Fruit Tree Canopy Management

A Brief Guide to Pruning, Training and Tree Growth

EVERGREEN

Introduction

EVERGREEN

This report is based on a workshop held June 13, 2012 covering the basics of Fruit Tree Canopy Management. This is the fourth in a series of learning modules covering the basics of fruit tree growing in the Pacific Northwest. The workshops were 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 worked with 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 the Director of Sustainable Agriculture and Food Security at the Institute for Sustainable Horticulture, Kwantlen Polytechnic University.

These workshops and learning modules are generously supported by the **Organic Sector Development Program, Vancity, the Sitka Foundation, and the Gencon Foundation**.

Vancity

sitka foundation

Gencon Foundation

Introduction

Canopy management is the 'art' of fruit growing - it is much more than cutting off a few branches. In fact, as you will learn in this document, removing wood from a tree is one of the last things you want to do. To optimize your fruit crop, thoughtful canopy management is one of the most important subjects to master, and the best way to master it is through practice!

Why Manage the Canopy?

Fruit trees produce fruit regardless of human intervention. Fruits house the seeds needed for trees to reproduce – when birds and animals eat the fruits, they distribute the seeds to start new growth.

However, for human consumption, it is important to manage fruit tree canopies to optimize the balance between vegetative growth and fruit production, and also to keep fruit picking manageable. An unmanaged canopy will grow all its fruit 25 – 30 feet in the air, which is difficult and just plain dangerous to get at!

Managing a canopy will help to develop a strong tree that will support heavy crop loads, while increasing fruit production and improving fruit quality in the long-term.

The Basics

There are three primary methods for managing fruit tree canopies:

Pruning: The removal of limbs or branches from the tree. This is what most of us think of as canopy management, but it is only one part of a larger process.

Training: Positioning limbs in specific ways to manage growth, rather than removing them. Train rather than prune when possible!

Horticultural Practice: Addition of nutrients, water, etc. E.g. Rather than cutting limbs, cut back on water and nitrogen to stop excessive tree growth.

When do we manage the canopy?
It's best to prune a fruit tree when it is dormant – typically the dormant season is in the winter months, running from around November to early March. Pruning during the dormant season is ideal for several reasons:

1. You can see the shape and structure of the tree, as there are no leaves – this gives you a better idea of what you're working with.
2. The tree's physiological response to pruning will be predictable throughout the dormant season – whether you prune in November or February, the tree's growth response will be the same. The metabolic processes are slow to nonexistent.
3. If you prune during the growing season (spring through fall), it is impossible to know what stage of growth the tree is in, and so it's growth response is unpredictable.
4. Microorganisms (e.g. bacterial and fungal infections) are plentiful during the summer months. Pruning in the summer creates wounds that make trees more susceptible to infections.

Growth

EVERGREEN

Knowledge Toolkit for Canopy Management

Rather than cutting away limbs, we can learn to manipulate trees based on our understanding of how they grow and develop.

As mentioned in our guide on Fruit Tree Management, all commercially grown fruit trees are made up of two genetically distinct organisms: a root stock and a scion. The rootstock of your tree will affect the way its canopy grows – a dwarf tree that will only grow to 5 ft must be managed differently than a standard tree that could grow to 25 ft.

The more 'dwarfing' a rootstock, the more inclined the tree will be to produce flowers and fruits. Because they don't produce as much vegetative (structural) growth, dwarf trees often need to be supported by posts and trellises.

How do Trees Grow?

Trees have a set amount of energy (created through photosynthesis) that they can use to grow. Based on external and internal cues, they will produce either reproductive growth or vegetative growth. Canopy management manipulates the allocation of the tree's resources to favor one kind of growth over another – creating the right balance is crucial!

Reproductive Growth: *Flowers, Fruits, Seeds*

Vegetative Growth: *Roots, Shoots, Leaves*

Growth

EVERGREEN

Maintaining the Balance

Too much fruit?

We want as much fruit as possible, but too much emphasis on fruit will prevent good structure. If a tree bears too much fruit too early, it can become 'runted out', or unable to grow adequately, and will produce far less fruit in the long run. It is important that enough vegetative growth occurs in roots, branches, etc. to ensure that the tree is healthy and sturdy.

Too much vegetation?

Because one form of growth occurs at the expense of the other, the best way to control overly vigorous vegetative growth is to let the tree fruit. Pruning can delay fruiting – if you want more fruit, sooner, don't prune.

What does good vegetative growth look like? Current season growth should be between 18 – 20 inches. More than that is excessive and should be controlled. Less than that will not be enough to support fruit.

How should you manage the balance between vegetative and reproductive growth?

