Fruit Tree Production

A Brief Guide to Growing Your Own Fruit in the City

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Introduction

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This report is based on a workshop held June 13, 2012 covering the basics of Fruit Tree Production. The reports following this one will summarize workshops on more specific topics including organic pest management, canopy management, and fruit tree budding. They are all hosted by Evergreen in Vancouver, BC; the hands on portions of the workshops are carried out in Evergreen's mobile urban orchard which consists of 60 dwarf apple trees.

This workshop was facilitated by Dr. Kent Mullinix, a pomologist who has been studying fruit trees for the past 35 years. He attended the University of Missouri where he earned a B.Sc. in Agriculture, M.Sc. in Horticulture (specializing in Pomology) and Ph.D. in Agriculture Education (curriculum and program development, crop sciences and soil conservation). He also earned a Ph.D. from the University of British Columbia in Plant Science (specializing in integrated pest management). He is a Professional Agrologist with the British Columbia Institute of Agrologists and is currently working as Director, Sustainable Agriculture and Food Security, Institute for Sustainable Horticulture, Kwantlen Polytechnic University.

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Vancity

sitka foundation

Gencon Foundation

Climate

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Apple, cherry, peach, apricot, pear and plum trees all originate from the hardwood forests of Eurasia/Asia. They are in the rose family (Rosaceae) and are ***temperate zone deciduous***, requiring four distinct seasons in order to thrive and actively produce fruit.

Fruit trees are ***ectothermic*** which means that the metabolism of the tree is driven by the accumulation of ***ambient heat*** (ie. they do not regulate internally). As the coast fails to accumulate large amounts of heat for prolonged periods of time throughout the summer, fruit trees grown in coastal areas exhibit different growth patterns than those in interior areas.

Apple trees begin photosynthesizing at 10 degrees Celsius and get to their optimal rate of photosynthesis at 31 degrees Celsius (after which the rate drops again). Different apple varieties have different heat requirements for fruit maturity.

Days of Heat Required from bloom to harvest:

GALA

RED DELICIOUS

FUJI

BRAEBURN

Note that due to the amount of cloud cover, rain and general lack of heat, on the Pacific Northwest Coast, these timeframes are generally longer. The Gala apple takes 130 days of heat to mature, which is almost a month longer than what it would be in the interior or under more normal conditions.

Climate

Strange things happen when trees fail to go dormant. At the Richmond Sharing Farm (an example of a coastal Orchard), there have been occurrences of flower **differentiation** on 1 year old (instead of 3 year old) wood. However these flowers were unable to bear fruit. This shows how different environmental signals can trigger changes in the trees usual production cycle.

Although coastal areas don't receive as much direct sunlight, apples grown in a city benefit from accumulated heat through the heat island effect.

Essentially this means that as a result of the asphalt, concrete, buildings and lack of trees, heat gets trapped and the temperature in an urban center is much higher than the surrounding rural land.

Apples also require direct sunlight in order to develop the pigment that occurs on their skin. This sunlight must be applied to the apple specifically (not just the canopy) which therefore increases the importance of adequate pruning and canopy management.

Fruit trees (and apples in particular) also require cold winters during their ***dormancy*** period. Apples need 1500 hours of chilling 0-7 degrees Celsius (32-45 F), which coastal areas regulated by the ocean don't always acquire throughout the winter months.

Site

Soil

Fruit trees require well drained soil in order to survive and flourish; they do not like wet feet or saturated soil conditions! They need at least a 2 foot depth of soil; mounding the earth to create a ***berm*** (3 feet) is an excellent idea if there is not enough space/depth where the tree is to be planted.

The roots of fruit trees grow in spring and fall (after the harvest) and if the soil is too wet during these times they will suffocate. Soil types can vary: sandy, gravelly, rocky or loams can all be cultivated as long as they are well drained. The pH of the soil must be slightly acidic, around 6.5. However, growing trees within the range of 5.5-7 can work with no immediate issues.

