

# FERTILIZING HOME GARDENS IN ARIZONA

Tom DeGomez

Gardens provide excellent quality vegetables for fresh use and for processing if the crops are supplied with an adequate level of nutrients and water. Other important management practices include plant spacing, insect, weed, and disease control, and timely harvest. This fertilizer guide for vegetable gardens aims at ensuring ample levels of all nutrients for optimum yield and quality.

Differing opinions have been expressed for many years concerning the merits of fertilizing with manures or other organic fertilizers versus “chemical” fertilizers. Excellent gardens can be grown using either method. Soil bacteria and fungi must act on the organic nutrient sources to change them into forms that plants can use. A major consideration in the use of organic sources is applying materials far enough in advance to allow for breakdown of the substance to ensure that an adequate supply of nutrients will be available when the growing plant needs it. Plants do not differentiate between nutrients from either “organic” or “chemical” fertilizers. The forms absorbed by plant roots from both sources is identical. It should be noted that regular additions of organic materials can improve the tilth, and water and nutrient-holding capacities of soils. In cases where predominantly organic fertilizers are used, a judicious use of supplemental chemical fertilizers will allow the gardener to take advantage of the benefits of added organic materials without compromising the availability of essential plant nutrients.

The content (analysis) of most fertilizers is designated by federal law with three numbers that appear on the fertilizer package and indicate the percent nitrogen (N), phosphate (P<sub>2</sub>O<sub>5</sub>), and potash (K<sub>2</sub>O) that it contains.

Table 1. Analysis of common fertilizers.

Fertilizer Name	Nutrient Analysis*
Ammonium phosphate	16-20-0
Ammonium sulfate	21-0-0
Urea	46-0-0
Triple superphosphate	0-45-0

\* Refers to % nitrogen, phosphate, and potash in the fertilizer.

Examples: 15-10-5 fertilizer contains 15% nitrogen, 10% phosphate and 5% potash: 21-0-0 fertilizer contains 21% nitrogen, but no phosphate or potash.

## Application Methods

There are different methods of applying fertilizer depending on its formulation and the crop needs.

The following terms describe the way fertilizer may be applied to a garden area.

**Broadcast:** The material is scattered uniformly over the surface of the soil before the garden is planted. Nutrients are more readily available to plant roots if fertilizers are worked into the upper 3” to 4” of the soil.

**Band:** Fertilizer is placed in a trench about 2-3” deep. The corner of a hoe works well to make the trench. Seeds are sown 1-½” to 2” above and to the side of the fertilizer. The plant roots grow into the fertilizer band and quickly absorb the nutrients.

**Side-dress:** After the plant is growing, additional fertilizer may be needed for some crops. Nitrogen is the usual side-dress element, but if other nutrients have been omitted from earlier applications, it’s “better late than never.” The fertilizer material is placed close to the growing plant. Nitrogen is very soluble and need not be mixed into the soil. A “complete” fertilizer containing nitrogen, phosphate and potash should be *lightly* scratched in, but take care to avoid damaging plant roots that are close to the surface. Irrigation water must be applied before the plant can absorb the nutrients. Keep fertilizer granules off the leaves to prevent burning.

**Transplant Solutions:** Diluted solutions of complete fertilizers high in phosphate promote quick recovery and early growth of transplants, especially in the early spring when soils are cool.

**Foliar Feeding:** Foliar feeding is used when insufficient fertilizer was used before planting; a quick growth response is wanted; micronutrients (such as iron or zinc) are locked into the soil; or when the soil is too

cold for the plants to use the fertilizer applied to the soil. Foliar-applied nutrients are absorbed and used by the plant rapidly. Absorption begins within minutes after application and with most nutrients is completed within 1-2 days. Foliar nutrition can be a supplement to soil nutrition at a critical time for the plant, but not a substitute. At transplanting an application of phosphorus spray helps establish young plants in cold soils. For perennial plants early spring growth is usually limited by cold soil, even when the air is warm. Under such conditions soil microorganisms are not active enough to convert nutrients into forms available for roots to absorb; yet, if the nutrients were available the plants could grow. Nutrients sprayed on the foliage will provide needed nutrients immediately, allowing growth to begin.

**Drip or Sprinkler Irrigation:** Soluble fertilizers can be applied through drip or sprinkler systems. Various injectors are available to facilitate adding fertilizer to water via irrigation lines. Inject fertilizer during the second half of the irrigation set to reduce the chance of nitrogen leaching.

