer needed per plant.

When a garden area of known square footage is to be fertilized uniformly and the amount of fertilizer recommended is given in pounds per acre, use table 8 as a guide.

**Table 6. Fertilizer rate conversion to ounces per 10 feet of row for selected row widths when recommendations are given pounds per acre.**

Pounds per Acre	Row Spacing		
	12-inch	24-inch	36-inch
	Ounces		
40	0.11	0.22	0.33
50	0.14	0.28	0.41
60	0.17	0.33	0.50
80	0.22	0.44	0.66
100	0.28	0.55	0.83
200	0.55	1.10	1.65
300	0.83	1.65	2.48
400	1.10	2.20	3.31

**Table 7. Fertilizer rate conversion to ounces per given spacing between plants when recommendations are given in pounds per acre.**

Fertilizer Rate Pounds/Acre	Spacing in Feet		
	5 x 5	2.25 x 2.25	2 x 1.5
	Ounces		
40	0.28	0.56	0.03
50	0.34	0.07	0.04
60	0.41	0.08	0.05
80	0.55	0.11	0.07
100	0.69	0.14	0.08
200	1.38	0.28	0.17
300	2.07	0.42	0.25
400	2.76	0.56	0.33

**Table 8. Fertilizer rate conversion to ounces per known square footage of garden when recommendations are given in pounds per acre.**

Fertilizer Rate Pounds/Acre	Square Feet to Fertilize			
	50	100	500	1,000
	Ounces* of Fertilizer			
40	0.6	1.1	5.5	11
50	0.7	1.4	6.9	14
60	0.8	1.7	8.3	17
80	1.1	2.2	11.0	22
100	1.4	2.8	13.8	28
200	2.8	5.5	27.6	55
300	4.1	8.3	41.3	83
400	5.5	11.0	55.1	110

\*There are 12 ounces per pound.

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