

## Getting the most out of your fruit tree soil test report

- Find a site suitable for the fruit trees you want to grow.
- Maintain your soil pH in the optimal range for the fruit trees you want to grow.
- Add fertilizer only at the recommended amount to avoid over-fertilizing.

## General information for your home orchard

Fruit trees need full sun to promote fruit maturity and reduce disease pressure. Winter and spring cold injury to flowers, buds, roots and trunks is common. When possible, plant on elevated land to avoid cold air settling which can cause cold injury during spring frosts.

A loamy well-drained soil, at least 3 feet deep, is ideal for fruit trees.

When possible prepare the site to an 18 inches depth a year before planting. That is the best time to

- Eliminate weeds – which compete for water and nutrients
- Deal with drainage issues and install sub-surface drainage lines if necessary
- Adjust soil pH if necessary
- Apply phosphorus and potassium if deficient
- Incorporate organic matter if desired and when trying to improve compacted soils

For more specifics on planting and growing fruit trees including site selection, variety selection and planting tips visit the [Cornell Garden-Based Learning website](http://gardening.cals.cornell.edu/garden-guidance/foodgarden/#Growing%20Fruit):

<http://gardening.cals.cornell.edu/garden-guidance/foodgarden/#Growing%20Fruit>

Remember the best time to plant fruit trees is in the spring as soon as the soil can be worked.

Soil pH in the 6.0 – 7.0 range is ideal for growing fruit trees.

Fruit trees can tolerate a wide range of soil acidity however they prefer a pH of 6.0-7.0. When soil pH is outside this optimal range lime or elemental sulfur can be used to adjust the soil pH.

**Use ground limestone to raise the soil pH.**

When lime is needed mix the lime into the upper 6 inches of soil one year before planting to avoid harming plant roots and to provide the necessary time for the material to adjust the pH throughout the root zone.

If a large amount of lime is recommended, such as 20 pounds per 100 square feet, mix half in the spring and the other half in the fall before planting.

### **Selecting a commercial liming material**

When selecting a liming material read the label and look for the Effective Neutralizing Value (ENV) which is used to calculate exactly how much lime to apply. A dolomitic type of lime, that provides both calcium and magnesium, will be recommended when both the soil pH and magnesium levels are low.

The ENV indicates the amount of material that will react with soil acidity in the first year of application. Take the recommended lime rate and divide it by the % ENV to determine exactly how much to apply.

For example, if the soil test report states you will need 8 pounds of lime for every 100 square feet and the product you have has an ENV of 90% you will actually have to apply 8.8 pounds to change the soil pH.

$$\frac{8 \text{ lbs. of lime (recommended rate)}}{.90 \text{ (percent of ENV which is listed on the bag)}} = 8.8 \text{ lbs. needed for each 100 sq. ft.}$$

### **Wood ashes as a liming source:**

Wood ashes are not used as an amendment to improve soil physical properties. However, they can be used to raise soil pH in place of lime. Avoid applying both lime and wood ashes which can raise the soil pH beyond the optimum range. When using wood ashes as a lime substitute, you will need to apply twice the amount of the lime recommendation and be sure to incorporate them into the upper 6 inches of soil in advance of planting. Do not apply more than 10 lbs. of wood ashes per 100 square feet to avoid raising the pH above the optimum range.

Wood ashes are also a source of potassium and contain 3-7% potash (K<sub>2</sub>O). If applying 5 pounds of wood ashes per 100 square feet supplemental potassium will not be needed.

## Use sulfur to lower soil pH

When the soil pH is too high for growing fruit trees you can use elemental sulfur to acidify the soil. Apply sulfur before planting so it has time to react in the soil and lower the pH. Incorporate the sulfur into the upper 6" of soil. Keep in mind, that if the orchard is already established it will take time to lower the soil pH.

## Promote plant health and increase yield with proper fertilizer applications.

Nutrients required by fruit trees in the highest quantity in order of importance are potassium (K), nitrogen (N,) calcium (Ca), magnesium (Mg) and phosphorus (P).

Other essential nutrients (micro-nutrients) are usually available in adequate quantities when the soil pH is in the optimal range.

