

**UBC Farm Heritage Orchard**



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## **Part I:**

### **Introduction**

In the summer of 2005 I decided, with approval, to complete a Directed Studies designing, preparing and planting an orchard at the UBC Farm. What began as a seemingly simple inspiration that summer has developed into a multi year project, and potentially the most challenging, stressful, exciting, rewarding and tangible experience of my university education thus far. I have put off completing my final report for this project time and again, as it seemed an insurmountable task. I have been challenged to learn such a broad base of information along the way that to recount it all seems formidable. Further, I consider the practical aspects of the project (e.g. the grafting, volunteer coordination, community interaction, tree care, site design, implementation and management) the most important, and the most demonstrative, of my work. My goal in this directed studies was not to write a paper on orchards and apple care; it was to design and plant an orchard. The intent of this paper is to roughly document the steps involved, and to provide suggestions for both future orchard care and student projects. It is a compilation of writings completed over the past 2 years, including my midterm report. To really understand the essence of this project, however, I encourage you to put this paper down and stroll through the orchard itself (while you're doing that please feel free to weed around the base of any tree you wish...).

### **Intent:**

In planning and establishing an orchard for the Centre for Sustainable Food Systems at UBC Farm, I have thought often of the Permaculture principle: "single element, multiple functions." This principle challenges designers to intensify the utility of elements within a project. My goals in the creation of the orchard were broad and diverse.

- 1) To increase perennial food crop production at the UBC Farm, thus contributing to its ecological and financial sustainability
- 2) To increase the potential for agricultural curriculum at the UBC Farm by providing a working orchard that is available for research, practicum experience, and study within the context of an agroecosystem. Currently the following classes will be involved with the orchard:
  - a. Agro 322 (Horticultural Techniques, Professor Douglas Justice) will be involved in both the grafting and pruning aspects of the orchard.

- b. Agro 402 (Sustainable Soil Management, Professor Art Bomke) was involved with soil testing and amendment recommendations for the orchard in 2006.
- 3) To create a productive, demonstration orchard, which may serve as an educational resource for urban fruit production.
  - 4) To provide a sanctuary for heritage apple cultivars, thereby contributing to the preservation of diverse apple genetics and culture.
  - 5) To increase the cultural, and therefore financial, value of the UBC Farm by creating a beautiful recreational space.
  - 6) To challenge myself.

## **Part II:**

### **Criteria for Orchard Site Selection:**

- a) **Visibility:** The public must be able to easily see the orchard.
- b) **Sun exposure:** Minimum 6 hours per day.
- c) **Good airflow:** It is preferable to position orchards nearer to the top of a slope. Cold winter air tends to flow downhill and form pools. This cold air may damage vulnerable spring buds, and creates conditions favorable to mildew, scab etc.
- d) **Wind protection:** Without windbreaks, the survival of young trees may be jeopardized. Young trees often require support to stand in their initial years, and high winds can add to their stress. Also, low-humidity winds can wick moisture away from the trees.
- e) **Potential for expansion**
- f) **Not planted in the same location as the original UBC Farm Orchard (1974-1991?).**  
Folk wisdom among farmers states that a new orchard should never be planted in the same place as an old orchard. Farmers have observed that planting new trees in an old site often results in poor vigor. Replant Disease is caused by depleted soil nutrients, compacted soil, bacteria, nematodes and fungi (Edwards, p 216). Our current site may have some overlap with the original bud wood orchard (I was not able to clarify the original location), but I still feel that it is our best site option. With careful monitoring and appropriate amendments, the deleterious affects of Replant Disease can be avoided or minimized.

### **Grafting and Rootstock Selection:**

Because apples have open pollinated flowers, apple seeds contain a mixture of maternal and paternal genetics. As a result, apple varieties do not grow “true” from seed and must be propagated through grafting. In 2004 I was taught how to graft by David Buckner and Oliver Kellhammer of Linnaea Farm. My wish for increased grafting experience was a primary inspiration for this subsequent project. In 2006 I sought further instruction from Brian Campbell and Derry Walsh and then taught approximately 30 students how to graft at the UBC Farm.

#### **Glossary:**

##### **Rootstock**

Trunk and root system, onto which scion or bud wood is grafted.

##### **Scion**

Propagation material from the desired plant (ex branchlet, stem).

##### **Grafting**

The joining of tissue from one plant to the stem and root system of another plant, resulting in the growth of a single plant

The final size of a tree is a combined result of the vigor of the scion wood, the vigor of the rootstock, irrigation and pruning. Today the majority of orchardists use industry standard M9 (Malling 9) dwarfing rootstock, which provides maximum production with minimal labour inputs. By limiting tree size, dwarfing rootstock makes pruning, blossom thinning and picking easier. Although relative to tree size overall production is comparable between full size and dwarf varieties (Flaherty, p 47), dwarfing rootstock encourages early fruit set (Edwards, p 214) and thus a shorter gap between initial costs and revenue. Further, while fully dwarfed varieties usually require structural support (staking or trellising) for the entirety of their lives, the money saved in maintenance over the years typically exceeds the infrastructure costs (Edwards).

In deciding which rootstock to use in the UBC Farm Orchard, I considered my original goals: education, production and recreational space. I wished to create a space that was educational, welcoming, lucrative and beautiful. I was not interested in creating only a productive, standardized monocrop, but rather a diverse system that illustrated and compared the options available in organic

apple production. In particular, I wished to demonstrate the potential for urban fruit production and I envisioned an educational variety of tree sizes – including fully dwarf, semi-dwarf, and full size.

I would like to acknowledge that before being led on a tour through an M9 orchard I was initially judgmental and resistant to M9 trees. They seemed mechanical to me, and did not match my romantic notion of what an orchard should look like. You cannot tie a hammock between dwarfed apple trees. You cannot position a picnic table beneath the ample shade of an M9, or lie easily beneath one to read. You cannot walk easily around and between them because of the trellises. To consider orchards only for their financial value seemed to me to be a cultural loss. However, after touring a handful of orchards and speaking with the orchardists, my view of M9 trees shifted dramatically. I came to appreciate both their beauty and their practicality, and in the end dwarfed trees play a significant role in my orchard.

Jim Rahe (Fraser Valley Orchardist) recommended that we plant only large size trees as he believed this would enable easier control of vegetative ground competition while complying with organic management standards. However, Linda Edwards (Similkameen Orchardist; author of Organic Fruit Tree Management) advocated for a majority of M9s. Edwards suggested that planting an orchard without M9s would present an insincere picture of contemporary apple production, and would fly in the face of the experience and knowledge of the local growers with whom I consulted. That said, to exclude the larger sizes of trees would limit the educational potential of the site. My final decision was that a mix of rootstocks would best suit the goals of the UBC Farm Orchard. Initial input costs were higher due to infrastructure costs for the dwarf trees, and long-term labour requirements will be higher for our larger trees. Over time, however, I believe that the educational and cultural value of the orchard will increase as a result of the diversity.

