Home and Market Garden Fertilization

Guide H-120

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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 upsurge 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 the soil tested is an excellent way to know its fertility level and how much fertilizer to add. In every New Mexico county, an Extension agent 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 commonly deficient in nitrogen and phosphorus, but potassium is usually adequate.

Commercial fertilizer labels usually show, in percentages, how much actual nitrogen (N), phosphorus as available phosphoric acid (P_2O_5) and potassium as potassium oxide (K_2O) they contain. Fertilizer recommendations often are given in terms of N, P and K.

To convert a recommendation for P into the P_2O_5 form, which is most common, multiply the P value by 2.29. Similarly, multiply the K value by 1.2 to obtain the recommended amount with K_2O (although this is rarely needed in New Mexico). Thus, a 20–20–20 (N-P-K) recommendation would mean the fertilizer contained 20 units of nitrogen, 45.8 units of phosphorous and 24 units of potassium.

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 ft^2. Table 2 shows the requirements for the same vegetables for 10 foot row.

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

1 pint = 1 lb
1 cup = 8 oz
1 tablespoon = 1/2 oz

Table 1. Nutrient requirements of some common garden vegetables (lb per 1,000 ft^2).

Vegetable	Nitrogen (N) (lb)	Phosphorus (P_2O_5) (lb)
Cabbage, broccoli, 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
Green beans	0.5	1.4
Pinto beans	0.5	1.0
Lettuce, onions	4.5	2.3
Potatoes	4.5	4.1
Tomatoes	3.7	3.4
Melons	1.8	1.8

MATCHING NUTRIENT NEEDS AND FERTILIZERS

Commercial fertilizer comes in many different formulations that supply differentnutrients amounts. 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 unit of nitrogen (N) or phosphoric acid (P_2O_5). Use table 3 to calculate how much

Table 2. Nutrient requirements of some common garden vegetables, given in oz per 10 linear ft.

Vegetable	Nitrogen (N)		Phosphorus (P_2O_5)	
	2-ft spacing**	3-ft spacing	2-ft spacing	3-ft spacing
	oz/10 ft of row			
Cabbage, broccoli, cauliflower	1.67	2.50	0.67	1.00
Carrots	0.88	1.33	0.50	0.67
Chile	0.63	0.88	0.33	0.50
Corn (sweet)	1.50	2.25	0.88	0.63
Cucumbers	0.75	1.13	0.88	0.63
Green beans	0.17	0.25	0.50	0.67
Pinto beans	0.17	0.25	0.33	0.50
Lettuce, onions	1.50	2.25	0.75	1.13
Potatoes	1.50	2.25	1.33	2.00
Tomatoes	1.17	1.63	1.13	1.67
Melons	0.63	0.88	0.63	0.88

* Multiply the above amounts by the appropriate fertilizer ratios in tables 3 and 4. For example, if you have planted cabbage in rows with 2-ft spacing, its nitrogen requirement (according to table 2) is 1.67 oz per 10 ft of. You have decided to fertilize with urea. According to table 3, the factor for N in urea is 2.17. So multiply 1.67 oz/10 ft of row by 2.17: 1.67 x 2.17 = 3.62 oz/10 ft.
**Spacing between rows.

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_2O_5).

Fertilizer**	Nutrient content		Proportion needed for one unit*	
	Percent N	Percent P_2O_5	N	P_2O_5
Urea	46.0	—	2.17	—
Ammonium chloride	28.0	—	3.57	—
Ammonium nitrate	32.5	—	3.09	—
Ammonium sulfate	20.5	—	4.88	—
Calcium nitrate	15.5	—	6.45	—
Diammonium phosphate	20.0	54.0	5.00	1.85
Monammonium phosphate	11.0	48.0	9.09	2.08
Superphosphate				
•ordinary	—	16.0	—	6.25
	—	18.0	—	5.56
	—	20.0	—	5.00
	—	22.0	—	4.55
•enriched	—	26.0	—	3.85
	—	28.0	—	3.57
	—	30.0	—	3.33
•triple	—	44.0	—	2.27
	—	46.0	—	2.17
	—	48.0	—	2.08
	—	50.0	—	2.00
	—	52.0	—	1.92
Mixed fertilizers				
5–10–10	5.0	10.0	20.0	10.0
6–6–6	6.0	6.0	16.7	16.7
8–8–8	8.0	8.0	12.5	12.5
10–10–10	10.0	10.0	10.0	10.0
12–6–4	12.0	6.0	8.3	16.7
16–20–0	16.0	20.0	6.3	5.0
18–12–6	18.0	12.0	5.6	8.3
20–20–20	20.0	20.0	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 materials not listed, obtain the amount (in pounds) of fertilizer needed by dividing 100 by the fertilizer percentage; then multiply by the amount of nutrient desired.
Example: Broccoli needs 5 lb/1,000 ft^2 of nitrogen and 2.0 lb/1,000 ft^2 of phosphorous (table 1). The fertilizer is 15–5–0. Therefore,
Nitrogen: 100 ÷ 15 x 5.0 = 33.3 lb/1,000 ft^2 of 15–5–0 fertilizer
Phosphorous: 100 ÷ 15 x 2.0 = 13.3 lb/1,000 ft^2 of 15–15–0 fertilizer.