There is no benefit to applying more fertilizer than plants require. In fact, over application of nutrients may be harmful to plant growth and the environment.

## Fertilizer Sources

Organic matter is added to the soil, especially before planting, to improve soil properties by increasing the water and nutrient holding capacity, improving aeration and drainage, feeding microorganisms and providing some nutrients. Common organic matter sources include composted manure, peat moss, plant-based compost and plant and animal by-products.

Soils that contain less than 2% organic matter will benefit greatly from the addition of organic amendments.

**Animal manures and plant-based compost** (yard waste, grass clippings, food waste) are readily available and popular amendments and fertilizers commonly considered as *natural organic*.

Nutrient content of composted products will vary depending on the source (plant or animal), moisture content, how it was stored and how long it was composted. Weed seeds, a high salt content and pathogens might be a problem with fresh manure or other organic materials if they are not fully composted. Knowing the nutrient and salt content of your compost or manure pile would add precision to

application rates for a given site. However, this would require testing every time one of the above variables changes, making this impractical and cost prohibitive for the average gardener.

The nutrient analysis of commercially available manure and compost is found on the bag. Keep in mind these products may also have a high salt content and only 5 to 20% of organic forms of nitrogen will be available to the plants during the first year of application.

Only mix in manure or other materials that are fully composted. Fully composted manure has aged for at least 6 to 9 months. Incorporate into the upper 6 to 8 inches of soil before plants are in the ground to allow time for the slow release of nutrients in the root zone and to minimize runoff.

**Inorganic** fertilizers are compounds that are chemically synthesized from basic raw materials, isolated from naturally occurring sources or mined materials that provide nutrients. They are less expensive and have a higher nutrient content than organic fertilizers. They are water-soluble and are quickly available to plants, easy to apply and especially useful in cool weather.

Care should be taken when using *water-soluble fertilizer* sources because they are made of salts that can damage plants if misapplied. If over applied and watered in excessively they can negatively impact water quality if leached beyond the root zone and into the ground water.

## Fertilizer Terms

**The nutrient content (fertilizer analysis) is required on every bag of commercially available fertilizer.** The first number indicates the *percent* of nitrogen (N), the second number is the *percent* of phosphate ( $P_2O_5$ ), a source of phosphorus, and the third number is the *percent* of potash ( $K_2O$ ) a source of potassium. They are simply referred to as N-P-K. A 50 lb. bag of 10-6-4 actually contains 5 lbs. of N, 3 lbs. of  $P_2O_5$  and 2 lbs. of  $K_2O$ . The rest of the material is made up of other inert material, such as sand or clay granules to help spread the fertilizer.

When nitrogen (N), phosphorus (P) and potassium (K) are all needed, a *complete fertilizer* that contains all 3 nutrients and has the correct ratio can be used. For example: if you needed twice as much nitrogen and potassium then phosphorus a fertilizer with a 2:1:2 ratio could be used. 10-5-10 or 20-10-20 would work.

## Pre-plant fertilizer practices

Ideally the soil should be prepared a year before planting to adjust soil pH if necessary and to add phosphorus and potassium if recommended. Mix into the upper 6 inches of soil.

**Nitrogen (N)** is generally *not applied* before planting, except in the form of biomass compost.

**Phosphorus (P)** is important in early root development and improves the quality of fruits.

Phosphorus does not move in the soil much, so it is best to thoroughly incorporate P before planting by mixing it into the upper 6 inches of the soil where root growth is most active.

If only P is needed, use **Table A** to help determine the amount of phosphorus fertilizer to apply.

If the planting is already established, select a water-soluble fertilizer with a high percentage of P and apply according to label directions.

**Be careful.** Animal manures, fresh and composted, often contain high levels of P. Regularly adding manure to plantings can raise soil phosphorus to excessive levels.