In 2006 I grafted (and/or supervised the grafting of) the following 155 trees:

- 100 M9 [Malling 9]: Fully dwarf, 30-55% of standard size
- 25 M26 [Merton Malling 26]: Semi dwarf, 40-60% of standard size
- 25 MM106 [Merton Malling 106]: Semi dwarf, 70-90% of standard size
- 5 plums

M9 is the hardest to graft, with an 80% success rate, while M26 and MM106 have closer to 95% success rates (Derry Walsh, BC Fruit Testers). Of our 155 grafts, 150 budded out in the spring.

### **Cultivar Selection:**

The majority of the orchard trees are apples, though I added a few plum varieties for diversification. Unfortunately there was no rootstock for pears available at the time I was grafting (quince rootstock). Should students in the future wish to complete Directed Studies in the orchard, the addition of pear trees would be valuable. For a full list of cultivars included in the orchard, please refer to Appendix II.

### **Cultivar Requirements:**

In selecting scion wood for the orchard, I used the following criteria:

- 1) Demonstrated regional success
  - a. Resistance to scab
  - b. Resistance to canker
- 2) Desirable characteristics
  - a. Excellent flavour
  - b. Cultivars good for a variety of uses, including:
    - i. Fresh eating (dessert apples)
    - ii. Cooking
    - iii. Storage
- 3) Variety of flowering to ensure compatibility for pollination
- 4) Variety of fruiting times to extend the harvest season
- 5) Unique characteristics (e.g. amusing names, such as the Peasgood Nonsuch 😊)

In line with my original goals, I wanted to graft as many heritage varieties as possible while also striving to promote the orchard's financial success. I intentionally selected some non-heritage, proven "workhorse" varieties, including a few patented cultivars (e.g. Sundance, Honeycrisp, Pristine, Dayton). Because the orchard is intended to be educational, I decided that it would be interesting to compare and contrast these recent varieties with the more traditional cultivars. Further the inclusion of a few patented trees provides an educational opportunity, as discussion may be generated regarding the ethics and conflicts involved with plant-based intellectual property rights.

My sources for scion wood were:

- BC Fruit Testers Association (through Derry Walsh)
- Orchardist Jim Rahe
- Strathcona Community Garden
- UBC Botanical Gardens (2007 ~ bud grafting plum)
- My neighbour's plum tree (2007 ~ bud grafting plum)

Unfortunately I was too late in 2006 to connect with the UBC Botanical Gardens to use their apple scion wood. However in August of 2007 I bud-grafted 2 of the 5 plum trees using budwood provided by Tony Maniezzo of the Botanical Gardens, and another tree with budwood from my neighbour's plum tree (variety unknown). Should future students wish to complete a Directed Studies with the orchard, the Botanical Gardens would be an excellent, local, and free source of scion wood.

### **Pollination:**

Because of the wide selection of cultivars, and the small, but dense, orchard size, there should be sufficient overlap in flowering times to ensure pollination. Further I included three crab apples, which are excellent pollinators. While there are a few Triploid<sup>1</sup> trees (e.g. Gravenstein and King of Tompkins County), I do not anticipate it being a problem.

The UBC Farm currently has non-native "honey bees" (*Apis mellifera*), as well as abundant insect life. However, the establishment of native bees – such as the Blue Orchard Bee (*Osmia lignaria*) - would be beneficial. These excellent pollinators can be purchased, or simply lured by providing suitable homes. These bee homes can be made or bought (e.g. Derry's Orchard and Nursery), and would be a great future project for either the UBC Farm Market Garden or a Directed Studies student. Other native pollinators such as flies, ants, wasps, solitary and bumblebees are also effective pollinators (Edwards, p 173).

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<sup>1</sup> A plant whose somatic cells contain triple sets, rather than pairs, of chromosomes. Cannot be a viable pollinator. Does not interfere with fruit formation in the triploid plant.

### **Groundcover:**

Pests (e.g. rodents) and weed competition for both water and nutrients are serious threats for young trees. Amongst conventional growers Round-Up (Glyphosate) is typically used to restrict vegetation at the base of trees, while short-mown grass is maintained between rows. Nancy Furness, an associate of Dr Upadhyaya, sought advice from Quality Seeds West regarding orchard floor management and selected a mix called Orchard Star (40% Turf-Type Tall Fescue, 40% Hard Fescue, 20% Turf-type Perennial Ryegrass). Upon recommendation I then added Birdsfoot Trefoil, a non-aggressive legume for Nitrogen fixation.

Through my interviews and visits I discovered that management of groundcover in orchard systems is strongly debated. Many support the use of mulch to: promote water conservation, minimize weed competition, limit the spread of disease, build soil organic matter, support macro fauna and reduce erosion. My original vision was to use locally sourced leaves, bark, woodchips, or other organic materials as mulch around the tree bases. During my visit to the Summerland Pacific Agri-Food Research Centre, Gene Hogue and Gerry Nielsen gave me a tour of their experimental organic apple plot. They are trialing various organic management methods, including: 1) Tillage and annual composting, 2) “Mow and Blow,” 3) Mulch over compost, and 4) Black woven plastic over compost. However, while Hogue and Nielsen are trialing these organic plots, their expertise lies in conventional management, and the organic trials are still young.

When I visited Linda Edwards and her partner Brian Mennell in Cawston (Similkameen) however, I received different advice. Edwards and Mennell manage their extensive organic orchards with the use of a Ranieri cultivator. The Ranieri is attached to a 3-point hitch, and cultivates shallowly between trees to a width of approximately 2 feet. Essentially, the orchard has a ground cover within the rows, but the area around the base of the trees is kept bare.

Edwards was emphatic that mulch is not an effective management strategy in an organic apple system. Perennial weeds will eventually establish themselves, resulting in high labour requirements for hand weeding. Further, mulch provides protection for rodents and enables them to feed safely on tree bark, typically resulting in tree death due to girdling. Local orchardist Derry Walsh uses landscape fabric to keep the weeds down, but even that, she says, is not fully effective. Finally, in

placing mulch space must be left around the base of the tree trunk to ensure that respiration is not inhibited.

In the end it is up to the UBC Farm team to decide what management they wish to employ. Whatever the decision, keeping weed pressure down must be the priority during the initial years of the orchard. Because the orchard is intended to be an educational site, the farm may wish to try both bare soil and mulch management. Edwards and Mennell have great success with their management, and I think serious consideration should be given to their warnings. However, the climate in the Similkameen is significantly drier than ours, and thus our concerns are different. Considering our high rainfall, the southward slope of the site and my lack of clarity around the most appropriate management technique, I positioned the orchard rows East/West to minimize erosion potential.