## Nitrogen And Phosphorus

Nitrogen and phosphorus are the two nutrients most often needed in Arizona's garden soils. Nitrogen produces a deep green color in foliage and promotes overall plant growth. It usually needs to be applied every year because rain or irrigation will leach much of the nitrogen not used by plants. Nitrogen amounts recommended in the following tables will be adequate to get newly planted seeds or transplants growing well. Up to one-third of the recommended fertilizers may be applied in a band below and to the side of the seed. The remainder should be broadcast prior to planting. All organic materials should be broadcast prior to planting and worked into the top 6" to 8" of soil.

Table 2. Applications of commercial nitrogen and phosphate fertilizers.

Recommended 'Broadcast' fertilizers per 1000 sq. ft.*		
N	4-8 lbs.	ammonium sulfate (21-0-0) OR
	5-10 lbs	ammonium phosphate (16-20-0)
P	4-8 lbs.	triple superphosphate
	5-10 lbs.	ammonium phosphate (16-10-0)

\* use lower rates if soil test levels are 'high' or above.

**REMEMBER:** *An application of ammonium phosphate contains both N and P.*

Table 3. Applications of organic nitrogen and phosphate fertilizers.

Recommended 'Broadcast' fertilizers per 1000 sq. Ft.		
N	75-150 lbs.	poultry droppings OR
	400-800 lbs.	Manure + straw
P	20-40 lbs.	bone meal*

(Use lower rates if soil test levels are 'high' or above. It may be advisable to band bone meal applications in the seed row. Avoid breathing bone meal dust when applying).

\* Bone meal may contain diseases transferable to humans.

About 4-5 weeks after planting, some plants may begin to show a pale green or yellow color and a slower rate of growth. At this point a side-dress of 4 tablespoons (T) urea or 8 T ammonium sulfate per 10' of row should be made every two to three weeks as needed. For uniform application, dissolve fertilizer in water and apply the solution evenly with a watering can. Corn, broccoli, cauliflower, potatoes, lettuce, carrots, and beets usually require this additional nitrogen. To avoid excessive foliar growth and poor fruiting, do not apply extra nitrogen to peas, tomatoes, or squash. Over-irrigation will leach nitrogen from the root zone and may result in the need for additional side-dressings of nitrogen later in the season.

## Organic Nitrogen

Manures are extremely variable in their nitrogen content. As little as 75 lbs. of poultry droppings or as much as 800 lbs. of manure mixed with straw may be required for each 1,000 sq. ft. Be sure to use composted manure, not fresh. Blood meal applied at 15 to 20 lbs. per 1,000 sq. ft. is also a good source of organic nitrogen. The application of municipal sewage sludge is recommended only if there is certainty that heavy metal contamination will not result.

**Caution:** Manures often contain weed seeds. Some of these weeds may be very difficult to control. In addition, feed-lot manures in particular can contain high levels of soluble salts. It may be advisable to test new sources of manure for salt content before applying it to a garden. Contact your County Extension Agent to obtain a list of agricultural laboratories operating in Arizona, which could determine the salt content of the manure.

Phosphate is essential for vigorous early season growth of seedlings. It moves very slowly in the soil and best results are obtained if phosphate is banded 2" below the seed or transplant at planting. Table 1 lists some of the more common nitrogen and phosphate-containing fertilizers that are recommended for gardens in Arizona.

A soil test for nitrate-nitrogen, abbreviated NO<sub>3</sub>-N, and for phosphate, PO<sub>4</sub>-P, are helpful in knowing which types

and what quantities of fertilizers are needed. Tests for these nutrients are normally reported as parts per million (ppm). The following tables will help determine the type and amount of fertilizer to use on your garden soil.

Table 4. Interpretation of soil test results for nitrate and phosphate

Soil Test Values				
Nutrient	Low	Medium	High	Excess
	<i>parts per million (ppm)</i>			
NO <sub>3</sub> -N	0-5	6-15	16-30	above 50
PO <sub>4</sub> -P	0-10	11-20	21-30	above 50

## Micronutrients

### Zinc

Deficiencies of zinc can occur on a few sensitive crops. Corn, beans, pecans, and grapes are the most susceptible. A zinc deficiency is indicated by broad yellow and green striping at the base of the youngest corn leaves or small reddish-brown spots on cotyledon (first) leaves of beans. A zinc deficiency in pecans and grapes will produce yellowing between the veins of leaves and a pronounced reduction in leaf size, especially at the ends of new shoots. A soil test reading of below 1.0 ppm zinc may also indicate the need for additional zinc for these crops.

When applying zinc to vegetable gardens, broadcast about 1 pound of zinc sulfate per 1,000 sq. ft. before planting or band 1 to 2 teaspoons zinc sulfate per 10' of row at planting. For applications after planting, dissolve 1-2 teaspoons of zinc sulfate in about 1 gallon water and side-dress evenly for every 10' of row. When applying zinc to trees and vines, dissolve ½ ounce zinc sulfate per gallon of water and drench new foliage 2-4 times beginning in the first month after growth resumes in the spring.