Establishment: When the tree is young, encourage vegetative growth and remove blossoms to prevent fruit growth.

Transition (typically at 3 years): When the tree is approximately the size you want, begin to encourage reproductive growth balanced with vegetative growth.

Mature Bearing Tree: When the tree is fully mature and producing fruit, encourage the fruit and maintain balance.

Growth

EVERGREEN

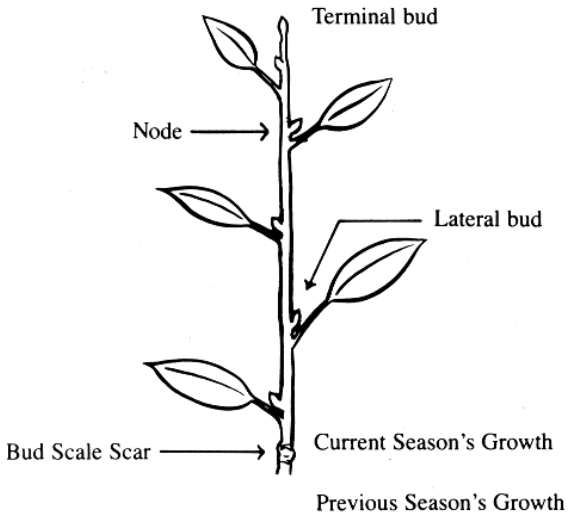
Trees grow in two ways:

Primary Growth: Growth in length of limbs. This form of growth results from the activity of the 'apical meristem', which creates undifferentiated cells (cells which have no particular function, but will eventually be differentiated to become blossoms, bark, etc.).

Secondary Growth: Growth outwards and in diameter (i.e. thickening of the limbs).

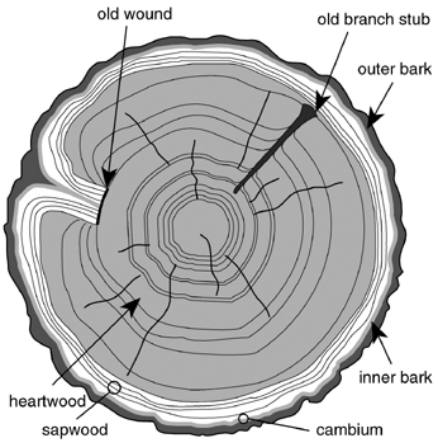
When managing the canopy, it's important to know what age of wood you're working with. This is referred to in years, e.g. one year old wood, two year old wood, etc.

Current Season Growth is the new shoot growth expanding from the last terminal bud. At the end of the season, when the tree goes dormant, it sets up a new terminal bud at the end of the growth. That growth then becomes one-year-old wood. Over time you will be able to recognize old terminal buds (bud scale scars) and the age of the wood stemming from them.



Above: Primary growth over two years
Photo: University of Georgia

Below: The rings of a tree demonstrate secondary growth. Image: Tree Trust



Growth

EVERGREEN

Tree Habits
Every tree has tendencies towards certain shapes of growth – knowing and understanding these tendencies can make canopy management much more efficient.

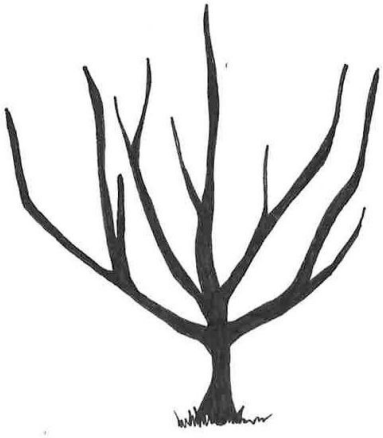
Growth Habit
The growth habit of a tree is its natural inclination towards a certain canopy shape. There are two basic growth habits:

Acrotonic: Strong growth at the top of the tree, at the expense of weaker growth on lower levels. Red Delicious apple has this tendency.

Basitonic: Lower branches are stronger and outgrow the top of the tree. Braeburn apple trees have this tendency.

Above: Acrotonic Growth Habit

There are also a number of growth habits in between, such as columnar or conical shaped canopies. When managing a canopy, we generally seek to develop a conical shape where the top of the tree is narrower than the bottom. This is easier to do with a basitonic growth habit. Not sure what kind of growth habit you're dealing with? Keep an eye on it as the leaves fall – the structure of the branches will become apparent.



Above: Basitonic Growth Habit

Growth

EVERGREEN

Fruiting Habit
A tree's fruiting habit refers to the timing of its fruit production.