The soil around the bases of the young trees may be cultivated with a hoe and by hand – for such a small orchard a Ranieri is not feasible. This past summer (2007) farm staff found that the large stirrup hoe is very effective for clearing large areas (though it is not precise enough for working immediately next to the trees). The hand held forks are good for working close to the tree bases. Should it be decided that some trees will be mulched, consideration should be given to what material is ideal. Douglas Justice suggested campus-sourced coffee grounds, which are uniform, can be applied to a 1-inch depth and do not provide good rodent habitat. Alternatively, Plant Operations can help source materials such as bark mulch (following Storm The Wall they have yards available). While bark mulch lasts longer than coffee grounds, it may tie up Nitrogen in the upper soil, and potentially provide rodent habitat.

In considering mulch, thought must also be given to irrigation management. Mulch not only acts as an effective barrier to water loss, it also makes water movement into the soil more difficult. Irrigation of mulched trees would have to be carefully monitored, as the mulch would need to be saturated before the soil beneath it could receive hydration. Deliberation about groundcover strategies will be an important task for the UBC Farm, or for a future Directed Studies student.

### **Soil Nutrition:**

Art Bomke's Agro 402 Sustainable Soil Management class (Jan-April 2006) analyzed the orchard site and found that the soil did not need amendment. Each tree was planted in a mix of soil and compost. I did not supervise the planting of every individual tree, but I asked the volunteers to mix the compost into the soil as much as possible. Because the UBC Farm compost is not very strong, Dr. Bomke assured me that root burn would not be an issue.

I found that compost amendment was also a debated issue. Some feel that the trees should be planted into the ground without added nutrients, thus encouraging roots to spread out in the native soil. Others advocate for the support of the young trees through increased nutrient availability at planting. While I understand the concern that providing a nutrient rich pocket may prevent roots from spreading out, I believe that it is best to feed young trees well initially. Further I didn't think a permanent nutrient pocket would be an issue because the trees were planted in sandy soil at the beginning of the rainy season.

### **Irrigation:**

Irrigation requirements of the orchard will change over time. Initially (spring/summer 2006), the young saplings were in pots and required consistent watering in order to reduce their stress and increase their chances of survival. When they were transplanted in the fall (2006), the saplings were watered in by the rain, and then left alone for the remaining fall/winter (2006) to enter dormancy. Spring/summer 2007, regular irrigation again became important. Jim Rahe (Annie's Orchard) does not water his trees at all, but given our soil conditions, and the fact that minimizing stress to young saplings increases their chances of survival, I believe that effective irrigation is advisable.

According to Edwards and Mennell, in the initial years of the orchard trees must be neither over nor under watered. With the advice and assistance of Brian Mennell, Steve Taylor (WaterTec), Timothy Carter (UBC Farm) and Mark Boxford (UBC Farm), the orchard irrigation equipment was selected, ordered and assembled. I chose to use a micro-jet emitter irrigation system. The jets are spaced 8-10 feet apart, and their sprays overlap sufficiently to ensure adequate irrigation for both the trees and the path groundcover.

Within the trellis tree area, the irrigation lines run along the first wire (1.5 feet above ground) and are buried in the middle pathway. Within the rows of free-standing trees, the lines are buried and the emitters are attached to ground stakes. Our Aboriginal summer student workers (Patrick Turner, Kris Hyzams, Johnson Wilson and Sonny Chapman) and their leader Adam Hicks laid a significant stretch of the piping.

### **Pathogen Management:**

Please refer to Linda Edwards' book, Organic Tree Fruit Management, for a complete guide to pest and disease control. The following notes are compiled from Edwards' book, and from my interview with Jim Rahe, Plant Pathologist.

*Pezizula malicorticis* - Anthracnose Canker (fungus), *Nectria galligena* - European Canker (fungus) and *Venturia inaequalis* – Apple Scab (fungus) cause the greatest strife to coastal apple orchards.

**Scab** is a discontinuous disease (must infect plant tissue annually). It impacts the leaves and fruit and over-winters in apple leaf litter and in pear twigs. Scab is usually worse in a wet, cold spring as rain and wind disperse the spores.

### **Scab Symptoms:**

- i. Olive green spots on underside of leaves
- ii. Olive green spots on fruit that become darker and rough. Grow in size (with fruit) until warm weather.

### **Scab control measures include:**

- iii. Pruning to keep canopies open (increasing air circulation)
- iv. Covering small trees (e.g. M9) with clear plastic covers
- v. Planting Scab-resistant cultivars
- vi. Protectant Sulfur sprays (a heavy duty corrosive, accepted by Organic standards ~ the UBC Farm has Kumulus Sulfur)
- vii. Collecting dead leaves in the fall (to break the cycle of inocula over-wintering on the leaves). Leaves must be dealt with appropriately, as spores travel by wind.
- viii. Adding Urea to the fallen leaves to break them down.
- ix. Flaming the orchard floor in the spring

**Canker** is a continuous disease (once it infects a tree, it becomes systemic). Canker will eventually kill its host, and will spread.

**Canker Symptoms:**

- x. Cankers start as little, dark, circular spots on the bark, and develop into larger ellipses.
- xi. Older cankers become rough, and split at the junction between healthy and diseased tissue.
- xii. Initial Anthracnose Cankers often appear on the trunk and main limbs, while European Cankers often appear at the base of branches and on scar sites

**Canker control measures include:**

- xiii. Grafting with disease-free wood.
- xiv. Careful winter pruning (Canker cannot establish in healthy bark tissue)
- xv. Vigilant pruning of diseased wood. This wood must be removed from site. Treated trees should be flagged and carefully monitored. If disease develops again, the tree should be removed.
- xvi. Disinfection of tools in water and bleach solution (10:1)
- xvii. Removal of trees.

**Pest Management:**

Again, please refer to Edwards' book, Organic Tree Fruit Management, for a complete guide to pest and disease control.

**Raccoons** can be dissuaded from climbing larger apple trees and eating the fruit by wrapping the trunk (up to 1m) with metal.

**Meadow Voles** live underground, and generally eat the leaves of grasses, weeds and legumes (Edwards, p 154). They can damage young apple trees by discovering and eating their roots during the winter, and/or by eating their bark. Derry Walsh loses 1/3 of her new saplings to voles each year. In 2005 she started a new trial by planting her trees within a home made cylindrical wire mesh cage. Her hope is that the cage will block the path of the voles, and stop them from discovering the trees' roots. She intends to leave the trees in for 3 years, and then to dig them up, remove the wire

(damaging some roots in the process), and replant them. At this point, she believes the tree roots will no longer be vulnerable to the voles.

