Steps to Success in

REPLANTING

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OKANAGAN VALLEY
TREE FRUIT AUTHORITY

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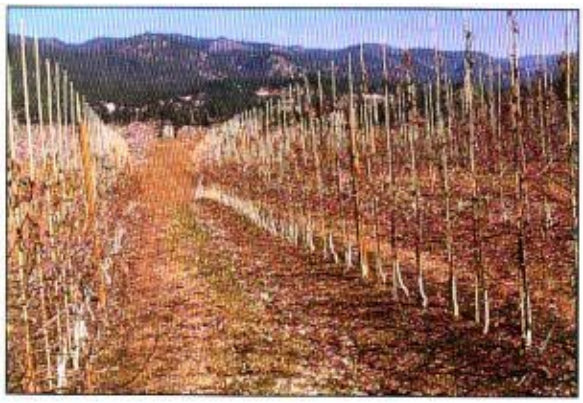
M. Sanders, Horticulturist, BCMAFF, Kelowna

Preface



Gala, super spindle 2.5 x 10 coming into second leaf

Fruit growing is an interesting, but continually challenging business. Growers must always be aware of and ready to respond to changing market trends and improved cultural methods if they expect to remain competitive in present and future markets. Given the present expansion of tree fruit production throughout the world and the over-supply of fruit on world markets, this readiness to adapt is critical to continued business success.

In recent years, the development of high-density systems for apples has opened up opportunities to obtain higher returns than with traditional orchard systems. This is especially true with apple varieties that have the potential to yield high returns. The use of high density orchard systems, however, means that orchardists must improve their management skills and acquire new ones to take advantage of these opportunities. This publication summarizes the key steps necessary for new fruit tree plantings to prosper.

The focus is on apples because they are the most widely planted tree fruit crop in BC. In addition, many new apple plantings fail to develop their full potential because of replant problems. Most of the discussion on planning, site preparation, and planting, however, can be applied to pears and soft fruits. These fruits are also discussed in the sections on rootstocks, spacing, and tree training and pruning.

Soft fruits and pears can also suffer from replant problem, but the effects are not usually as severe as with apples. Since, in addition to this fact, replant analysis is available only for apples, the safest method is to fumigate the site before replanting to the same type of soft fruit or to pears. This is particularly advised if a previous planting has indicated there is a problem.

TWELVE STEPS TO A SUCCESSFUL REPLANT

The following summarizes the critical steps described in this publication in replanting your orchard successfully. As each orchard is somewhat different, discuss your replanting plans with your local horticultural advisor and/or packinghouse field staff.

1. Timing Orchard Renovation
   - Develop a long-range plan to renovate 5-10% of your acreage each year
   - Consider cultural and variety factors necessary to make an informed decision on the best variety(ies), rootstock(s), training system(s), and spacing(s) for your situation.

2. Variety Selection
   - Keep abreast of new varieties and the specific market and cultural conditions required for success.
   - Use government and industry sources of up-to-date information.

3. Rootstocks
   - In the majority of orchards in the Southern Interior, M.9 and B9 rootstocks will be the best choice for high density plantings.
   - Ottawa 3 (03) is also suitable for BC conditions.
   - Rootstock selections for soft fruits are quite limited, particularly size-controlling ones; preferred ones are Old Home x Farmingdale (OHF) for pears, Mazzard F12/1 and Mazzard seedlings for cherries, Siberian C for peaches and nectarines, Haggith for apricots, and Myrobolan B for prunes and plums.
4. Training Systems for High Density Apple Plantings
   - Slender spindle (700-1500 trees/ac), vertical axis (550-900 trees/ac), and super spindle (2000-5000 trees/ac) are the best bet for the Southern Interior of BC at present.
   - Super spindle is the newest system and requires advanced horticultural skills and dedication to be successful.

5. Apple Nursery Stock
   - Feathered trees are preferred for high density plantings of slender spindle or vertical axis.
   - Whips or trees with short feathers are preferred for super spindle.
   - Buy only high-quality trees in good condition.
   - If you are considering growing your own replacement trees, refer to *Tree Fruit Home Nurseries: A Growers Manual, OVTFA, 1993.*

6. Site Preparation
   - Start planning well before planting and do a thorough job of site preparation.

7. Tree Handling
   - Plant as early in the spring as possible.
   - Protect trees from wind, sun, and/or frost at all times before planting; do not store in a fruit storage room as ethylene gas can damage young trees.

8. Planting
   - Add peat to planting hole, especially on lighter soils.
   - Fertigate as soon as trees are planted OR add fertilizer mix to hole and around trees every 7-10 days after planting.
   - Plant trees at correct depth for rootstock type used.

9. Pruning and Training
   - Prune all trees immediately after planting.

   Apples:
      - See Oberhofer, *Pruning the Slender Spindle OR Pruning and Tree Training Techniques for High Density Orchards*, OVTFA, 1994 for complete details.

   Soft Fruits and Pears:
      - Pears are normally trained to a central leader.
      - Cherries are normally trained to a central leader or modified central leader.
      - Apricots, peaches, prunes, and plums are normally trained to a modified open centre.

10. Support Systems
   - Install appropriate support system(s) for the particular type of training system used; see K. Bert van Dalfsen. *Support Systems for High Density Orchards*, BCMAFF
   - Install before or right after planting.

11. Tying Trees to Support System
   - Tie trees to supports right after planting.

12. Helping Trees Grow
   - Maintain regular program of nutrition, pest control, irrigation, weed control, and control of unwanted growth.
   - For detailed instructions on fertigation, see Peter Waterman, *Fertigation Guidelines in High Density Apples and Apple Nurseries in the Okanagan Similkameen*, BCMAFF, 1993.

STEPS TO SUCCESS IN REPLANTING

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STEPS TO SUCCESS IN REPLANTING

1.0 TIMING YOUR ORCHARD RENOVATION

Your decision on when to renovate any particular orchard block is not an easy one, but critical to your long-term business success. No single formula is possible, however, as every grower's situation and orchard are different.

Unfortunately, the tendency is to wait until a block is past its peak production before renovating. At this point, returns will decline and internal funding of new plantings may not be possible. Undoubtedly, however, it is not easy, or perhaps even possible in most cases, to pick with certainty a particular high point or point of decline at which you should renovate; neither the market nor tree production can be predicted precisely. Alternatives to this approach are clearly needed.

The most direct way to avoid having to pick a particular point in the production or market cycles at which to renovate your orchard is to develop a comprehensive, long-range plan. Any such plan will need to be flexible in order to incorporate unforeseen circumstances such as 'hot' new varieties or superior systems; however, on the basis of today's technology and variety selection, a reasonable approach is to plan on renovating between 5% and 10% of your acreage every year. This will ensure that the necessary preparation for replanting blocks, such as soil and replant analyses, can be done in plenty of time and that over a period of time, your orchard will be, and will continue to be, up to date.

