



Fertilizing Your Vegetable Garden

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Vegetable plants need water and sunlight to grow, but they also need nutrients to support growth. A good soil rich in organic matter may provide many of those nutrients, but our soils in northern Nevada are more mineral than organic – so they need a little help. You can provide the help they need by fertilizing your plants. But what kind, how much and when?

Nutrients. The three major nutrients plants need are nitrogen, phosphorus and potassium. *Nitrogen* is the main nutrient that supports plant growth. It makes plants green and leafy. Provided at the right time and in the proper amounts, nitrogen can give plants the kick-start they need to produce a bountiful harvest. Be careful, though – too much nitrogen can cause plants to grow too fast and become leggy, and it can interfere with flower and fruit development in vegetables such as tomatoes and cucumbers. *Phosphorus* is the nutrient that supports root, flower and fruit development but it also supports plant growth. Too little phosphorus may cause stunted growth and reduced yield. *Potassium* is required for overall plant development. Timing of application and

application amounts of these nutrients are important because nitrogen, phosphorus or potassium applied in excess can be leached into groundwater and pollute our waterways.



What the numbers mean. Commercial fertilizers, by law, have a code on the front of the label that tells you the relative proportion by weight of nitrogen (N), phosphorus as P_2O_5 (P), and potassium as K_2O (K), in that order. For example, a 5-10-15 fertilizer contains 5 percent nitrogen, 10 percent phosphorus, and 15 percent potassium. This is an example of a *complete* fertilizer because it contains all three major nutrients. An *incomplete* fertilizer contains only one or two of the major nutrients. Examples of incomplete fertilizers include 46-0-0, which is 46 percent nitrogen by

weight and no phosphorus or potassium; and 3-15-0, which is 3 percent nitrogen and 15 percent phosphorus by weight, and no potassium. Many different fertilizer formulations exist. A soil test can tell you if your soil is deficient in a particular nutrient. Nevada soils are generally low in organic matter and overall fertility, so incorporating a *balanced* fertilizer containing equal proportions of the three major nutrients prior to planting can be helpful. As an alternative, you can work into your soil well-aged manure or compost as a source of slowly released nutrients. Never use fresh manure or pet wastes as a pre-plant fertilizer. They may contaminate the soil with harmful bacteria that can transmit food-borne illness. Also, fresh manures are high in nutrient salts which can burn tender young plants.

Other nutrients. Plants need many other nutrients such as magnesium, calcium and sulfur, and micronutrients such as iron, manganese, zinc and others in smaller amounts. Fortunately, our soils are not usually deficient in these nutrients, and unless your soil pH is outside the optimal range for most plants (5.5 to 7.5) or extremely sandy, they should be available for uptake by plant roots. Soils that are too acid (low pH) or alkaline (high pH) will bind to certain nutrients and make them less available to plants. You can have your soil pH tested by a soil testing lab. Contact your local Cooperative Extension office for a list of soil testing labs in your area.

Natural or synthetic? Natural organic fertilizers come from living sources that decompose over time into an inorganic form. Commercial synthetic fertilizers are manufactured from inorganic sources. Plants take up all nutrients in their inorganic form, so the source of the nutrients does not matter to the plant. For example, the N that plants take up from decomposed compost is the same as the N taken up from a commercial granular fertilizer. The difference is that nutrients, especially nitrogen, from natural sources are released slowly over time and are more likely to be taken up by plant roots rather than leached into groundwater. Some synthetic fertilizers are also manufactured to be released slowly and may last all season. Natural organic fertilizers tend to have lower concentrations of nutrients than synthetic fertilizers, however, and some are high in only one or two of the major nutrients, but many have the added benefit of improving your soil's structure and water-holding capacity. For more information on garden soils, refer to *Nevada's Soils – Worth the Toil*, University of Nevada Cooperative Extension Fact Sheet-09-14.

Whether natural or synthetic, fertilizers come in a variety of forms. Soluble powders and crystals are mixed with water before applying. Liquid forms are usually sold as concentrates, and they need to be diluted before applying. Granular forms are cultivated into the soil, and need to be watered in. Liquid forms, including dry powders applied as liquids, are fast-acting but are easily leached. Granular forms need

to be watered in after application to release the nutrients into the soil, and to avoid burning tender young plants.