Other vole control measures:

- xviii. Keep vegetation down – voles avoid the danger of open areas.
- xix. Install wire mesh/plastic guards around the base of the trees (5-10cm into soil, up to 45 cm above ground).
- xx. Minimize vole habitats, such as debris piles.
- xxi. Exercise caution when using mulches.
- xxii. Traps

So far the UBC Farm Orchard has not lost any trees to voles. However given our high numbers of rodents I believe rodent guards will be essential in order to protect the bases of the trees.

### **Nursery:**

Given the potential for tree loss in the first couple of years, I established a temporary Nursery row at the Southern end of the orchard. This spring (2007) I tagged a few trees that did not survive the winter. These trees may be replaced with trees from the nursery row in the spring of 2008. In 2008 I shall give the remaining trees (all MM106s) to Derry Walsh, one of my key supporters throughout the project. Further, I gave two MM106 trees to the Intergenerational Landed Learning Project to be planted in the Children's Garden in the spring of 2008.

### **Pruning:**

My forays into the world of pruning have thus far been limited. I have gained introductory experience through: Linnaea Farm Ecological Gardening Programme, Agro 322: Horticultural Techniques, a day course with the Environmental Youth Alliance and one-on-one discussion with Derry Walsh. This winter I will shadow Tony Maniezzo at the UBC Botanical Gardens. I will also utilize available literature and then set about the first round of orchard pruning. In particular Tony recommended The Cavendish Encyclopedia of Pruning and Training (Brickell and Joyce). Also, courtesy of Linda Edwards, Gene Hogue and Gerry Nielsen I have a pruning video and a few relevant publications. Notes from Derry Walsh's instructions may also be found in Appendix VI.

### **Part III:**

#### **Budget:**

In 2006 I followed the advice of Mark Bomford; I applied for and was awarded an Innovative Projects Fund grant for \$3022. This sum covered many, but not all, of the fundamental costs of orchard establishment. Further financing will be necessary in the future for orchard maintenance. For a detailed breakdown of the costs of orchard establishment please see Appendix III. Recently two of my greatest orchard supporters, my aunts Trudy Norton and Lauri Lachemann, donated \$300 to the farm to cover the costs of proper labels for the orchard. These labels (to be commissioned through the UBC Botanical Gardens) will indicate tree names, rootstock, and date of origin.

#### ***Income:***

Predicting production levels is neither easy nor exact, especially considering our mix of tree sizes and scion selections. Additionally, it is hard to make official estimates for Lower Mainland production when most Ministry of Agriculture data is based in the Similkameen – a bioregion so different to that of the coast. Local grower Jim Rahe estimated that once the trees have reached their full bearing potential, we might expect an average of 50 lbs/year per apple tree. The larger trees will take longer to bear fruit, but eventually will yield a greater amount (up to 150 lb per tree), while the dwarfed varieties will bear sooner, with less yield per tree (max 50 lb). Plums are hard to predict, and depend on the maturity of the tree, pruning and the weather. Jim's younger plum trees produce 10-15 lb/year, while the older varieties produce max 100 lb/year. Similkameen grower Edwards suggested that M9 trees produce 20-30 lbs of fruit per year.

Crop-derived income is always dependent upon fluctuating market prices, competition and crop yield. However, I believe that finding a market for UBC Farm tree fruits will not be a problem. Our clientele value our high quality, locally grown, organic produce, and are willing to pay fair market prices. Financially (and culturally) it is best to sell directly to the customer, and the UBC Farm has excellent marketing options available, including:

- 1) UBC Farm Saturday Markets
- 2) UBC Farm Community Supported Agriculture box program
- 3) UBC Botanical Garden Apple Festival
- 4) Sprouts (UBC Food Co-op)

5) Local restaurants

The following price table shows a rough (and incomplete) estimate of current rates.

**Price Table (2006)**

<b>Crop</b>	<b>Price/lb Direct to Customer</b>	<b>Price/lb Sold to Middleman</b>	<b>Price/lb In store</b>
Apples (organic)	\$1.80	\$0.40	\$1.20-1.80
Apples (non-organic)	\$0.70 (pre-ordered) \$0.80 (not pre-ordered)	\$0.23	\$1.00-1.20
Plums (organic)	\$1.50 (to \$4 at market)	\$1.25	
Plums (non-organic)	\$1.00		

(Source: Jim Rahe, Salt Spring Market, and the East Van Coop)

Depending on our management choices (e.g. to remove blossoms or not) our earliest crop could be in 2008, and would be light. As with all crops, production rates and quality will be impacted by disease, pests, weather, weeding, nutrition and general care.

**Orchard Design and Infrastructure:**

In the Similkameen the industry standard spacing for M9 trees is 2 feet. According to Edwards, to plant further apart is a waste of space, and to do so would be a false representation of the industry. Given our wetter conditions, I decided to plant the M9 trees 3 feet apart. The M26 trees are spaced 5 feet apart, the MM106's are spaced 14 feet apart and the nursery trees are spaced 2 feet apart. The pathways vary from 8-25 feet wide. For a visual view please see Appendix I.

The M9s are supported by 10-foot cedar posts, which were sunk, but not tamped, by Plant Operations. The posts are old growth cedar, which is acceptable under organic standards and has the longest lifespan of untreated woods. The posts were sold to me by Brian Mennell, and came from a forest fire in McBride. I modeled the design of my trellised trees on the Mennell/Edwards farm, which was a wonderful introduction to slender spindle production. As previously mentioned, my tour of Brian and Linda's property shifted my initially skeptical judgments about intensive M9 cultivation. Their property is beautiful as well as highly productive.

## **Summary of orchard work to date:**

### **Summer 2005**

- Wrote initial proposal

### **Fall 2005**

- Attended Salt Spring Island Apple Festival
- Toured Salt Spring orchards and conducted informal interviews with growers
- Attended UBC Botanical Gardens Apple Festival

### **Winter/Spring 2006**

- Visited orchards in the Fraser Valley and conducted interviews with growers
- Arranged and attended grafting lesson with Brian Campbell
- Coordinated and instructed volunteers (mostly students) to graft 155 trees
- Stored trees in wet sawdust, in the shade and out of the rain, until buds broke
- Re-grafted the few trees which did not take
- Mixed up a potting mix, and re-potted all trees
- Countless email inquiries with Derry Walsh!
- Ongoing tree monitoring

### **Summer 2006**

- Removed plastic around grafting scars
- Removed growth from rootstocks
- Removed blossoms
- Watered trees all summer
- Ongoing tree monitoring

### **Fall 2006**

- Visited orchards in the Similkameen and Okanagan and conducted interviews with growers and researchers
- Finalized orchard design
- Ordered and sowed groundcover
- Returned to the Similkameen (with Delisa Lewis) to fetch cedar posts
- Arranged for Plant Operations to bury posts
- Coordinated and worked with student volunteers to plant trees