It is critical to maintain correct pH levels in the soil due to the fact that pH directly affects the ***solubility*** of soil borne nutrients – meaning an incorrect pH can prevent the tree from absorbing critical nutrients, essentially starving the tree.

Here in the Pacific Northwest, our soils are generally more acidic than most plants and trees are adapted to, so we need to amend the soil with a yearly addition of lime. If you are unaware or doubtful of your soil conditions, it is possible to do your own testing to determine your soil's pH level. A home test kit can be bought at most garden supply centers.

Trees in planter boxes at Evergreen's Urban Orchard

Site

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Area

Apple trees are best planted in areas that are protected from high winds as they are generally shallow rooted (roots within the top 12 inches of soil are the most functional) and therefore could fall over in high winds. Apple trees also need a lot of their own space; you don't want one tree shading another due to the extreme importance of adequate sun exposure. Peach trees should be kept under cover in areas with high amounts of precipitation in order to prevent disease.

Nutrients

Fruit trees require the following micronutrients:

- Nitrogen: At least ½ lb per year (deficiency: yellow leaves and small fruit.)
- Iron: (deficiency: Chlorosis)
- Zinc: (deficiency: Blank wood)
- Boron (deficiency: Blossom collapse)

Refer to Tree Maintenance on p.13 for methods to correct these common deficiencies.

Tree Propagation

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Fruit trees are ***asexually propagated*** and ***heterozygous***. Their seeds are ***open pollinated*** and therefore the seeds are never of the same genetic type as the mother tree. If you plant an apple seed, the tree that grows from it will be completely wild!

In order to ***propagate***, and have control over the type of tree you grow, tissue must be taken from the original plant (a stem or bud) and put onto a root stock (called budding or ***grafting***).

All fruit trees have two genetically different parts: the rootstock is different than the rest of the tree and fruit. As a result of this, every specific variety of apple or fruit is genetically identical to a mother tree that was discovered in the past. For example, all Bing cherry trees are genetically identical to the same tree that was discovered 100 years ago.

Grafting and budding ensure that we get the fruit we want - without this process we would just end up growing wild and often inedible fruit.

Did you know that tree grafting was invented by the Chinese over 1000 years ago?

A grafted apple tree

Tree Propagation

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New Cultivars

New fruit ***cultivars*** come about through two distinct processes: either a targeted breeding program or chance seedlings.

Targeting breeding: These programs can take at least 30 years to acquire a new cultivar as the process includes plenty of experimentation. Breeding programs take two tree varieties and cross pollinate them in a controlled environment. Each seed is then taken and planted, and the resulting trees grown and then tested for the qualities that the breeders are looking for. Both Fuji and Gala apples were found in this way.

Chance Seedlings: ***Open pollination*** ensures that every seed is unique. Birds and bears often eat the spoilt fruit left on orchard floors and then redistribute these seeds into clearings or under high electric wires. These seeds will germinate and perhaps someone might taste a fruit from a tree. If it produces a good fruit, a cutting can be taken and then re-budded onto a rootstock to be grown commercially! Anjou pear, Granny Smith and Ambrosia apples were all found this way.

When you consume an apple or a pear with a full complement of seeds you are consuming 11 different and genetically distinct organisms! This is because each seed is genetically different through pollination (with 10 seeds) and the apple itself is part of the mother plant stem tissue (another unique being!)

Tree Propagation

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Fruit trees are routinely selected for their disease resistance/tolerance, dessert quality, ability to store and pack well, and maturation date. In terms of disease resistance however, only apple varieties appear to have some evidence of built-in tolerance to disease. You *can* find varieties that are resistant to apple scab and powdery mildew.

These days, stone fruits in particular but also apples and pears are selected for their ability to be packed by machines, sorted and stored for a year and shipped across the world, not necessarily for dessert quality and taste. You can however, visit places like Apple Annie's in Abbotsford or the UBC Apple Festival to taste rare and heritage cultivars. You will be surprised by the difference!