How to apply commercial synthetic fertilizers.

Fertilization can be thought of as a two-step process. *The first step* is to work a complete fertilizer into the upper 2 to 3 inches of soil prior to planting. Leafy vegetables do well with a balanced nitrogen-containing fertilizer such as 10-10-10 or 16-16-16 (Table 1). Vegetables grown for their fruits, seeds, roots or bulbs will thrive on a pre-plant fertilization with a low



N complete fertilizer such as 6-24-24, 6-12-18 or 8-16-16. For many plants such as beets, carrots, beans and peas, this single pre-plant fertilization will be enough to

carry them through the growing season. Other vegetable plants require a *second fertilization step* to support a good yield: application of supplemental nitrogen as a sidedressing during the growing season. This is especially true of vegetables such as corn, garlic, onions and potatoes, but any plant that shows signs of nitrogen deficiency – pale green or yellow leaves and slowed growth rate – may need supplemental nitrogen. Sidedressing means applying the fertilizer 3 to 6 inches to one side of the plant row, taking care to keep dry fertilizer off of foliage, and watering it in

to the soil. One caution about tomatoes and some other vegetables grown for their fruits – mid-season supplemental nitrogen should not be provided. Nitrogen provided too close to the start of fruit set will divert the plant’s energy towards green leafy growth at the expense of fruit development, and may affect fruit yield. For more information on symptoms of plant nutrient deficiencies, refer to *Recognizing Plant Nutrient Deficiencies*, University of Nevada Cooperative Extension Fact Sheet-02-65.

How to apply natural organic fertilizers.

Using natural organic fertilizers to meet the nutrient needs of your vegetable plants seems

complicated because of the low and often limited nutrient content of organic products, but it doesn’t have to be so. The balance



does not have to be perfect to produce healthy, vigorous plants. The important thing is to know the basic needs of the vegetables you are growing and to be observant for symptoms of possible nutrient deficiencies. Use the two tables below to compare the needs of your vegetables with the nutrient values and decomposition rates of different products. Mixing and matching products may be necessary to meet the needs of some plants. An important thing to know is that most northern Nevada soils have an alkaline

pH, so adding lime is not helpful, and may limit the availability of some nutrients to your plants. Similarly, adding gypsum to Nevada's sandy soils does not improve fertility, pH or structure. Watch for these ingredients in pre-mixed commercial products where they may be included as a source of calcium, and avoid them.

The following are some guidelines to follow when using organic fertilizers and amendments:

Using organic fertilizers is philosophically different from conventional use of commercial synthetic fertilizers. Fertilizing with organics is all about enhancing the environment for the soil microbes (bacteria and fungi) that decompose these materials and convert the nutrients released into forms available to plants. So, rather than providing a quickly released source of nutrients on demand, you are providing slowly released nutrients in the form of organic matter that supports the life in your soil and enhances its chemical and physical structure.

Fertilizing versus amending: Fertilizing is providing nutrients to plants. Amending is adding material to the soil that enhances its structure and overall health. When using organic fertilizers, the line between fertilizing and amending is blurred because

you are providing a source of slowly released nutrients at the same time you are improving its structure.

Work manure and/or compost into your soil in the fall. This will ensure that soil microbes decompose the organic matter and release nutrients in time for spring gardening. This is especially important when using manures; fall incorporation leaches salts, reduces viability of weed seeds, and eliminates most potentially harmful bacteria that could contaminate your vegetables.

Many organic fertilizers are formulated with mixtures of various organic components. The contents and quality of these products varies. Look for products that are certified organic and have ingredients clearly labeled.

Whether natural organic or commercial synthetic, rapidly released nutrients should be provided based on the results of regular soil testing. Otherwise, you risk leaching nutrients or disrupting the nutrient balance of your soil.



Work aged compost into the soil in the fall for a healthy, productive crop next spring.