<b>Table A: Soil test levels and <u>approximate</u> pre-plant phosphorus (P) recommendations for fruit trees</b>					
<b>Soil test report levels</b>	<b>Ounces of phosphate (P<sub>2</sub>O<sub>5</sub>) to apply per 100 sq. ft. before planting</b>	<b>Some fertilizer sources that contain phosphorus</b> (notice the concentration differs for each so the amount to apply differs)			
		<b>Inorganic fertilizers</b>		<b>Organic fertilizers</b>	
		Super-phosphate 0-20-0	Triple Super-phosphate 0-46-0	Bone Meal* 1-15-0	Rock Phosphate 0-3-0
		20% P <sub>2</sub> O <sub>5</sub>	46% P <sub>2</sub> O <sub>5</sub>	15% P <sub>2</sub> O <sub>5</sub>	3% P <sub>2</sub> O <sub>5</sub>
		Quickly available	Quickly available	Slowly available	Slowly available
<b>Amount of product to apply per 100 square feet</b>					
Very low	4½ oz.	1⅓ lbs.	9¾ oz.	2 lbs.	9⅓ lbs.
Low	3½ oz.	1 lbs.	7½ oz.	1½ lbs.	7⅓ lbs.
Medium	2¼ oz.	11¼ oz.	5 oz.	1 lb.	4½ lbs.
Relatively high	1½ oz.	7½ oz.	3¼ oz.	10 oz.	3 lbs.

\* Bone meal also supplies nitrogen.

**Potassium (K)** increases water efficiency, improves stress tolerance and the quality of fruit.

Pre-plant incorporation of K is the most effective way to get enough K into the soil system when soil test indicates a less than optimum level is present.

When only potassium is needed note the soil test level, select a potassium fertilizer source and apply the recommended amount. Use the higher bolded amount in **Table B** if the soil is sandy (coarse-textured). Do not exceed the recommended fertilizer rate.

Keep in mind that wood ashes contain potassium (3-7% K<sub>2</sub>O) and if 5 pounds of wood ashes are applied per 100 square feet supplemental K will not be needed.

**Table B: Soil test levels and approximate pre-plant potassium (K) recommendations for fruit trees**

Soil test report levels	Ounces of potash (K <sub>2</sub> O) to apply per 100 sq. ft. before planting	Fertilizer sources that contain potassium (K) (notice the concentration differs for each so the amount to apply differs)			
		Inorganic fertilizers		Organic fertilizers	
		Potassium sulfate 0-0-50	Potassium chloride 0-0-60	Kelp*	Greensand
		50% K <sub>2</sub> O	60% K <sub>2</sub> O	2% K <sub>2</sub> O	7% K <sub>2</sub> O
		Quickly available	Quickly available	Quickly available	Very slowly available
Amount of product to apply per 100 square feet					
Very low	4½ - <b>5½ oz.</b>	<b>9 - 11 oz.</b>	7½ - <b>9 oz.</b>	<b>14 - 17 lbs.</b>	<b>4 - 5 lbs.</b>
Low	3⅓ - <b>3½ oz.</b>	<b>6½ - 7 oz.</b>	5½ - <b>5¾ oz.</b>	<b>10⅓ - 11 lbs.</b>	<b>3 - 3 lbs.</b>
Medium	1¾ oz.	3½ oz.	3 oz.	5½ lbs.	1½ lb.
High	-	-	-	-	-

Note: \*Kelp also supplies nitrogen.

Remember to use the higher bolded amount if your soils are sandy.

## Fertilizing Established Fruit Trees

### General information:

When the soil test indicates phosphorus and potassium are low a complete fertilizer can be used. Immediately after new trees are planted in early spring, make an application of 2-4 gallons per tree of a water-soluble fertilizer solution made by mixing 1 ounce of 10-5-10 or ½ ounce of 20-10-20 in 5 gallons of water.

If phosphorus and potassium levels are adequate only nitrogen will be needed. See **Table C** for nitrogen application rates and timing.

### Nitrogen (N)

Nitrogen is one of the most important nutrients for plant growth and is needed in relatively large amounts by all plants.

The nitrogen content of a soil sample does not necessarily reflect the future availability of nitrogen because unlike phosphorus and potassium, the nitrogen level will fluctuate depending on biological activity, soil organic matter and soil conditions.

Other factors are used to estimate the amount of nitrogen that will be needed annually. Use the higher bolded amount in **Table C** if the fruit size is small, leaf color is pale-green or yellow or new shoot growth is less than 12 inches per year. In these situations an application of nitrogen will likely be beneficial for tree health and yields.