1.1 Developing a Comprehensive Renovation Plan

The following factors should be considered in a comprehensive renovation plan:

- timing of replant and long-term schedule for various blocks
- variety selection
- most suitable rootstocks for particular orchard
- training system(s)
- type of tree: whip or feathered
- tree quality
- timing of nursery order
- planting density
- pollinizers
- spacing
- site preparation: timing and method
- planting: timing and hand or machine planted

1.2 Planning Your New Planting

Deciding on the details of a specific new planting requires careful thought and should not be rushed. Allow plenty of time for possible adjustments and unforeseen holdups. A new planting is a big investment of money and time and will not yield well without careful, knowledgeable management from the very start.

- Investigate the different varieties, rootstocks, training systems, and spacings available to arrive at a combination that is most suitable for your particular site.
- Have replant and soil analyses results at least 9 months before you expect to plant; this will determine which treatments are necessary.
- Order nursery stock at least one, and preferably two years in advance of planting to make sure the varieties and number of trees you need are available. Consider having your trees grown under contract to ensure high quality and the number you need.
- Include pollinizers in your plan and order these with the other trees.
- If you are using topsoil from another site for the planting holes, have it analyzed for pH and salt levels.
- Topsoil from another location may contain herbicide residues; sow cucumbers into this soil, as they are good indicators of such residues.
- Order materials for support systems well in advance of planting to make sure that supplies are available when needed.
- Have the irrigation/fertigation system designed so that materials are available and the system can be installed before or immediately after planting.

2.0 WHICH VARIETIES TO CHOOSE?

The most critical decision in renovating a block is what variety to plant. The market does not base prices on commodities, but on particular varieties and on the supply of and demand for them. Since the best prices are usually paid when a variety first comes on the market, it is very important to keep abreast of what new varieties are being developed. You must also know what orchard system(s) and management will get a new variety into heavy early production.

Information on varieties can be obtained from a number of reliable sources: the Plant Industry Improvement Company (PICO), BC Ministry of Agriculture, Fisheries and Food horticulturists, your packinghouse, the Horticultural Forum and local grower's meetings, and the Goodfruit Grower and local publications.

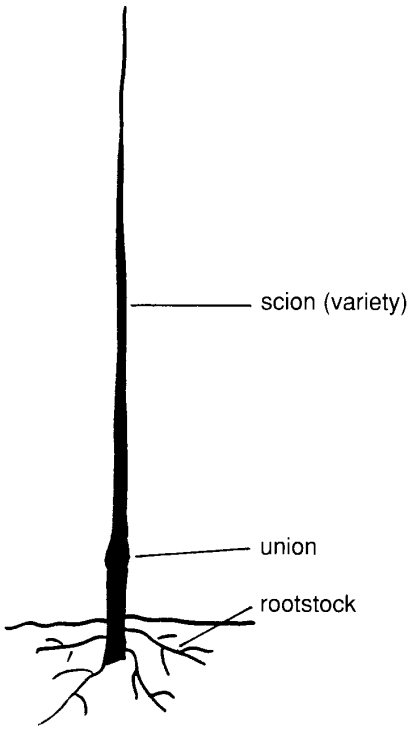
3.0 THE CASE FOR HIGH DENSITY PLANTINGS

High density planting in BC is used chiefly for apples. Some countries have developed such systems for other fruits as well. In British Columbia, “high density” is considered to be plantings of more than 600 trees per acre. Many growers, however, are planting at higher rates, of 800 to 1200 trees per acre, and some are planting super spindle systems at densities from 2000 to 5000 trees per acre.

Research results and observations of commercial orchards in BC show that high density plantings offer the greatest potential for net profit. Research has also shown that the level of early production is related directly to planting density:
the higher the density, the heavier the early production. Economic analysis indicates that maximum profits are gained from tree fruit plantings that come into heavy production early. Early production is particularly important for new varieties so that the grower can gain the advantage of the higher prices paid when a variety is in short supply for the market.

Growers should be aware, however, that as densities increase, more and somewhat different skills are needed to manage the trees adequately. Updating and acquiring new skills should be part of your orchard renovation plan.

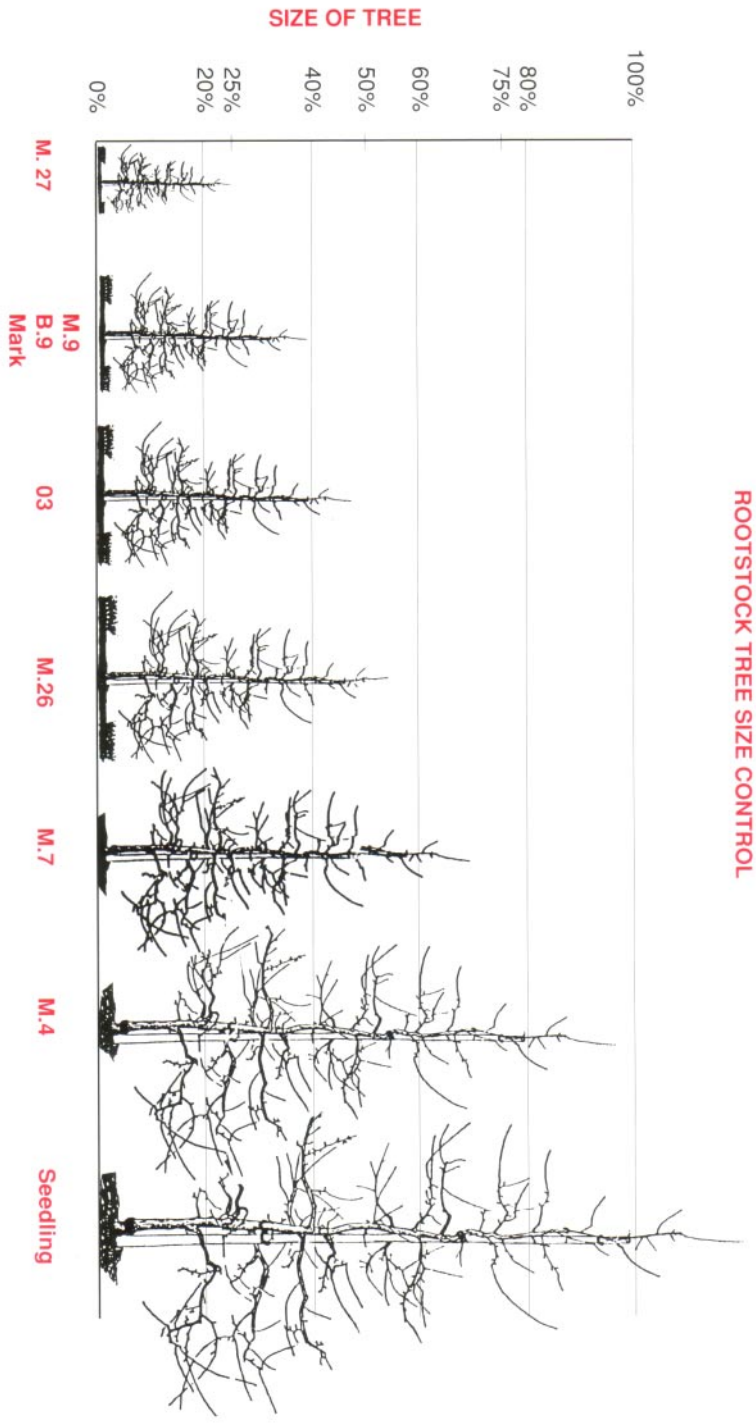
3.1 Rootstocks for High Density Plantings