Rootstock

There is no distinct age of a fruit tree as the ***rootstock*** is always at least two years older than the ***scion***. Therefore it is much more common to refer to apple trees by what leaf they are in (ie. first leaf, second leaf etc.). There are two different ways to create rootstock: seedling rootstock and clonal rootstock. Clonal rootstock is much more commonly used in commercial agriculture.

Seedling Rootstock: This comes from a seed! The tree is grown for one season, budded, and then the next season the top is cut off to let the budded section grow. This technique is less popular because it takes 5-10 years to grow fruit, and the tree often grows to 25 feet tall and 25 feet across.

Tree Propagation

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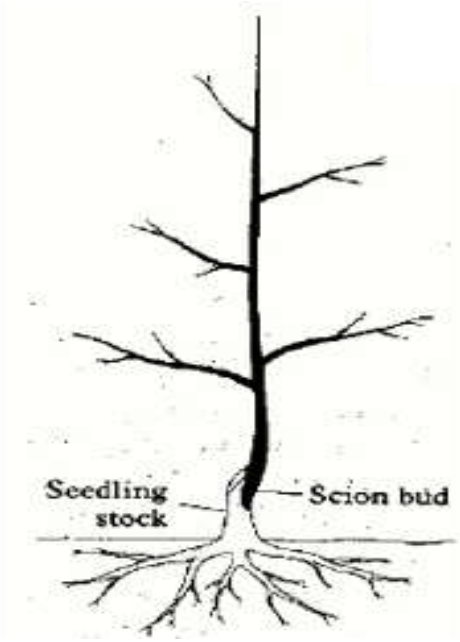
Clonal Rootstock: Good rootstock is cloned to achieve three characteristics: **Precocity** (earlier fruit bearing), efficiency (increased # fruit per unit area of leaf) and dwarfism (decreased size of the tree).

Dwarfism and precocity rise and fall in tandem; the smaller the dwarfing, the earlier the tree will bear fruit. Some varieties include M9 (50-60% dwarf), M27 (25% dwarf! Only 5-6 feet at maturity), M26 (65% dwarf), M7a (75% dwarf) and M111 (80% dwarf).

Clonal rootstocks are produced by layering, which is the process of asexually propagating a plant while it is still attached to the 'mother plant'. Almost all plants can be layered.



Layering... step by step.

- Pin a tree or branch close to the ground sideways.
- Pile sawdust over it, more and more until light is completely excluded.
- Add nitrogen to stimulate growth of roots.
- In the fall, take away the sawdust and cut each tree from the mother plant.
- Plant individual trees in the spring and that same summer plant a bud 8" from the soil line.
- Overwinter the tree and in the spring cut off the top of the original tree to let the bud grow.

Fruit and Flowers

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Fruit

In Pomefruits (Apples and Pears) fruit is (usually) borne on three year old wood. In the first year, the shoot is allowed to grow. During the second year the tree will grow ***lateral buds***, which will usually only come to bear fruit in the third year.

When planning your pruning, you want to have a good rotation of wood ages to ensure adequate fruit production. As the wood gets older the fruit quality declines; 3-6 year wood is ideal for producing good quality fruit.

As wood gets too old (for example in its 6 or 7th year of growth), it is best to prune it just above a lateral bud in order to ensure new wood is grown in its place. This new wood will be ready to bear fruit in three years.

Prune yearly to ensure steady fruit production and multiple ages of wood on the tree.

Flowers

One center bloom (the king bloom) will arrive two days before the five blooms that will surround it. The king bloom produces the biggest and best fruit – this is the bloom you want to keep when you're thinning the blossoms.

Remove all the flowers surrounding the king blooms to ensure optimal fruit production.

On stonefruit (peaches and plums) the buds differentiate on current season growth, but at the end of the growing season, so there is a flower on 2 year wood. Canopy management techniques for these trees differ greatly as it is necessary to maintain a good supply of first and second year wood.