Nitrogen application rates and timing are listed in **Table C**. Do not exceed the recommended fertilizer rate.

<b>Table C: Approximate nitrogen to apply per tree based on age of planting and different nitrogen sources</b>				
<b>Age of Planting</b>	<b>Timing of application</b>	<b>Amount of actual nitrogen per tree (ounces)</b>	<b>Amount to apply if using</b>	
			<b>Calcium nitrate 15-0-0</b>	<b>Ammonium sulfate* 20-0-0</b>
1 <sup>st</sup> season	Apply after leafing out and repeat 4 weeks later	.6 – <b>1.0 oz.</b>	4- <b>6 oz.</b>	3- <b>5 oz.</b>
2 <sup>nd</sup> - 4 <sup>th</sup> seasons*	When possible apply half the rate in late April (between bud-break and bloom) and the other half in late May (at petal fall).	1.0 – <b>2.0 oz.</b>	6- <b>12 oz.</b>	5- <b>10 oz.</b>
After the 5 <sup>th</sup> season		1.0 oz.	6 oz.	5 oz.

Remember to use the higher bolded amount if the fruit size is small, leaf color is pale-green or yellow or new shoot growth is less than 12 inches per year.

\* If the soil pH is high, 7.5 or higher, select ammonium sulfate as your nitrogen sources.

## Phosphorus (P):

Once established fruit trees rarely benefit from additional phosphorus unless soil test levels are extremely low or if the pH is very low.

## Potassium (K)

Potassium is an extremely important nutrient in fruit production because fruit removes a lot of K. Also, rain can leach potassium out of the root zone.

**Table D** lists the potassium application rate per established fruit tree. Remember to use the higher bolded amount if your soils are sandy.

The best time to apply potassium is the fall before the soil freezes.

<b>Table D: Soil test levels and approximate potassium (K) recommendations for fruit trees</b>					
<b>Soil test report levels</b>	<b>Ounces of potash (K<sub>2</sub>O) to apply per tree per application</b>	<b>Fertilizer sources that contain potassium (K)</b> (notice the concentration differs for each so the amount to apply differs)			
		<b>Inorganic fertilizers</b>		<b>Organic fertilizers</b>	
		Potassium sulfate 0-0-50	Potassium chloride 0-0-60	Kelp*	Greensand
		50% K <sub>2</sub> O	60% K <sub>2</sub> O	2% K <sub>2</sub> O	7% K <sub>2</sub> O
		Quickly available	Quickly available	Quickly available	Very slowly available
<b>Amount of product to apply per tree per application</b>					
Very low	2½ - <b>2¾ oz.</b>	5 - <b>5½ oz.</b>	4 - <b>4½ oz.</b>	7¾ - <b>8½ lbs.</b>	2¼ - <b>2½ lbs.</b>
Low	1½ - <b>1¾ oz.</b>	3 - <b>3½ oz.</b>	2½ - <b>3 oz.</b>	4½ - <b>5½ lbs.</b>	1⅓ - <b>1½ lbs.</b>
Medium	½ - <b>¾ oz.</b>	1 - <b>1½ oz.</b>	¾ - <b>1¼ oz.</b>	1½ - <b>2⅓ lbs.</b>	7 oz. - <b>11 oz.</b>
High		-	-	-	-

Note: \*Kelp also supplies nitrogen.

## Fertilizer Application Tips

- Always avoid fertilizer contact with tree trunk.
- You can broadcast/ spread the fertilizer starting 6-18" away from the trunk under the tree canopy or you can apply the fertilizer in a 6" band around the drip line of the tree branches.



- Water fertilizer into the soil with  $\frac{1}{4}$ -  $\frac{1}{2}$  inch of water if rain is not expected in the next 2 days.

**For more gardening information visit Cornell Garden-Based Learning website:**  
<http://gardening.cals.cornell.edu/garden-guidance>

**For more information on growing fruit:**  
<http://gardening.cals.cornell.edu/garden-guidance/foodgarden/#Growing%20Fruit>

**You may also be interested in this Cornell publication:**  
A Grower's Guide to Organic Apples