Pome Fruits (apple, pear) will only produce fruit on three year old wood or older. New shoots become year 1 wood. The cells will differentiate in year 2, developing small spurs which will eventually bear fruit. This wood overwinters, and blooms in year 3. Good fruit production will occur on 4 – 5 year old wood, which is why you want to avoid pruning it all off!

Stone Fruits (plum, peach, cherry) produce fruit on two year old wood. Buds grow in late summer, after the harvest, rather than in early spring.

Pruning older wood (e.g. 7 years and older) renews a tree's fruit production capacity - as wood ages, it becomes too twisted and vascular for good reproductive growth.

Trees need sun to grow! In addition to the sun required to fuel the vegetative growth process:

•Trees require a minimum of 35% illumination throughout the day for flowers to appear.

•Without sun, apples will not develop any color.

•If we let a canopy grow unmanaged, sunlight will not reach lower branches; fruit will grow on the outside and the top of the trees. To let sunlight filter through all parts of the canopy, narrow the top of the tree, and thin out the branches as you work your way in to the center. This is one of the only times where pruning is the best solution!

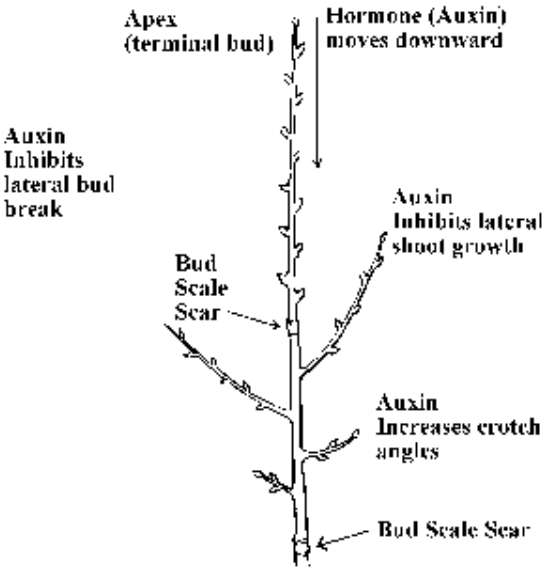
Apical Dominance

EVERGREEN

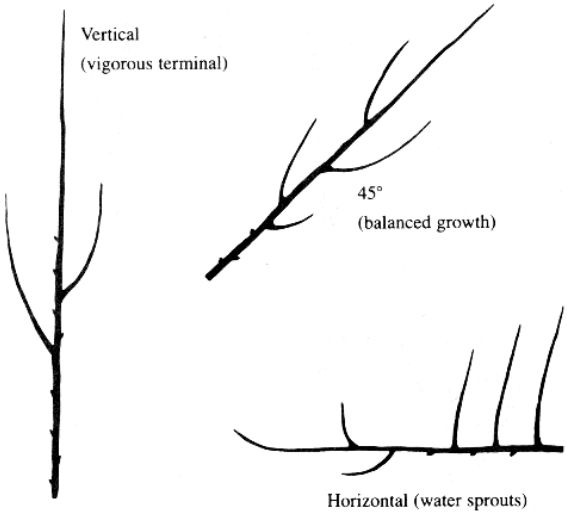
The **apical meristem**, or growing tip, is a completely undifferentiated tissue found in the terminal bud of a tree. Its main function is to grow new cells at the tips of roots and shoots (forming buds, among other things). An active apical meristem lays down a growing root or shoot behind itself, pushing itself forward.

Apical dominance is where the meristem at the tip of the main trunk prevents or inhibits the growth of other meristems. This dominant meristem, which releases the hormone Auxin, promotes vegetative growth. Therefore, the tip of the trunk grows rapidly and is not shadowed by branches. If the dominant meristem is cut off, one or more other branch tips will become dominant. These newly dominant branches will start growing faster and the new growth will be vertical, leading to bushy growth.

You can train a tree by bringing shoots/branches down to horizontal, altering the flow of Auxin. The lower you pull the branch, the more new breaking buds you will create.



Apical dominance at work

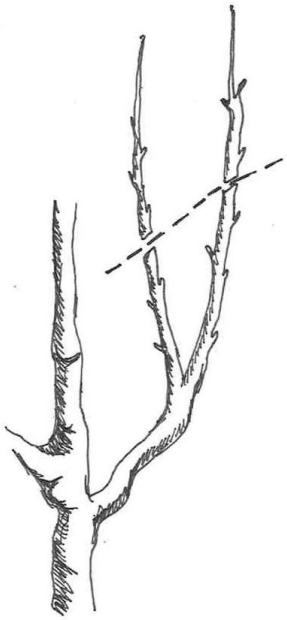


Altering the flow of Auxin
Images: University of Georgia

Pruning

All pruning is dwarfing in the sense that it reduces the overall size of the tree. Any growth stimulated by cutting is local and temporary. There are two main kinds of cuts used in pruning:

***Heading*:** Cutting one year old wood to destroy apical dominance and invigorate local growth. DO NOT go overboard with heading cuts – you will end up with a bush.