Fruit and Flowers

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Crop Load Management

All trees produce more fruit that they can fully mature. This is nature's way of accounting for any potential disasters and to ensure that at least some of the fruit comes to maturity.

Peach and Apricot trees produce 90% more fruit than can mature so often growers will beat the branches with rubber bats when the fruit is marble sized to knock off excess. Apple trees produce 50-70% more, sothinning is necessary to produce the quality and quantity of fruit desirable.

As fruit begins to grow, the tree produces a hormone that affects flower bud differentiation for fruit production the following year. Leaving too many fruits on the tree increases embryo production which triggers the release of a hormone that decreases the amount of flower buds for next year. This makes apple trees ***alternate bearing*** (the first year they have lots of fruit and the next year, very little).

Dr. Kent Mullinix demonstrating apple tree pruning

There is only a week-or-so window at bloom time to reduce the crop load. If you don't remove excess fruit before it gets 5-10mm in diameter then the hormone will still be released into the tree no matter how much you thin the fruit afterwards!

Tree Maintenance

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It is important to check on and diagnose any problems or deficiencies found on fruit trees throughout the season.

- Blank wood (a sign of Zinc deficiency) can be identified by long stretches of branch that have not produced any growth *(see example to the left)*. Zinc can be applied ***foliarly*** (directly to the tree/leaves) to resolve this problem.

- Stunted growth can result from a lack of nitrogen. Trees should be getting ~½ lb of N per year. This can be applied by using bloodmeal, feathermeal or fish fertilizer.

Chlorosis (when the veins are green but the rest of the leaf is lighter) is a sign of Iron deficiency. Iron Chelate can be applied foliarly or added to water.

Glossary

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Alternate bearing: Alternate bearing (also called biennial or uneven bearing) is the tendency of fruit trees to produce a heavy crop one year (called "on-crop") followed by a light crop or no crop the following "off-crop" year.

Ambient heat: Heat that is available from environmental sources like the Sun for heating water, building materials, or air.

Berm: A mound of earth or sand.

Cultivar: The variety of a plant/tree. However, technically there is a difference between cultivar and variety. Cultivar is considered to be a product of intentional breeding whereas variety is the product of accidental crossing.

Deciduous: (of plants and shrubs) shedding foliage at the end of the growing season.

Differentiation: The process by which cells or parts of an organism change during development to serve a specific function.

Dormancy: (dormant) in a condition of biological rest or suspended animation; "dormant buds"; "a hibernating bear"; "torpid frogs".

Ectothermic: The term ectothermic refers to living things (animals, plants, etc) that warm their bodies using external sources.

Foliarly: Application to the leaves of plants.

Grafting: Grafting is a method of asexual plant propagation widely used in agriculture and horticulture where the tissues of one plant are encouraged to fuse with those of another. It is most commonly used for the propagation of trees and shrubs grown commercially.

Glossary

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Heterozygous: The state of a plant or animal having one or more recessive characteristics in its genetic code and therefore not breeding true to "type."

Lateral buds: Any bud on a tree other than the end one on the main stem or side branch.

Open Pollinated: A plant that is pollinated by natural means, such as bees and other insects, animals or the wind.

Precocity: When a tree comes into bearing (ie. grows fruit) earlier.

Propagate: The creation of plants, either by seeds or by means of cuttings, division, grafting or layering.

Rootstock: A rootstock is a plant, and sometimes just the stump, which already has an established, healthy root system, used for grafting a cutting or budding from another plant.

Saturated Soil: Soil in which the pore space is completely filled with water.

Scion: A young shoot or twig of a plant, especially one cut for grafting.

Solubility: The ability of a substance to be dissolved

Temperate Zone: The part of the Earth's surface between the Arctic Circle and the Tropic of Cancer or between the Antarctic Circle and the Tropic of Capricorn; characterized by temperate climate.