a typical 2-piece tree

Apple growers can select what size tree they wish based on their choice of rootstock. There are rootstocks that will produce trees all the way from full size to less than 20% of full size. In general, as tree size decreases, precocity to fruit increases; the products of photosynthesis in dwarfed trees are directed from vegetative growth to fruit production. The disadvantage of using dwarfing rootstocks is that more trees per unit area are needed to establish a complete tree cover than with full-sized trees. Trees on dwarfing rootstocks also require support.

Tree density is important whatever rootstock is used. If it is too low, light interception is low and the orchard will not reach its full yield potential. If tree density is too high, fruit size and quality will be reduced by the shade the trees cast. Techniques such as limb pruning, root pruning, limb bending, girdling, and nutrition and irrigation management help to control tree size, but will not prevent self-shading if tree densities are too high. For each rootstock-tree management system there is an optimum density at which fruit yields are highest and self-shading at a minimum. The challenge for the orchardist is to find that optimum level for each new planting.


SIZE OF TREE
0%
20%
25%
40%
50%
60%
75%
80%
100%
3.1
ROOTSTOCK TREE SIZE CONTROL
M. 27
M.9
B.9
Mark
03
M.26
M.7
M.4
Seedling

3.2 Choice of Clonal Rootstocks for High Density Apple Plantings in British Columbia

The following suggestions for rootstocks most suitable for use in British Columbia's high density plantings are based on local experience, and information from local research trials and elsewhere.

3.2.1 Apples

For most apple varieties currently being planted in BC, there are three rootstocks to consider seriously: M.9, B9, and Ottawa 3. Mark, another precocious, productive dwarfing rootstock, has a problem that is discussed later.

M.26 is another, but less desirable, choice except perhaps for use with spur-type strains or weak-growing varieties such as Braeburn. For some high density training systems, the semi-dwarfing rootstock M.7 produces a desirable size of tree for these strains or varieties also. The use of M.7 is discouraged, however, since it is both winter-tender and susceptible to crown rot.

There may be a place in British Columbia for relatively untested rootstocks such as P2, P22, and M.27. These are in research plantings and are worthy of orchard trial.

3.2.2 Soft fruits and pears

For soft fruits and pears, rootstock selection is limited. This is chiefly because there are no dwarfing rootstocks available that have been fully tested and judged suitable for our conditions.

For pears, some of the Old Home x Farmingdale (OHF) rootstock selections are more precocious and productive than seedling rootstocks although they do not give very much tree size control. The most interesting at the moment are OHF 69 and 87.

There are some promising size-controlling cherry rootstocks from abroad, but these have not been adequately tested for commercial plantings under our conditions. Mazzard F12/1 and Mazzard seedlings are considered the most suitable at present.

For peaches, apricots, nectarines, prunes, and plums, growers do not usually have any choices of rootstocks and receive what the nursery has available. For your records, however, find out what rootstock you have bought in case any rootstock-related problems arise. The preferred rootstocks are as follows: peaches and nectarines - Siberian C, apricots - Haggith, prunes and plums - Myrobolan B.

When selecting rootstocks, keep in mind that there is no perfect one. Each rootstock has advantages and disadvantages. If you expect too much from any one, you will be disappointed. Accept certain weaknesses in an otherwise suitable and productive stock and take steps to minimize the adverse effects of these weaknesses.

3.3 Most Suitable Rootstocks for High Density Apple Plantings in British Columbia

3.3.1 Malling 9 (M.9)

This rootstock produces a tree about 30% to 35% the size of one on a standard rootstock. Nurseries sell several strains of Malling 9 that vary slightly in vigour control.

M.9 (T337) is the strain most often imported from Holland, a large supplier to the BC industry. It is 5% to 10% larger than the original M.9.

M.9 EMLA is another commonly used strain that is larger than the original M.9. There are also other strains such as Pajam 1, Pajam 2, and Fleuron used in Europe. These are in trial here, but no test results are available as yet.

Advantages:

- very widely planted throughout Europe and in recent years has become so in BC
- performs well on a wide range of soils here as long as soil moisture is not limiting; the oldest plantings in BC on this rootstock are over 25 years and at the Summerland Research Station, one block was over 30 years old when it was removed in 1985
- has withstood some severe winters, but there have been losses also; most losses have been of trees on light soils when there was no snow cover; however, under such conditions, other rootstocks such as M.4 and M.7 have also suffered

- rated “moderate” for winter hardiness: not as hardy as M.26, but hardier than M.7 and M.4
- trees on M.9 have been precocious and productive
- losses from crown rot have been rare
- fruit is generally larger than on other dwarfing rootstocks

Disadvantages:

- poor anchorage, that is, brittle root system, and trees must be supported for the life of the plantings
- rootstock considered subject to moisture stress and soils must not be allowed to dry out
- requires a slightly higher leaf nitrogen level than other rootstocks
- sensitivity to residual herbicides such as simazine has been noted in some areas
- susceptible to fireblight
- trees which, once stunted, are difficult to get to regrow

With non-spur cultivars, M.9 is a logical choice for high density plantings. Use of M.9 with spur-type cultivars is not recommended except for the adventurous grower with proven tree-growing skills.

3.3.2 Budagovski 9 (B9)

This rootstock produces a tree about the same size as M.9 EMLA or slightly larger. It comes from a Russian breeding programme and has performed well in BC test plots and in other regions of North America. So far, there have been only a few plantings on this rootstock in commercial orchards.

Advantages:

- **excellent winter hardiness**
- **resistance to crown rot**
- like M.9, can do well in a wide range of soil as long as soil moisture and nutrition not limiting
- trees precocious and productive

Disadvantages:

- anchorage poor and trees must be supported for the life of the planting

B9 is a logical choice where an M.9-sized tree and winter hardiness are required.

3.3.3 Mark

Mark was bred at Michigan State University and before being named was called MAC 9. This rootstock produces a tree in the same size range as M.9. It has not been widely planted in British Columbia so that a full assessment is not possible. So far it has performed well, but there is one possibly serious problem with it which is outlined below.