- Ongoing tree monitoring (including grave concern that they were dying... as leaves were turning brown and falling... Until someone pointed out that they are deciduous...☺)

### **Winter 2007**

- Attended Fruit Tree Pruning Workshop with Environmental Youth Alliance and TreeCity
- Toured UBC Botanical Gardens Fruit Trees with Tony Maniezzo and received instruction on pruning
- Ongoing tree monitoring and care, including:
  - o Removal of root stock suckers

### **Spring/Summer 2007**

- Countless phone and email inquiries with Linda Edwards and Brian Mennell
- Re-ordered and re-sowed orchard groundcover (where necessary)
- Set up first 3 wires for trellis (following instruction from Brian Mennell, Appendix IV)
- Finalized irrigation plan and order
- Assembled irrigation
- Began Kumulus sprays
- Ongoing tree monitoring and care, including:
  - o Tagging of dead trees for replacement
  - o Removal of a couple of trees due to Canker ☹
  - o Removal of blossoms
  - o Irrigation
- Removal of Thistle and Morning Glory
- Clearing of vegetation at base of trees (circle with minimum 1 foot radius)
- Bud-grafted the 3 plum trees that did not take in 2006

### **Orchards visited:**

#### **Fraser Valley**

- Annie's Orchard – Aldergrove – Jim Rahe
- Dave's Orchard – Aldergrove – Dave Ormrod
- Derry's Orchard and Nursery – Aldergrove – Derry Walsh

#### **Salt Spring Island**

- Appleluscious – Salt Spring Island – Harry Burton

- Brighte Farm – Salt Spring Island – Charlie and Bree Eagle
- Isabella Farm – Salt Spring Island
- Fern Creek Farm – Salt Spring Island
- Salt Spring Centre Orchard – Salt Spring Island
- Wavehill Farm – Salt Spring Island – Rosalie Beech

### **Similkameen**

- Mennell/Edwards Orchards – Cawston – Linda Edwards and Brian Mennell

### **Okanagan**

- Pacific Agriculture Research Centre – Summerland – Gene Hogue and Gerry Nielson

### **Human Resources:**

The following individuals provided technical insight, information, and support during or throughout the project:

***Mark Bomford*** – B.Sc. Agroecology; UBC Farm Programs Coordinator; Budget expert!

***Bomke, Art*** – PhD; Soil Science Professor, UBC.

***Buckner, David*** – Head Instructor, Linnaea Farm Ecological Gardening Programme; One of my first grafting teachers

***Campbell, Brian*** – Grafter; The third gentleman who taught me to graft.

***Timothy Carter*** – UBC Farm Production Coordinator; Irrigation expert!

***Eaton, George*** – PhD; Retired Plant Science Professor, UBC; Founder of the original UBC Farm Orchard.

***Edwards, Linda*** – M.Sc. Entomologist; Author of Organic Fruit Tree Management; Orchardist.

***Hogue, Gene*** – PhD; Expert in vegetative orchard floor management; Agriculture Canada: Summerland Agriculture Research Centre.

***Justice, Douglas*** – M.Sc; Horticulture Professor, UBC; Associate Director and Curator of Collections, UBC Botanical Garden.

***Nielsen, Gerry*** – PhD; Expert in major/minor element plant nutrition in horticultural systems; Agriculture Canada: Summerland Agriculture Research Centre.

***Kellhammer, Oliver*** – Permaculture Instructor; One of my first grafting teachers

***Maniezzo, Tony*** – Manager of the UBC Botanical Garden Food Garden; Espalier expert.

***Mennell, Brian*** – B.Sc; Orchardist.

**Ormrod, Dave** – PhD; Retired Plant Pathologist, Ministry of Agriculture; Orchardist.

**Rahe, Jim** – PhD; Retired Plant Pathologist/Professor, SFU; Orchardist.

**Steve Taylor** – Irrigation Specialist, WaterTec

**Tracey, David** – M.L.A (Master of Landscape Architecture). Strathcona Community Garden Orchardist; TreeCity Board of Directors.

**Walsh, Derry** – M.Sc; Botanist; Orchardist.

## **Part IV:**

### **Yearly Management Guidelines:**

#### **Winter**

- Dormant season pruning: all apples (May be done in part by students in Agro 322)
- Careful monitoring for Canker sores
- Removal of diseased tissue – either full trees, or branches (in which case, flag the tree for monitoring)

#### **Spring**

- Flaming of Orchard floor (optional - to kill Scab)
- Blossom thinning to:
  - o Avoid biennial bearing
  - o Improve fruit size
  - o Remove undesirable fruit(see Edwards, p 175)
- Pest and disease monitoring
- Application of Kumulus Sulfur – every 7-10 days from first leaf bud until the summer is hot and dry (July). Mix 4 Tablespoons per 5 Gallons H<sub>2</sub>O and spray to “thorough wetting” (Edwards).
- Weed control
  - o Try to maintain a 2 foot strip (approx) of bare soil for the trellised trees, and a wide bare circle for the free standing trees. Stirrup hoes and hand forks!<sup>2</sup>
- Regular irrigation (especially important in the initial years)
- Pruning Plums (April)

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<sup>2</sup> Dependent on final management decision

- Compost/soil amendment application (e.g. Fish fertilizer – to avoid nutrient loss apply after the main rains have passed)
- Removal of suckers from rootstock base

### **Summer**

- Weed Control (see Spring)
- Pest and disease monitoring
- Application of Kumulus Sulfur
- Regular irrigation
- Removal of suckers from rootstock base
- Summer pruning: Cordons and trellised trees (June, Sept)

### **Fall**

- Harvest
- Gathering of fallen leaves and disposing of them (covered composting, removal from site, burning...)

### **Recommendations to the UBC Farm Market Garden for Orchard Care:**

- Install rodent guards around the bases of the trees!!!
- Follow the **Yearly Management Guidelines** and use Edwards' Organic Tree Fruit Management
- Monitor tree growth and loosen current labels accordingly! (They are around the tree trunks)
- Install the final 4<sup>th</sup> trellis wire
- Begin pruning in dormant season of 2007/2008
- Hire a student to organize and complete yearly pruning.
- Replace the current bamboo pieces in the angled cordons with longer pieces (7 feet)
- Management decision: Whether or not to allow some trees to produce fruit in the 2008 season (early fruit production will detract from the establishment of tree structure).
- Management decision: What form of groundcover management to employ at base of trees.
- Once the trees are an appropriate size, position picnic tables in the northern portion of the orchard
- Consider the educational potential of the orchard. Consider offering urban fruit tree short-courses, and including the orchard in farm tours.