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 lb per 1,000 ft^2. The gardener plans to use urea to fertilize. According to table 3, 2.17 is the proportion needed for one unit of N. Therefore, multiply 1.8 lb/1,000 ft^2 by 2.17.

$$1.8 \times 2.17 = 3.91$$

For chile, the gardener will need to apply 3.91 lb of urea per 1,000 ft^2.

Example 2: For the same chile crop, the gardener needs to know how much P_2O_5 to apply. Table 1 recommends applying 1 lb of P_2O_5 per 1,000 ft^2. The gardener is going to use triple superphosphate (44% P_2O_5) to fertilize. According to table 3, 2.27 is the proportion needed for one unit of P_2O_5. Therefore multiply 1 lb/1,000 ft^2 by 2.27.

$$1 \times 2.27 = 2.27$$

Apply 2.27 lb of triple superphosphate per 1,000 ft^2 for chile.

Too much nitrogen can burn plants. If you are applying a mixed fertilizer, apply amounts according to the nitrogen requirement to avoid applying too much. For example, tomatoes. the N requirement for tomatoes (table 1), is 3.7 lb/1,000 ft^2. You have decided to use 18–12–6 fertilizer. According to table 3, the proportion needed for one unit of N is 5.6. Multiply the fertilizer recommendation (3.7) by the proportion needed (5.7).

$$3.7 \times 5.7 = 21.09$$

You will need to apply about 21 lb of 18–12–6 fertilizer per 1,000 ft^2 for 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 lb/1,000 ft^2. For 18–12–6 fertilizer, the proportion needed for one unit of P_2O_5 is 8.3. Multiply the recommendation by the proportion needed:

$$3.4 \times 8.3 = 28.22 \text{ lb/1,000 ft}^2.$$

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_2O_5).

Organic materials*	Nutrient content**		Proportion needed for one unit***	
	Percent N	Percent P_2O_5	N	P_2O_5
Alfalfa hay	2.3	0.3	43.4	333.0
Blood meal	12.0	3.0	8.3	33.3
Bone meal	3.0	28.0	33.3	3.5
Compost	1.0	0.2	100.0	500.0
Cottonseed meal	7.0	1.0	14.2	100.0
Fish meal	12.0	3.0	8.3	33.3
Manure (wet)				
rabbit	2.4	1.4	41.7	71.4
hen	1.1	0.8	98.0	125.0
sheep	0.7	0.3	142.8	333.0
steer	0.7	0.3	142.8	333.0
horse	0.7	0.3	142.8	333.0
pig	0.5	0.3	200.0	333.0
Peanut shells	3.6	0.7	27.7	142.8
Phosphate, rock colloidal	0.0	25.0	0.0	4.0
Sewage sludge	5.0	3.0	20.0	33.3
Sunflower seed-oil cake	5.5	1.0	18.1	100.0
Tankage	7.0	8.0	14.2	12.5
Wood ashes	-Do not use-	1.0	-Do not use-	100.0

* Some organic materials, such as manures, contain salts that may be detrimental to plants if added in large quantities. Apply these fertilizers in split applications (see the section "When to Apply Fertilizers").

** Average percentages. Actual percentage may vary.

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

If you had figured the amount to apply by the P_2O_5 recommendation, you would have applied about 28 lb of the fertilizer, which would have provided too much nitrogen and risked burning the tomatoes.

For vegetable gardening, do not use fertilizers that are mixed with herbicides or pesticides, as plants are easily burned when these are applied to the garden.

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 phosphoric acid.

WHEN TO APPLY FERTILIZERS

Phosphorus becomes available to plants gradually, so it can be applied all at one time 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 lb of nitrogen at one time for 1,000 ft^2 of garden space. When the total nitrogen requirement is more than 1 lb, supply it in two or more applications.

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

PLANTING VEGETABLES BY GROUP

Home vegetable gardeners tend to have a potpourri of vegetables in a small area, so fertilizing different crops with differing 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 ft^2 of any single crop or combination of crops within the group. Use this table to help you group vegetables according to their nutrient requirements.

FERTILIZING SMALL GARDEN AREAS

If the garden area is small, a compromise fertilizer application can be made. The application will not provide the correct amount of nutrients for each crop, but it should provide enough nutrients for adequate growth and development. For most gardens and vegetables, 3 lb of nitrogen and 2 lb of phosphoric acid per 1,000 ft^2 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.

Table 5. Vegetables with similar nutrient requirements grouped by pounds of nitrogen (N) and phosphorus (P_2O_5) needed per 1,000 ft^2.

4.5 lb N and 2.0 lb P_2O_5	2.5 lb N and 1.5 lb P_2O_5	1.5 lb N and 1.5 lb P_2O_5	0.5 lb N and 1.0 lb P_2O_5
Broccoli	Beets	Asparagus	Beans, all
Brussels sprouts	Carrots	Cantaloupe	Peas, all
Cabbage (incl. Chinese)	Eggplant	Chile	
Cauliflower	Okra	Cucumbers	
Chard, Swiss	Parsnips	Pumpkins	
Corn, sweet	Peppers, bell	Radishes	
Kohlrabi	Squash, summer	Sweet potatoes	
Lettuce (all)	Tomato	Squash, winter	
Mustard greens	Turnips	Watermelon	
Onions			
Potato (Irish)			
Spinach			

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