Advantages:

- very precocious and productive, competing well with M.9
- appears not highly susceptible to crown rot
- anchorage considered better than that of M.9, but permanent support still necessary
- may do better on heavy-textured soils than other rootstocks

Disadvantages:

- thorough evaluation of rootstock's winter hardiness not yet available
- sensitive to drought and requires same level of management as M.9
- should not be over-cropped early in the life of the orchard

A possible serious problem with Mark is a swelling or proliferation of tissue at ground level that extends into the soil; the fear is that this may prove harmful to trees as they age and result in runting out; nevertheless, research plots in British Columbia have yielded well and after eight years have not shown signs of runting out.

Mark does not appear to have any definite advantage over M.9. Unless Mark proves more winter hardy than M.9, the latter seems the preferred choice.

3.3.4 Ottawa (0.3)

As the name implies, 0.3 is a Canadian-bred rootstock from Agriculture Canada's cold-hardiness breeding programme in Ottawa. It produces a tree about 35% to 40% the size of one on a standard rootstock. This ranks 0.3 between M.9 EMLA and M.26 for dwarfing capabilities.

Advantages:

- winter hardy
- not generally taken to be as precocious as M.9 EMLA, B9, or Mark, but close
- productivity ranks with M.9 EMLA, B9, or Mark
- appears to tolerate a wide range of soil conditions, but intensive management still required

- anchorage better than with the other three rootstocks, but permanent support still recommended
- tends to produce fewer, but stronger shoots than trees on the other three rootstocks, which produce numerous side shoots

Disadvantages:

- status of O.3's resistance to crown rot not clear; commercial plantings in BC have had some losses from crown rot, but the rootstock has been fairly widely planted in Canada and in the NC-140 Rootstock Trial in the USA and Canada and crown rot has not been seen; cut-shoot tests have not indicated any problems of this sort; crown rot testing is underway at Summerland
- may be sensitive to transplanting so may require more care in planting than other rootstocks; avoid late planting and prune aggressively if buds have begun to break

O.3 is a good rootstock to select for high density plantings especially on sites prone to winter damage. Since it is more vigorous than M.9 EMLA, B9, or Mark, it may be more suited to weak sites and spur-type varieties or weak-growing ones such as Braeburn than to non-spur or strong-growing varieties.

3.3.5 M.26

This is a semi-dwarfing rootstock that produces a tree about 40% to 45% the size of one on a standard rootstock. M.26 is considered a poor choice well behind M.9 EMLA, B9, 0.3, and perhaps Mark for all but weak-growing varieties. Until quite recently in British Columbia, however, before the dwarfing rootstocks became the type of choice, M.26 was planted extensively.

Under good management, M.26 has performed extremely well, but under poor management it has often grown poorly. There is a wide range of performance.

Advantages:

- a precocious rootstock and potentially productive if well managed; for example, at the Summerland Research Station, exceptionally early and heavy production was obtained with non-spur McIntosh on M.26
- can be a useful rootstock for high density plantings if low-vigour varieties are grown and good cultural practices are used from the start; plant good-quality trees, treat for replant disease, adjust soil pH to 6.5, and maintain good soil moisture

- anchorage definitely better than with M.9 EMLA, B9, Mark, and 0.3, although there have been some problems; permanent supports recommended for high density systems
- a hardy rootstock, although management to encourage early acclimation (hardening off in fall) is suggested (see 3.3.5.1)
- rated moderate to high for resistance to crown rot; not a serious problem, but there have been some losses

Disadvantages:

- use of spur-type cultivars on this rootstock may have caused some of the growth problems, often resulting in a tree smaller than a non-spur-type on M.9 EMLA; such cultivar-rootstock combinations require careful management
- sensitive to drought and low pH soil; can result in stunted trees which, once stunted, are difficult to get to regrow which can restrict the flow of nutrients and water in the tree and contribute to uneven performance
- tends to develop burr knots

M.26 is more susceptible to burr knots than other dwarfing rootstocks.

3.3.5.1 Winter hardiness of M.26

Sometimes, cultivars on this rootstock have been winter injured when the same cultivar on other rootstocks has survived. This is thought to be because of M.26's tendency to be late in acclimating. Consequently, some trees, notably McIntosh, have suffered injury from early cold snaps.

Cultural practices suggested to encourage early acclimation are: avoid excess nitrogen in late spring and summer; allow weeds to invade herbicide strips during August; and control soil moisture by reducing irrigation in September to allow growth to slow down and then applying water in October if soils are dry.

3.4 Other Apple Rootstocks Worthy of Trial for British Columbia High Density Plantings

Breeders in many countries are in the process of trying to develop the 'perfect' rootstock. For British Columbia conditions, it would be very helpful to have a better selection of rootstocks with a range of growth control from which to choose. Necessary characteristics in these rootstocks, compared to M.9, would be for them to:

- be as productive
- be more winter hardy
- be more resistant to fireblight
- have better anchorage
- be better able to overcome replant problems

A number of rootstocks from various breeding programmes being tested in North America bear some of the above required characteristics. Although not fully tested, they are worthy of commercial trial. The following describes the most promising of these rootstocks in order of degree of size control starting with the greatest.

3.4.1 Malling 27 (M.27)

M.27 was developed at the East Malling Research Station in England. It produces a tree about 20% the size of one on a standard rootstock. This is the least vigorous of the rootstocks used in commercial orchards. M.27 is not widely planted in British Columbia so comments are from limited observations.

There is considerable interest in M.27 among European growers for super spindle plantings and with vigorous varieties in normal high-density plantings. The rootstock has been reported as producing small fruit, but this may be the result of heavy fruit set as M.27 is precocious and can be very productive if the vigour is maintained. Some European growers use M.27 with large-fruited varieties to reduce fruit size.

Some reports indicate that M.27 is resistant to crown rot, but cut-shoot assays at the Summerland Research Station have not confirmed this.

The winter hardiness of M.27 has not been fully evaluated, but nursery and orchard trees on it have survived several cold winters in British Columbia. Anchorage is poor and support is required.

M.27 may be a desirable rootstock in BC for super spindle plantings. It may also be suitable for vigorous varieties on very productive sites.

M.27 can stunt out. Do not crop until the space is filled.

3.4.2 P-22

This rootstock is from a Polish breeding programme. It produces a tree about the same size as M.27 does, or perhaps slightly larger. P-22 is reported to be resistant to crown rot and more winter hardy than M.9. Anchorage is poor and support is required.

P-22 is worthy of commercial trial in British Columbia for super spindle plantings or for vigorous varieties on very productive sites.

3.4.3 P-2

This rootstock was also developed in Poland. It produces a slightly smaller tree than does M.9 EMLA.

P-2 has excellent winter hardiness and is precocious and productive. Tests at the Summerland Research Station indicate that it is highly resistant to crown rot and freezing injury.

With these characteristics, P-2 is worthy of commercial trial where slightly more dwarfing and hardiness is required than M.9 EMLA produces.

** For further details on rootstocks, refer to H.A. Quamme and R.T. Brownlee, *Rootstocks for High Density Apple Plantings*, Summerland Research Station Technical Report 90-02.