### **Sarah's Still To Do List:**

- **Finalize labels** for the trees via the UBC Botanical Gardens. To include: name, rootstock, and date of origin. Potentially country of origin as well.
- **Printing of a logbook** ~ this book will use the Strathcona Community Garden orchard log template. A page will be provided for each tree so that disease management, care and production can be logged as desired.
- **Winter pruning** ☺ (shadow Tony Maniezzo)
- **Re-graft:** Trees that have not taken
- **Compile a hard copy of orchard media and photos**

### **Potential for future Directed Studies involving the orchard:**

- Expansion to include raspberries, pears, or more apples
- Researching and potentially establishing orchard bees
- Focused pruning
- Trials of different organic management styles in our climate (especially ground cover management)
- Researching and trialing the result of using Kumulus Sulfur spray as a preventative (as was suggested to me by Edwards) or as an IPM case-by-case application.
- Grafting multiple varieties of apples onto one tree

### **Part V:**

#### **Orchard Publicity:**

Over the course of the orchard's establishment I was interviewed for a total of 6 articles and pod casts. Hyperlinks follow:

1) Sarah Abbot, UBC Farm Newsletter, November 2006

[http://www.landfood.ubc.ca/ubcfarm/2006-11\\_newsletter.php](http://www.landfood.ubc.ca/ubcfarm/2006-11_newsletter.php)

2) Jordan Chittley, UBC Journalism Student, Spring 07

<http://typo3.arts.ubc.ca/v4site/index.php?id=778>

There is an article and also a link to a pod cast here (see "Belanger on the Radio" on sidebar). Please excuse his misuse of term "perennial."

3) Jason Gray, Agro 461 Pod cast, Spring 07

[http://www.landfood.ubc.ca/learningcentre/podcasts/agro461/long\\_podcast/](http://www.landfood.ubc.ca/learningcentre/podcasts/agro461/long_podcast/)

4) Jennifer Honeybourne, LFS ReachOut Newsletter, Spring 07

[http://www.landfood.ubc.ca/aboutus/documents/reach\\_out\\_spring2007.pdf](http://www.landfood.ubc.ca/aboutus/documents/reach_out_spring2007.pdf)

5) Nicholas Read, Vancouver Sun, “UBC’s apple tree has roots to Newton,” July 2007

~ Article unavailable at this time.

6) Basil Waugh, UBC Reports, June 2007

<http://www.publicaffairs.ubc.ca/ubcreports/2007/07jun07/trees.html>

### **Reflections:**

I have learned more through this Directed Studies than I have in any university AGSCI course thus far. That said it was also more work than any university course I have ever taken, and should probably have been a shared project between multiple students. It was at times completely overwhelming and exhausting (not to mention never-ending!), but I would not trade it. More so than in any other university project I feel a sense of accomplishment, ownership and pride in my work, largely because it is a tangible product that may be enjoyed by many (rather than read by just one professor, as with a student paper). Further, because it was entirely self-directed, my orchard project feels more personal than an average assignment, and I feel a lasting sense of responsibility for, and connection to, it.

### **Summary of Challenges:**

- Lack of structured university support (I often felt very much out on my own in the project. I don’t think anyone had a clear understanding at the beginning of how big the project was, or what exactly it would entail).
- Lack of orchard expertise within the UBC community
- Financial aspect was up to me
- Multi-faceted expectations (teach volunteers how to graft, graft 155 trees, mix potting mix, pot-up trees, monitor summer irrigation, research orchard management, organize orchard tours in BC, interview people, design the orchard, plant the orchard, arrange cover crops, arrange posts and wires, arrange irrigation and installation, care for the trees, write a comprehensive report...). The list kept going and left me with a sense of never-ending responsibility...

The largest challenges for me were: lack of support, lack of structure and the massive size of the project. I felt very discouraged when well into the project I realized that berries would have been a much more climate appropriate crop, as the threat of disease in organic apple production is high on the coast. Had I developed my research more thoroughly before leaping into action I may have come to this conclusion earlier, and perhaps changed my project. However, in the long run I appreciate the educational value of the orchard ~ both for myself, and for others in the future. I know that diseases will be an issue, but I think the educational potential of the orchard is still significant. Also, while I love berries, I find trees more exciting.

### **Summary of Benefits:**

- Hands on experience (grafting, installation, management...) and skill development
- Interaction and connection with wider agricultural/horticultural community
- Independence and responsibility (coordinating volunteers, planning project, budget...)
- Knowledge acquisition and realistic application (vs. theoretical)
- Tangible, lasting, ongoing project at the farm
- Head, Hands, Heart ~ all engaged

Overall my orchard Directed Study has been invaluable to me. However, for future Directed Studies I would suggest the following:

- Ideally, a key Land and Food Systems contact person (e.g. a “Directed Studies Coordinator”) whose roll is to help students brainstorm ideas, set out realistic objectives and timelines, and connect them with resources (including professors).
- Increased structure for professor/student check-ins
- Group projects (seem to work well for adhering to a timeline, and distributing workload)

### **Appreciations:**

At this point I would like to extend my great and sincere thanks to all of my wonderful helpers of many forms! Unfortunately I did not keep a complete and thorough list of all the volunteers who contributed time and energy to the orchard, but THANK YOU! For a list of the folks who

generously answered my questions, phone calls and emails please see “Human Resources.” In particular, I would like to single out and thank the following people:

- My mother Carol Belanger, and my aunties Trudy Norton and Lauri Lachemann: For being my most outstanding and consistent orchard volunteers, and such inspirational women
- Brian Mennell and Linda Edwards: For being so patient and generous. Thank you!
- Derry Walsh: For always answering my millions of questions with a smile.
- The WONDERFUL UBC Farm Staff: For your support, encouragement, hard work and senses of humour!!! (and cookies).
- Delisa Lewis: For driving to Cawston and back with me, in one long, wonderful day, to fetch our old growth cedar posts in the Honeycrisp Truck.
- Gavin Wright: For believing in and encouraging me when I felt completely overwhelmed. Thank you.
- Jason and Simon: For all the grafting help!
- All the wonderful volunteers who have grafted, potted, planted, handled, buried, weeded, strung up, written down, hauled and so on! There would be no orchard without you.
- The AMS Innovative Projects Fund: For financially supporting this project!
- Dr Art Bomke and Douglas Justice: For your emotional and academic support. Thank you gentlemen.
- Faculty of Land and Food Systems: For responding quickly to my request and paying for our tree guards!

And anyone else who I may have neglected (at this moment) to include ~ thank you too!