Heading cuts

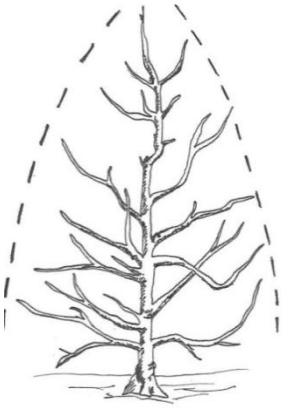
Thinning Out: Removing a shoot or shoot system at the point of origin. These cuts allow sunshine to filter through and penetrate the tree's branches. Avoid cutting everything – often you can find one or two optimal thinning cuts that will affect the whole canopy. Thinning cuts stop or greatly weaken growth – you are basically telling the branch that it's time is done.

A thinning cut

Training

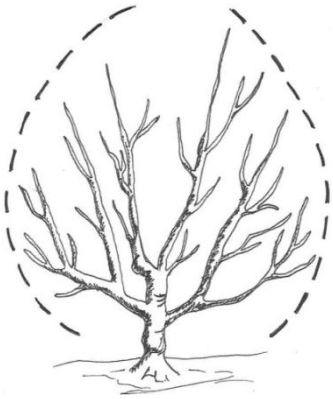
When pruning and training trees, there are a few basic systems to choose between. For more information on each of these, check out the resources section at the end of this manual.

Central Leader: For dwarfing trees, it is common to use a Central Leader System. Weak side shoots are trimmed back in favor of a central trunk with side branches.



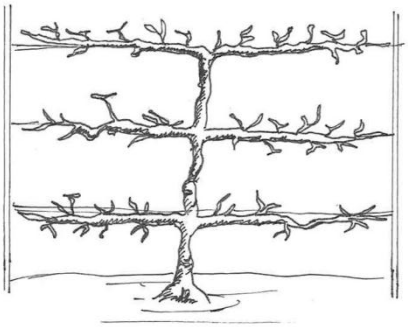
Tree pruned to a central leader

Open-Center or 'Beehive': In larger trees we aim for a beehive or A shape – a slight narrowing at the top and bottom.



Tree pruned with an open center

Espalier: A great method for saving space when growing dwarf trees – training limited branches horizontally.



An espaliered tree

Tools

Canopy management is more about knowledge than it is about equipment– but there a few critical tools you'll want to have ready when you set to work!

Loppers: Find a pair with a bypass blade instead of anvil cutters – this will ensure that you slice the branch instead of crushing it. A commercial grade pair such as these ones by Corona are best. They can be purchased at Evergro or Lee Valley in the BC lower mainland.

Hand Shears: These are good for young trees with low, thinner branches. These should be made of good steel and should be kept sharp using a wet stone.

Tree Saw: Best for big old trees with branches that are too big for loppers. Most tree saws cut on the pull.

Ladder: A ladder is the best way to get up into a taller tree and see what you're doing. It will save you from reaching up and straining yourself, and you'll make cleaner cuts as a result. Do NOT use pole pruners to try and reach higher branches – their cuts leave little nubs behind which are essentially little pest hotels.

Resources

EVERGREEN

This guide can serve as a starting point to managing your fruit tree canopy. For more detail on particular pruning and training styles, the science behind fruit tree growth, etc., explore some of the resources below.

How to Train and Prune Your Home Orchard. *Oregon State University Extension Service:* http://extension.oregonstate.edu/gardening/how-train-and-prune-your-home-orchard

Training and Pruning Apple Trees. *University of Wisconsin Extension Services:* http://learningstore.uwex.edu/assets/pdfs/A1959.pdf

Vegetative Growth and Vigor Control. *Washington State University:* *http://classes.hortla.wsu.edu/hort310/hort%20310%20-%20documents/Vegetative%20Growth%20Control.pdf*

Pruning Fruit Trees Fact Sheet. *Ontario Ministry of Agriculture, Food and Rural Areas:* http://www.omafra.gov.on.ca/english/crops/facts/00-005.htm

Training and Pruning Apple Trees. *Cornell Cooperation Extension Publication:* http://eap.mcgill.ca/CPTFP_7.htm

Pruning Fruit Trees. *Nebraska Cooperative Extension:* http://urbanagriculturehub.ca/index.php?doc_action=display&doc_id=213