3.5 Virus Status of Rootstocks

There are a number of viruses that can seriously affect the growth and performance of apple rootstocks in the nursery and in the orchard. Growers are strongly recommended to make sure rootstocks they plant come from a source certified as virus free.

4.0 HIGH DENSITY APPLE PLANTINGS

4.1 Training Systems

There are a number of training systems for high density apple plantings. At the present time, the slender spindle, vertical axis, and perhaps super spindle seem the best bets for the Southern Interior of BC.

Local research has shown higher production from slender spindle and vertical axis than from central leader or van Roechoudt. Well-documented local results, however, are not available for super spindle, but those from two-year-old trees seem promising. The key to profitability will be sustained production and high returns; the system may work, but it must be profitable.

The following are short descriptions of the three main systems: slender spindle, vertical axis, and super spindle.

4.1.1 Slender spindle

slender spindle trees
a) Europe

Slender spindle trees are planted at between 700 and 1200 trees per acre. They are supported by posts and grown to a height of 6 to 8 feet. The posts are necessary for tree support because of poorly anchored rootstocks and for tree training.

This system uses zig-zagging or bending of the leader to help control the vigour at the top of the tree. The post is also used as a place to which to tie the leader. Vigour of the branches is controlled by tying them down.

slender spindle trees
b) Okanagan

The key to success with this system is early production, which helps suppress tree vigour. Start with high quality, well-feathered nursery trees for success with this system. Use of poor quality trees limits its economic viability so that paying a little extra for strong, well-feathered trees is a good investment.

Very little pruning is needed on slender spindle trees in the early years. Pruning stimulates growth which delays fruiting. Strong branches are removed and remaining branches are bent, a measure that reduces vegetative vigour and encourages fruit buds to develop. Pruning to the annual ring of wood two years old and older helps to stiffen branches, shape trees, and provide renewed fruiting wood. In the third or fourth year when shading begins, start to remove branches selectively.

Once the space is filled, the spread of the trees is contained by cutting back to older wood. In a similar fashion, trees are maintained in a conical shape by cutting back to older wood and by removing and renewing vigorous wood.

4.1.2 Vertical axis

Vertical axis trees are ten feet tall at maturity and are planted at 600 to 800 trees per acre. This system uses a trellis support with several alternative arrangements. For dwarfing rootstocks, five equally spaced wires arranged horizontally support the tree and are

themselves attached to posts at the end of each row. An alternative is to use 2 horizontal wires plus a vertical wooden or bamboo stake for each tree; the stake is attached to the wire.

tree on vertical axis

The main disadvantage of vertical axis is the height of the trees which means that ladders are required. On the other hand, to encourage early production, very little pruning is done in the early years. At planting, whips are headed whereas feathered trees are not. In both cases, the leader is never headed after the planting year, although at times it may be removed by making a thinning cut to a replacement leader. The lack of heading cuts to the leader encourages fruiting which helps control the tree's vigour and height.

Pinch lateral shoots on leader below terminal shoot.

Because leaders are not headed, however, the leaders are weak and must be tied to the wire or the support post to prevent breaking. The lack of heading also often results in sparse branching which can be compensated for by pinching the tips off the 3 or 4 lateral shoots immediately below the terminal shoot.

The first pinching is done when the new shoots are 2" to 4" long and may need to be repeated once or twice more at about 2-week intervals. This is done annually to the top of the tree for 2 to 3 years to encourage development of flat-angled branches on the leader.

Complete removal of second, third, and perhaps fourth shoot from terminal is less desirable than pinching. Note response to complete removal; shoots developing below the removal are sharp-angled rather than flat as when pinched.

If the pinching is done properly, little pruning will be needed in the early years. During the dormant period, the removal of the odd strong branch, low branches, and the shoots that were pinched (since they tend to be sharp-angled) is all that will be needed. When branches are 2 to 3 years old, they will need to be cut back to the annual ring, fruit buds, or weak shoots to keep fruiting close to the leader.

In the third or fourth year, shading will develop and some branches will need to be thinned out to promote good distribution of light. The lowest layer of branches should be thinned out first. Over 1 to 3 years, depending on the number of branches, remove all but 4 or 5 of these lower branches. The remaining branches will be left permanently. Branch removal should not be started unless the branches in the layer immediately above are expected to

crop the following season. This helps prevent the leader becoming too vigorous.

Thinning of the other layers of branches is done in the same way. Except for the 4 or 5 permanent basal branches, all others are considered temporary and branch renewal is carried out on them.

As with the slender spindle, vertical axis trees are contained within their space by cutting back to older wood. The conical shape is maintained down the row by cutting back to older wood and by removing and renewing vigorous wood. In the row, however, shape is not important; this allows a fruiting wall with maximum bearing surface to develop.

Patience must be exercised with the top of vertical axis trees. If the tops are pruned too soon, they will become dominant, forming an umbrella. The object is to wait until fruiting brings vigour at the top under control before you prune. This is usually when the trees are 4 to 6 years old.

At this stage, trees may be as much as 4’ to 5’ above the top wire. A thinning cut in the vicinity of the top wire to a 2 to 3-year-old shoot bearing fruit buds is usually sufficient to keep top vigour under control.

4.1.3 Super spindle

Super spindle is a relatively new development in high density apple production. It uses extremely high numbers of trees per unit area to increase early production levels.

Trees in a super spindle system are planted at 2000 to 5000 per acre. The system requires strong support of wire and posts or bamboo stakes and is expensive to establish. It is not a system for those unfamiliar with it or unprepared to take the time necessary to establish and maintain it. Experience with this system in the Southern Interior is limited; the oldest commercial trees were 2 years old in 1993.

Okanagan super spindle plantings: trained to V shape on trellis

While increasing density increases early production, it has not been determined if the growth can be controlled well enough to prevent self-shading and poor quality fruit. This is the greatest risk with super spindle and could lead to a short life for the orchards. The cost of controlling growth is another factor to consider.

Control of vigour by heavy fruiting is the key to success with super spindle. No dormant pruning is done and pruning during the growing season is a matter of removing vigorous branches and shoots by breaking or tearing them off. Growth regulators such as ethephon (ethrel) and NAA are also used to keep vigour in check.

4.1.4 Comparison of training systems

	Vertical Axis	Slender Spindle	Super Spindle*
planting densities	550-900 t/ac	700-1500 t/ac	2000-5000 t/ac
row spacing	12’- 13’	10’- 12’	9’- 10’
in-row spacing	4’ – 6’	3’ – 5’	1’ – 2’
tree height	10’	6’ - 8’	6’ - 8’
rootstocks	dwarfing	dwarfing	dwarfing
tree form	fruiting wall	single tree	fruiting wall
support	trellis	post	trellis
nursery stock	feathered preferred		whip with short shoots
costs to establish	lowest	middle-low	highest
early production	similar		highest
production at maturity	should be similar for all systems if good space is chosen		
total production	similar		highest
fruit quality	highest	high-middle	lowest
labour required	lowest	middle	middle to highest
skill required	lowest	middle	highest
planting life	similar		shortest

Since super spindle is a new system, there is some guesswork in the comparisons.