## **Part VI:**

### **Literary Resources:**

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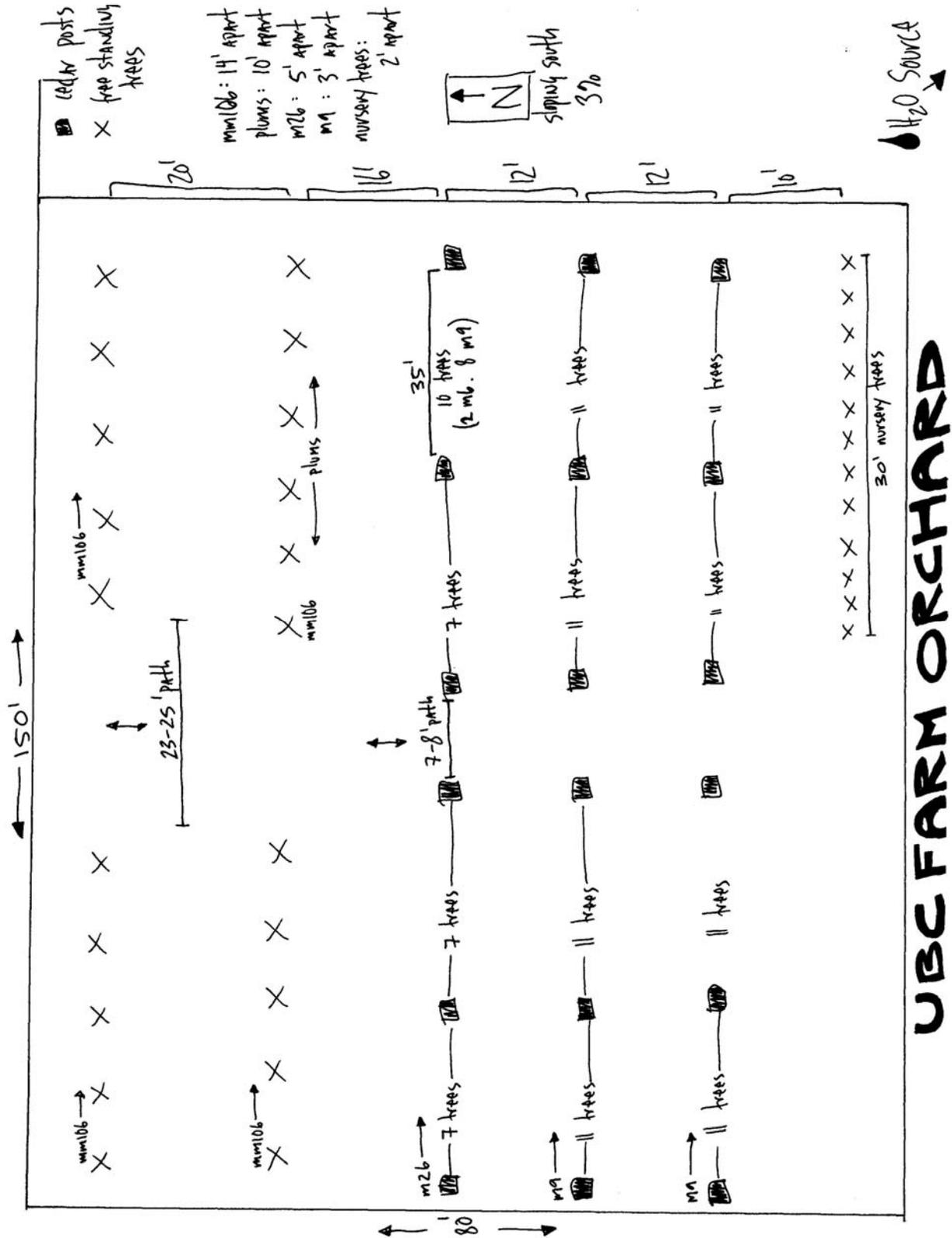
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Appendix I: Orchard Schematic Map



**UBC FARM ORCHARD**

## Appendix II: Cultivar List

M9	M26	Mm106	Plum
99 (2 purchased as whips)	23	27	5
			Brooks *
Akane	Adam's Pearmain	Belle de Boskoop *	Italian *
Alexander	Chehalis *	Bramley's Seedling (Triploid)	Cannor's Gold*
Alexander	Cornish Gilliflower *	Duchess of Oldenburg *	Unknown (neighbour's tree)*
Alexander	Cox's Orange Pippin	Epicure *	
Alexander	Cox's Orange Pippin *	Fameuse	
Ashmead's Kernel * M	Cox's Orange Pippin *	Golden Russet *	
Ashmead's Kernel * M	Cox's Orange Pippin *	Gravenstein (Triploid)	<b>Didn't take:</b>
Belle de Boskoop * H	Cox's Queen *	Grimes Golden	Bradshaw
Belle de Boskoop H	Dolgo Crab *	Grimes Golden	Victoria *
Blenheim Orange H	Florina *	Grimes Golden	Opal *
Blenheim Orange H	Gravenstein	Jaegher's Reinette	
Blenheim Orange H	Grimes Golden *	King (Triploid)	
Bramley's Seedling * H	John Downie Crab *	King * (Triploid)	
Bramley's Seedling H	John Downie Crab *	Lord Lambourne	
Bramley's Seedling H	Kidd's Orange Red *	Lord Lambourne *	
Bramley's Seedling H	Margil *	Northern Spy	
Carmeliter Reinette	Northern Spy	Priam *	
Carmeliter Reinette *	Peasgood Nonsuch *	Strathcona Russet	
Chehalis * M	Peasgood Nonsuch *	Tydemans Late Orange *	
Chehalis M	Priscilla	Wealthy	
Chehalis M	Pristine	Wealthy	
Cornish Gilliflower	St Edmund's Pippin *	Wealthy	
Cox's Queen * M	Yellow Transparent	Wealthy	
Dayton H		Wealthy *	
Dayton H		Wolf River	
Duchess of Oldenburg * M		Yellow Transparent	
Esopus *		York Imperial	
Fameuse * M			
Golden Russet * M			
Golden Russet * M			
Gravenstein H			
Grimes Golden * M			
Grimes Golden * M			
Honeycrisp (purchased)			
Honeycrisp (purchased)			

Hudson's Golden Gem \*  
Jaegher's Reinette  
Jaegher's Reinette  
Jeffris  
Johnathan \*  
Johnathan \*  
Jonafree H  
Jonafree H  
Kidd's Orange Red \* M  
King \* H  
King H  
King H  
Liberty H  
Liberty H  
Margil \*  
Mystery Apple  
Northern Spy M  
Northern Spy M  
Nova Easygrow \* M  
Nova Easygrow M  
Oaken Pin \* M  
Oaken Pin \* M  
Orenco  
Orenco \*  
Orin \*  
Peasgood Nonsuch M  
Peasgood Nonsuch M  
Pitmaston Pineapple \*  
Pitmaston Pineapple  
Pitmaston Pineapple  
Poppy's Wonder \* M  
Prima H  
Prima H  
Priscilla M  
Priscilla M  
Pristine  
Pristine  
Schmidtberger's Rote  
Reinette \* H  
Schmidtberger's Rote  
Reinette H  
Spartan \* M  
Spartan M  
Spigold H  
Spigold H  
St Edmund's Pippin \* M  
St Edmund's Pippin M