Table 1 Nutrient Content and Availability of Common Fertilizers

Fertilizer	N-P-K analysis	How much to apply annually[†]
Natural organic - single		
	(approximate)	Rate of decomposition (availability)
Alfalfa meal	2-1-2	Moderate – 10 lbs per 100 sq ft.
Bat guano	10-3-1	Rapid – 3 cups per 100 sq ft.
Blood meal	12-0-0	Rapid – 3 cups per 100 sq ft.
Bone meal	3-15-0	Moderate – 2-4 lbs per 100 sq ft (if need indicated by soil test).
Cottonseed meal	5-2-1	Slow – 4 lbs per 100 sq ft.
Fish emulsion	5-2-2	Rapid – 4 lbs per 100 sq ft.
Fish meal	10-5-0	Rapid – 2 lbs per 100 sq ft.
Kelp powder	0.6-0.5-4.0	Moderate – 5 lbs per 100 sq ft (if need indicated by soil test).
Horse manure (fresh)	0.7-0.2-0.7	Slow – Work 2 inches into soil in fall.
Poultry manure (fresh)	1.6-0.9-0.4	Rapid – Work 2 inches into soil in fall.
Steer manure (fresh)	0.7-0.6-0.9	Moderate – Work 2 inches into soil in fall.
Natural organic - blend		
All-purpose blend	4-4-4 or 5-5-5	Incorporate 4 lbs per 100 sq ft prior to planting.
Compost	Varies	Apply 2 inches of unfinished compost in fall or 4 inches of finished compost prior to planting (24 cu ft will provide 4 inches of compost for 100 sq ft). Apply 1 inch as a mid-season sidedressing to heavy feeders (Table 2).
Compost tea	Varies	Use as a foliar spray or as a soil drench.
Commercial synthetic		
Ammonium sulfate	21-0-0	1 lb fertilizer per 100 sq ft (about 2 cups).
Ammonium nitrate	34-0-0	0.6 lb fertilizer per 100 sq ft (about 1 1/3 cups).
Urea	46-0-0	0.4 lb fertilizer per 100 sq ft (about 1 cup).
Balanced fertilizer	10-10-10 or 16-16-16	2-4 cups per 100 sq ft.
Low N complete fertilizer	6-24-24, 6-12-18 or 8-16-16	2-3 cups per 100 sq ft.

[†]Based on the average organic matter content of Nevada soils ($\leq 1\%$). 1 lb of fertilizer = 2 cups.

Table 2 Fertilizer Recommendations for Commonly Grown Vegetables

Plant	Fertilizer 1st Step	Fertilizer 2nd Step
Bean	Apply 2 cups low N complete fertilizer per 100 sq ft. [†]	Beans fix N from the air. Do not provide mid-season N.
Beet	Apply 3 cups low N complete fertilizer per 100 sq ft.	Mid-season fertilization not needed.
Carrot	Apply 3 cups low N complete fertilizer per 100 sq ft.	Mid-season fertilization not needed.
Corn	Apply 4 cups balanced fertilizer per 100 sq ft.	Sidedress with extra N fertilizer <u>twice</u> during the growing season.
Cucumber	Apply 3 cups balanced fertilizer per 100 sq ft.	Sidedress with extra N fertilizer only if plants show N deficiency symptoms.
Garlic	Apply 3 cups low N complete fertilizer per 100 sq ft.	Sidedress with extra N fertilizer in early May.
Lettuce	Apply 4 cups balanced fertilizer per 100 sq ft.	Sidedress with extra N fertilizer 4 weeks after thinning.
Onion	Apply 4 cups balanced fertilizer per 100 sq ft.	Sidedress with extra N fertilizer in early June.
Pea	Apply 2 cups low N complete fertilizer per 100 sq ft.	Peas fix N from the air. Do not provide mid-season N.
Pepper	Apply 3 cups balanced fertilizer per 100 sq ft.	Mid-season N may decrease yield. Do not sidedress with additional N.
Potato	Apply 4 cups balanced fertilizer per 100 sq ft.	Sidedress with extra N fertilizer 6 weeks after seedlings emerge.
Squash	Apply 3 cups balanced fertilizer per 100 sq ft.	Sidedress with extra N fertilizer after vines develop runners.
Tomato	Apply 3 cups balanced fertilizer per 100 sq ft.	Mid-season N may decrease yield. Do not sidedress with additional N.

[†] Application rates are approximate. A soil test may give a more accurate recommendation.

1 lb of fertilizer = 2 cups.

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