For further reading on slender spindle and vertical axis training systems, refer to Bruce H. Barritt, *Intensive Orchard Management*, Washington State University.

4.2 Spacing and Row Configuration for Different Fruits

Proper spacing in high density plantings is critical to obtain high yields of good quality fruit. The goal is to have the tree intercept as much light as possible with good distribution of light throughout the tree. If there is too much space between rows, light interception will be poor and yields will be low.

If rows are too close together, there will be shading as the trees develop and heavy pruning will be needed to contain the growth. The pruning in turn, however, may cause trees to be overly vigorous and lead to poor quality fruit. In general, the closer the spacing, the more skill and understanding of the systems are needed.

4.2.1 Apples

A rough rule of thumb for Southern Interior conditions to get the maximum light interception is to space the rows a distance of about 1.3 to 1.5 times the height of the trees as in the following:

Tree Height at Maturity	**Space Required Between Rows**
6’	7’8” to 9’
7’	9’l”to 10’5”
8’	10’4’to 12’
9’	11’7” to 13’5”
10’	13’ to 15’

If narrow equipment is available and the trees are to be kept compact, the closest spacings can be used. If wider equipment is to be used and the tree diameters are to be greater, the wider spacings are more suitable. Your skill level must also be considered.

4.2.1.1 Multiple rows

Multiple rows and bed systems offer greater potential for higher early yields than do single rows. Unfortunately, by the fourth or fifth year, the trees will begin to be shaded. Fruit quality, size, and yields will start to decline and more work will be needed to contain the trees; hence, higher costs. Because of these factors, multiple rows and bed systems are not recommended.

3-row bed system in South Tyrol, Italy

A better method is to plant single rows, but keep the space between the rows and between the trees in the row as narrow as possible.

4.2.1.2 Row direction

Wherever possible, plant rows in a north-south direction rather than east-west to improve light distribution. If air movement would be blocked or reduced by north-south rows and the risk of spring frost damage increased, plant with air drainage in mind.

4.2.1.3 Suggested spacings

The following summarizes the range of spacings suggested for varieties of standard growth habits on M.9 EMLA and B9 rootstocks. If vigorous varieties such as

Granny Smith or Fuji are to be planted, increase these spacings by about 10% to 20%. If weak-growing varieties such as Braeburn are being planted, decrease spacings by about the same percentage.

If Ottawa 3 is used, increase spacings by about 5% to 10%. With M.26, increase spacings by about 10% to 20%.

If you are concerned about the level of your tree management skills, choose the widest of the suggested spacings.

Slender spindle: 12’ x 5(726 trees/ac) to 9’6” x 3’ (1528 trees/ac)
Vertical axis: 13’ x 6’ (558 trees/ac) to 12’ x 4’ (907 trees/ac)
Super spindle: 10’ x 2’ (2178 trees/ac) to 9’ x 1’ (4840 trees/ac)

4.2.2 Sweet cherries

Normal spacing for sweet cherries has been from 15’ x 15’ to 15’ x 20’. More recently, some adventurous growers have tried to increase the level of early production by increasing density. Spacing of about 8’ x 16’ has been tried.

To encourage early cropping, the trees are pruned only lightly in the early years. Most emphasis is placed on tree training by bending branches. Additional branches are encouraged by using Promalin.

As the space is filled, trees are contained in their spaces by branch removal and renewal and by cutting into older wood. If it is impossible to hold trees to the space available, every second tree within the row is removed leaving a spacing of 16’ x 16’.

4.2.3 Pears

Pears are normally spaced from 15’ x 15’ to 15’ x 20’.

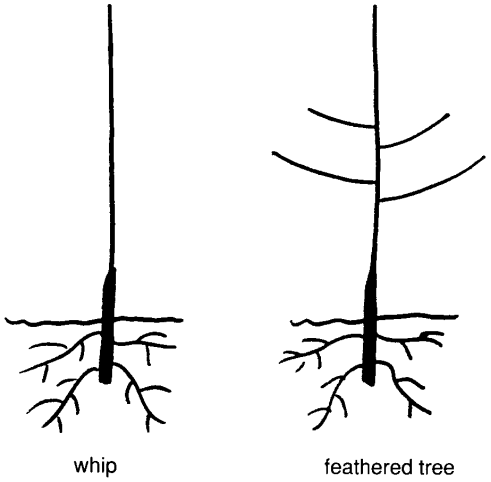
4.2.4 Peaches, prunes, plums

Most growers are trying to increase planting density of peaches, prunes, and plums. Suggested spacings range from 10’ x 13’ to 15’ x 20’, but some trial plantings are spaced considerably closer together.

4.2.5 Apricots

Suggested spacings range from 12’ x 15’ to 15’ x 20’. Only experienced apricot growers should consider the closest spacings.

4.3 Nursery Stock Requirements for Apple Trees



High density plantings are big investments and good quality nursery stock is essential for success. Feathered trees are preferred for either vertical axis or slender spindle systems; however, if these are not available, large caliper trees should be selected. The best are 5/8" to 11/16" followed by 9/16" and then 1/2". Anything less than 1/2" is not suitable.

The trees are measured 2" to 3" above the bud union. Feathers should be at least 8" to 10" long and at least 18" above the ground.

Whips or trees with short feathers are best for a super spindle system. They should be as large as the sizes given above.

All nursery stock should have the following characteristics:

- roots well developed, fibrous, and not dry
- tree straight from rootstock to tip
- tree free of frost or other injury
- feathers intact
- trees still dormant
- bud union properly healed showing no sign of dieback
- roots and rootstock shank free of crown gall

Orchardists considering growing their own trees should refer to *Tree Fruit Home Nurseries: A Growers' Manual*, Okanagan Valley Tree Fruit Authority, 1993.

4.4 Site Preparation

(For an additional discussion of this topic, see *Soil Fumigation for Orchards: An Overview*, OVTFA, 1994)

Site preparation is an extremely important part of any replant program. Poor growth on replanted trees is frequently traced to difficulties such as replant disease which can be prevented or mitigated by soil analysis and proper preparation.

The following are guidelines on the steps required for several planting methods.

4.4.1 Preparation over a year: trees not planted for one year

Ideally, at least a year should be left between removing the old trees and replanting. This allows time to fumigate properly if fumigation is necessary, to add and incorporate cover crops and soil amendments such as lime, and to prepare the soil properly and plot out the site.