St Edmund's Pippin M  
Strathcona Russet  
Sundance  
Sundance \*  
Tydeman's Late Orange H  
Vanderpool Red \*  
Winesap \* M  
Winesap \* M  
Winston \*  
Wolf River \* H  
Wolf River H  
Yellow Transparent M  
Yellow Transparent M  
York Imperial \* M  
York Imperial M  
York Imperial M

**Legend:**

\* =Grafted by Sarah

M=Moderate vigor

H=High vigor

### Appendix III: Orchard Establishment Budget

#### IPF Orchard - project 10S36255 - working budget

	Budgeted (IPF)	Spent to Date	Pending	Total	Remaining	Notes
<b><u>Rootstock</u></b>						
M9 (2 bundles of 50, \$70/bundle, \$1.40 each)	140.00		386.61			Expense claim that needs re-allocation
MM26 (25 x \$2 each)	50.00					
MM106 (25 x \$2 each)	50.00					
Quince (for pears, 10 x \$2 each)	20.00					
St Julian A (for plums, 5 x \$2 each)	10.00					
<b><u>Scion wood</u></b>						
(\$1/stick, good for 2 trees)	85.00	60.82				Tags and Scions
Contingency, re-allocated from labour	266.00					
<b><u>Subtotal: Plant material</u></b>	<b>621.00</b>	<b>60.82</b>	<b>386.61</b>	<b>447.43</b>	<b>173.57</b>	
<b><u>Irrigation</u></b>						
Hydrant adapters, PR valve, laterals, low-flow emitters, timers, etc.	900.00	155.07				Hose from Corix, Lee Valley Sprinklers, etc.
<b><u>Amendments and Infrastructure</u></b>						
Sawdust	8.00					
Bark mulch potting mix	42.00					
Potting mix delivery	50.00		80.00			Invoice pending - shavings, delivery, etc.
Pots						
Mulch						
Posts (for M9 and M26))	300.00	437.30				Cedar posts, wire, transportation

Mason Bees	36.00				
Mason Bee houses (3)	90.00				
Rodent Tree Guards	300.00	115.93			Cover Crop seed
<b><u>Subtotal: Non-Plant Material</u></b>	<b>1,726.00</b>	<b>708.30</b>	<b>80.00</b>	<b>788.30</b>	<b>937.70</b>
<hr/>					
<b>Land Preparation - \$80/hr x 8, including equipment hire and labour</b>	400.00	384.00	360.00		Plowing and disc x 2
<b>Planting into field (staking as necessary) – 20 min/tree x 165 trees = 55 hours</b>	275.00				
	<b>675.00</b>	<b>384.00</b>	<b>360.00</b>	<b>744.00</b>	<b>-69.00</b>
<hr/>					
<b><u>Total 2006 Project Costs:</u></b>	<b>3,022.00</b>	<b>1,153.12</b>	<b>826.61</b>	<b>1,979.73</b>	<b>1,042.27</b>

Total Requested from IPF: 3,022.00

#### Appendix IV: Trellis Set Up Instructions (Source: Brian Mennell)

1. Drill holes in poles (except end slant poles)
2. Take wire (high tensile) at one end (slant pole) and wrap 2 times around post, then wrap again and loop around main wire
  - a. Use a 6 inch piece of metal with a hole through it to twist the wire (3/4 inch pipe)
  - b. Can use a skill saw wrench with a hole
3. Run wire through middle path post, with 1.5 extra feet
4. Position Vice Grip in drilled hole in middle post
5. Pull wire through (will lock). Use claw on hammer to pull.

6. Nail in vice grip for support
7. Return to slanted pole. Use metal piece with hole to twist wire more. 10 wraps.
8. Cut end so not to poke anyone
9. Tighten again at middle.

**Posts:**

- If no concrete used, be sure to tamp: (Use metal bar to compress soil around post base)
- Three bottom wires are secured with vice grips to make the walkway
- The top wire (fourth) goes right through the full row
- Also good to loop a couple of times around the tops of the middle two posts
  - o Secure with a 2-way-gripper

**Appendix V: Kumulus Sulfur Spray Instructions:**

- Ratio: 4 Tablespoons Kumulus: 5 Gallons H<sub>2</sub>O
  - o 0.8 T/Ga
  - o 2.4 t/Ga
- Sprayed as a barrier against Scab and Powdery Mildew. While mildew cannot grow in the rain, Scab can.
- Should be sprayed every 7-10 days from first budding until the dry and hot season (summer). If no scab has shown up by the end of June, quit.
- Annual application
- Spray to thorough wetting, but not excessive run off
- If too much is made, can store in a closed bucket
- If just a little extra is left over can spray over a grass field area at same application rate
- Some people have reactions to it, so use of gloves etc may be desirable.

**Appendix VI: Pruning** (source Derry Walsh)

- For cordons (45 degrees):

- Choose leader, tie down side branches at an angle, and let grow to full height.
  - Need full length bamboo: 7 feet
  - Once at full height, pinch back top to encourage side growth (likely fruiting spurs)
  - If branches get too long, trim back by 1/3
- For other trellised trees:
    - Cut back to just below first wire to encourage a new leader and side branching (to be attached to first wire).
    - If nice side branches already exist, tie them to the wire on an angle
    - Recommended adding another wire (every foot vs. every 2 feet)
- For free standing trees:
    - Cut back leader: 8 inches below the cut is where branches will form

### **General guidelines:**

- Pruning in late winter, so disease is less likely (Jan/Feb/March)
- If there is only 1 branch and the 1 leader, cut the branch in order to encourage multiple branches
- If weeding around base of tree: 27 inches is good
- Height for first branches of trellised trees ~ approx 27 inches...
- For the few wimpy trees ~ cut back fruit buds and pinch back tops to encourage growth
- Says plums don't get canker

### **Bud grafts:**

- In April (or whenever the buds start swelling because sap is flowing) cut back wood above the bud

### **Terms:**

- *Blind wood*: no growth, has been beaten by wind etc. Not dead, just no leaves
- *Rosy apple aphid*: sucks the fruits when little, so they grow very small, usually still in a cluster
- *Fruit bud*: little bud sticking straight out with many leaves surrounding it.

- *Leaf bud*: little bud lying flush against the trunk, with only 1 leaf next to it.

**Nutrition:**

- Apply magnesium/lime (?) in winter and/or spring. 1lb per tree. Cox's Pippin: 2 lbs both seasons.

**Appendix VII: Tree Names Map** (separate document)