### Iron

Deficiencies of iron are observed in some crops in many Arizona soils. Turfgrass, citrus, apples, peaches, and a variety of other ornamental and landscape plants are the types most often affected. Deficiencies of iron are characterized by yellow leaves with green veins, especially on the youngest leaves; this is called 'iron chlorosis'. A soil test reading below 4 ppm iron may indicate a low level of available iron in the soil. Applications of granular iron sulfate materials before planting or liquid iron products after planting can be helpful in supplying iron for plant growth. Chelated-iron fertilizers usually remain available in the soil longer than non-chelated materials. Foliar iron applications can also be made. Apply preparation specifically for foliar sprays, others may burn the plant. Always follow label instructions carefully when using these materials.

## Soil Amendments

### Gypsum

Gypsum is a common soil amendment not usually needed in southwest soils. It is especially useful in ridding soils of excess sodium. When a soil contains too much sodium, it tends to become heavy, difficult to work, and unable to absorb water adequately. If these problems are evident, an application of gypsum is recommended. A soil test value for Exchangeable Sodium Percentage (ESP) above 10% also probably indicates the need for gypsum. When applying gypsum, broadcast 50 to 100 lbs. per 1,000 sq. ft. and work into the top several inches of the soil. Then apply at least 4" of water as a pre-irrigation to leach the excess sodium down through the soil and out below the root zone. Applications of gypsum may need to be repeated in following years if the problem persists. The use of gypsum will not correct all "problem" soils. It will have no effect on compacted soil caused by excessive traffic or tillage and cannot alter the texture of a natural heavy clay soil. Gypsum will not break up caliche layers.

### Lime

Most garden vegetables grow best if the soil pH is between 6.0 and 7.5. If the soil is too acidic, then an application of lime is recommended. Very few soils in Arizona require lime so don't make an application unless a soil test for pH has been made. Apply 50 to 75 lbs. finely ground lime per 1,000 sq. ft. if the soil pH is below 6.0. Use the higher rate only if the pH is below 5.5. Lime should be broadcast prior to planting and worked into the surface 4-6" of soil.

### Sulfur

Sulfur can be applied to help reduce the pH of the highly alkaline soils (pH above 8.0). It is often difficult, however, to effectively reduce the pH of soils high in free lime (calcium carbonate) content. Nearly all of the lime must be neutralized before the soil pH will be appreciably lowered. Annual applications of 25 to 50 lbs. sulfur per 1,000 sq. ft. should be broadcast and worked into the surface 4-6" of soil, although repeated applications may be required. Only very finely ground sulfur should be used as coarsely ground products will not react quickly enough with the soil.

### Salinity

High levels of salinity (salts) in the soil can result in poor plant growth due to restricted availability of soil water or the toxic effect of certain salts. Plants vary in their tolerance of soil salinity. A soil test reading below 2.0 mmhos/cm (or 1,300 ppm) indicates a favorable salinity level for most garden crops. A value above 4 mmhos/cm (2,500 ppm) will probably result in poor growth of the more sensitive crops. Proper steps should be taken as soon as salt levels exceed 2.0 E. C. (Electrical Conductivity).

The most effective way to correct a high salinity level is by deep irrigations using good quality water. This will

leach salts out of the root zone, assuming the soil has good drainage. Sprinklers and drip systems are particularly well suited to deep irrigations and avoid water loss due to runoff. Most domestic water supplies in the metropolitan areas of Arizona are of good irrigation water quality. If you suspect high salt levels in your water, you may wish to obtain a water analysis. Contact your County Extension Agent for more information.

**NOTE:** Applications of gypsum are *not* effective in reducing soil salinity.

## Other Nutrients

Most Arizona soils and/or irrigation waters contain quantities of all other essential plant nutrients to supply adequate levels for the growth of garden crops.

## Adapted from:

“Fertilizing Home Gardens in Arizona”, Tom Doerge, former Extension Soil Specialist.

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**THE UNIVERSITY OF ARIZONA**  
**COLLEGE OF AGRICULTURE AND LIFE SCIENCES**  
**TUCSON, ARIZONA 85721**

**TOM DeGOMEZ**  
*Associate Agent, Agriculture and Natural Resources*

**CONTACT:**  
**TOM DeGOMEZ**  
[degomez@ag.arizona.edu](mailto:degomez@ag.arizona.edu)

**This information has been reviewed by University faculty.**  
[cals.arizona.edu/pubs/garden/az1020.pdf](http://cals.arizona.edu/pubs/garden/az1020.pdf)

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