4.4.1.1 Summer/fall (and into spring)

- Obtain replant analysis results at least 9 months before planting.
- Obtain soil analysis results at least 9 months before planting.
- Control weeds before removing trees.
- Remove trees along with as many roots as possible.
- Level the site and add topsoil or organic matter where topsoil was scraped away during leveling.
- On fine-textured soils such as silts and clays, deep plough and disc.
- Rotovate fine-textured soils only after ploughing and discing; rotovators work only in the top 6" to 8" of soil and often leave a hard layer beneath which can restrict drainage and root growth.
- Deep chisel or subsoil where hard layer of soil impede drainage; if either of these is not sufficient to break up the hard layer, drainage tiles may be necessary.
- On coarse or shallow soils, surface tillage may be sufficient or even preferable.

4.4.1.2 'Open land' year

- In spring, cultivate and seed cover crops to build up organic matter; oats and field peas can be seeded together in April.
- Incorporate cover crops before seed matures fully.
- Seed a second, and perhaps even a third, crop of oats incorporating them before seed matures fully.
- Mark out the planting area.
- If necessary, add lime to the planting area and incorporate it; do not apply lime within one month of applying boron or nitrogen.
- If necessary, apply fumigant; **follow directions carefully**.

4.4.1.3 Planting year

- In spring, cultivate the site; if area was fumigated, it may be necessary to wait 2 to 4 weeks for the material to dissipate from the soil unless the site was cultivated in the fall.
- Before planting, check for the presence of fumigants with a germination test:
    - plant lettuce or cress seeds in a closed jar in soil from the fumigated plot
    - at the same time, plant similar seeds in soil from an untreated area

- compare germination rates of the two seedings
- if after a few days, germination in the treated soil is poor, repeat the test at 2 to 3-day intervals until germination appears normal, that is, similar to germination in the untreated soil sample (see *Soil Fumigation for Orchards: An Overview* for detailed instructions)
- plant trees

4.4.2 Preparation for planting the spring following tree removal

It is strongly suggested that a full year be left for site preparation. Many growers do not wish to have their land out of production for a year, however, and wish to plant the spring after trees have been removed from a block. In these cases, the following process should be used:

- obtain replant analysis results by previous summer
- obtain soil analysis results by previous summer

4.4.2.1 Fumigant not needed

- Control weeds before removing trees.
- Remove the trees after harvest along with as many roots as possible.
- Deep chisel or subsoil where hard layers of soil impede drainage; if either of these is not sufficient to break up the hard layer, drainage tiles may be necessary.
- Add any soil amendments needed.
- Plough, disc, or rotovate as outlined in the previous section, 4.4.1.1 p. 28.
- In spring, cultivate to prepare for planting.
- Plant as early as possible in spring.

4.4.2.2 Fumigant needed - fall fumigant other than Vapam used

- Control weeds before removing trees.
- Remove the trees after harvest along with as many roots as possible.
- Deep chisel or subsoil where hard layers of soil impede drainage; if either of these is not sufficient to break up the hard layer, drainage tiles may be necessary.
- Add any soil amendments needed.
- Plough, disc, or rotovate as outlined in the previous section, 4.4.1.1, p. 28.
- Before planting, check for presence of fumigant by carrying out the germination test outlined in 4.4.1.1, p. 28.
- Plant trees as early as possible in spring.

4.4.2.3 Fumigant needed - Vapam fall sod treatment used

- Remove trees after harvest if possible; if trees cannot be removed, fumigant can still be applied, but results may be inconsistent over the site.
- Mow the cover crop.
- Apply fumigant; follow directions carefully.
- Do not remove tree stumps until Vapam has had a chance to fumigate, preferably a minimum of 3 weeks after application.
- In spring, deep chisel or subsoil where hard layers of soil impede drainage; if either of these is not sufficient to break up the hard layer, drainage tiles may be necessary.
- Add any soil amendments needed.
- Plough, disc, or rotovate as outlined in the previous section, 4.4.1.1, p. 28.
- Plant trees as early as possible in spring.

4.4.2.4 Fumigant needed - Vapam spring treatment used

- Fully prepare site as described in 4.4.2.1, p. 29.
- Apply Vapam in spring as soon as soil is warm enough.
- Leave soil undisturbed for about 2 weeks after fumigation.
- Aerate soil by shallow discing or cultivation.
- Leave for another week.
- Check for presence of Vapam with the germination test outlined in section 4.4.1.1, p. 28.
- Plant as soon as soil is free of Vapam.

4.5 Tree Handling and Planting

Trees can be planted in early spring or fall, but fall planting risks winter damage in some years. Planting must also fit around fumigation. Airing out following fumigation should be done as soon as the ground can be worked in spring if planting is to be done then. Every attempt should be made to get the trees planted as early as possible in the spring.

Early planting aids root growth in particular. New roots form when soil temperature reaches 7°C, but existing roots start to grow at temperatures lower than this. The most active period of root growth extends into May and starts again towards fall. Root growth is slowest in summer when the above-ground tree parts are growing more rapidly.

Plant before the buds have begun to break and the roots to grow. Late planting of non-dormant nursery stock may inhibit tree growth and reduce the chances of survival.

4.5.1 Handling trees

poor practice: keep entire tree covered in transit

- Handle trees carefully and never allow the roots to dry out; dehydrated plants may take several seasons to return to normal activity.
- Keep trees protected from wind and sun; cover when hauling.
- Cover roots with damp sawdust and keep all tree parts covered for transport from nursery.
- If planting soon after trees are received, place trees in a clean barrel of clean water for 6 to 12 hours.
- If trees cannot be planted for several days, store in a protected site free from wind, sun, and frost; break up tree bundles to prevent air pockets, place trees in a trench mounded with soil over roots, and water thoroughly.

NOTE: Never store trees in a fruit storage room as ethylene gas released from fruit can injure trees. Ethylene can persist even after the fruit has been removed unless the storage area has been thoroughly ventilated.

4.5.2 Before planting

Dig holes just before planting to avoid soil drying out.

- Before planting, prune roots back to about 6” long to help develop a good root system.
- Remove any galls on roots.
- Dig holes with a shovel or an auger, or use a tree planter.
- If a shovel or auger is used, do not dig holes so far in advance of planting that the soil dries out.

NOTE: An auger can create glazing on the walls of the hole in all but the coarsest soils. This inhibits drainage, root penetration, and moisture transfer. If augers are to be used, be sure to break up the glazed surface with a shovel or fork. Augers can be modified by welding on flanges which reduces glazing.

4.5.3 Fertilizing

With or without fertigation, add peat to the planting hole, especially on lighter soils.

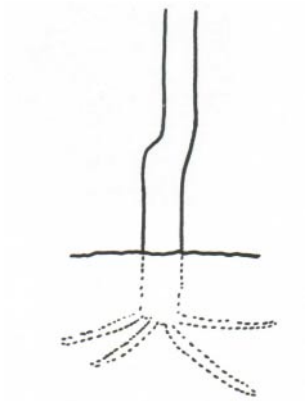
4.5.3.1 Without fertigation

- If fertigation is not used, a planting-hole granular or liquid fertilizer is strongly suggested.
- Granular material (1 gm per litre soil of 11-55-0 or 11-51-0) must be well mixed with the soil or roots will be injured.
- Various liquid formulations have been used successfully. A common one is 10-34-0 mixed with water and applied to the ground or injected into the irrigation water following planting.
- Four applications of 40 to 50 ml liquid formulation per tree per application at 7 to 10-day intervals starting right after planting are strongly suggested.

4.5.3.2 With fertigation

- If fertigation is to be used, start as soon as the trees are planted; if the fertigation system startup is to be delayed, apply a planting hole treatment as described above.

4.5.4 Planting



correct planting height with bud union 3” - 4” above ground

It is critical that trees be planted at the correct depth.

- Plant trees on size-controlling rootstock so that the bottom of the bud union is 3”- 4” above the ground after the hole is filled and smoothed out and the ground has settled.
- The standard rule of thumb for trees not on size-controlling rootstocks is to plant them 1” to 2” deeper than they were in the nursery.
- Trees can settle, so inspect height after planting and gently pull trees up to the correct height.

- If trees are planted with the bud union in the ground, the scion can root and the dwarfing effect of the rootstock will be lost.
- While planting, protect the trees from the drying effects of heat or wind.
- **When planting by hand**, have at least 2 people working: one to hold the tree at the right height, the other to fill in the hole.
- Plant the tree so that the bud union is on the opposite side to the support post.
- Plant trees about 4” away from posts.
- Gently shake the tree as the hole is filled to ensure that the roots are in contact with the soil.

trees in foreground planted at right depth; trees in background planted too deep and scion rooted; tree size control lost

proper distance from post

- When planting, fill half the hole, firm it, and add water to help soil pack around roots.
- If liquid fertilizer is to be added to the planting hole, now is the time.
- Finish filling the hole.

- When the tree is planted, the area around it should be level or slightly mounded; do not leave depressions as water can accumulate and cause injury to tree; the tree will settle more in a larger hole so do not overdo the size of the hole.
- Pack and level the soil.
- Irrigate the planting area as soon as the trees are planted.

- **When planting by machine**, have someone follow the machine to ensure that the trees are firmly planted.
- Remove any tree tags as these can damage trees as they grow.

tree planted too close to post

4.5.5 After planting

4.5.5.1 Apples

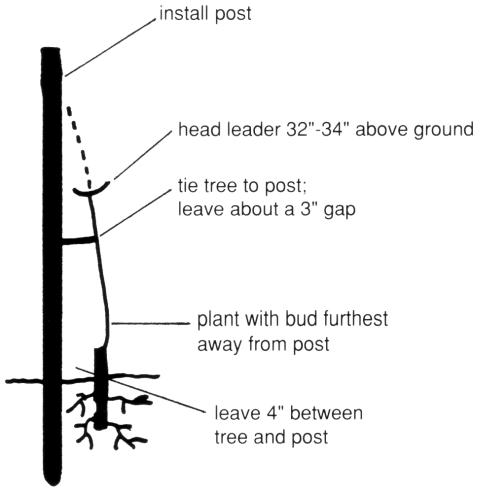
- Prune slender spindle and vertical axis trees; super spindle trees are not dormant pruned.
- Cut back whips to 32” to 34” from the ground (see diagrams a & b, p.35).
- On feathered trees, do not cut leader shorter than 8” above the top feather on slender spindle trees (see diagrams c & d, p.35).
- Do not cut the leader on feathered vertical axis trees (see diagram e, p.36); leader is not headed, except on whips in the planting years. To stimulate development of flat-angled shoots from leader, 2-3 shoots below terminal shoot are pinched by removing terminal when shoots are 3” to 4” long; 2 to 3 pinchings at 10 to 14-day intervals are required.
- For both systems remove any feathers closer to the ground than 20”.
- If feathered trees do not have at least 4 full, well-spaced feathers starting at 20” from the ground, remove the feathers and treat the trees as whips (see diagram f, p.36; see also diagram c, p.36.)

There is considerable debate over whether or not to head back feathers at planting time. Heading back of trees that grow well results in delayed cropping and excessive vigour.

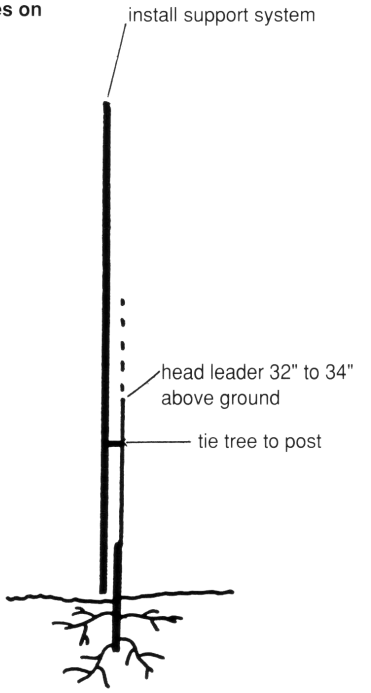
Whether or not to head feathers should be based on the variety’s response to heading. Some varieties, most notably Spartan, Fuji, and Elstar, do not benefit from heading feathers. If these are to be headed at all, it is best to delay until the trees start to show new growth. On the other hand, Jonagold and Braeburn often benefit from heading.

4.5.5.1
a - d

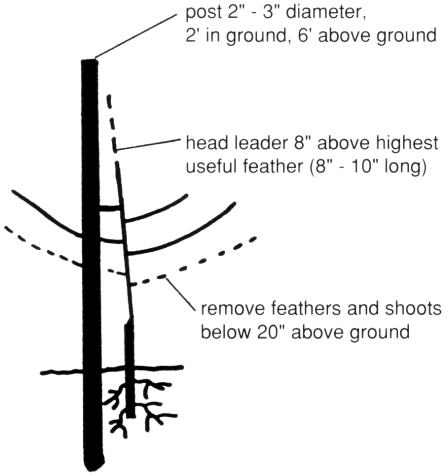
Post-Planting Treatment of Whips and Feathered Trees on Slender Spindle and Vertical Axis (Apples)



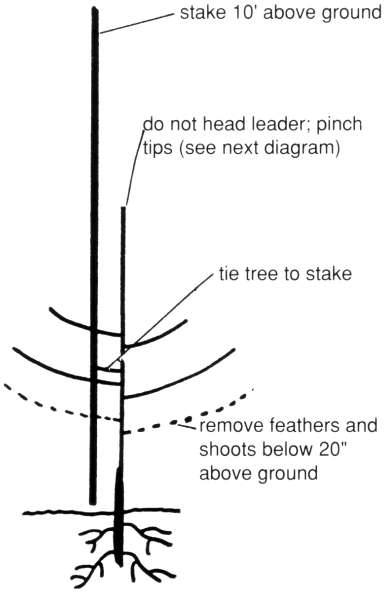
a) **Whip treatment for slender spindle**



b) **Whip treatment for vertical axis**



c) **Planting-year treatment of feathered tree for slender spindle**



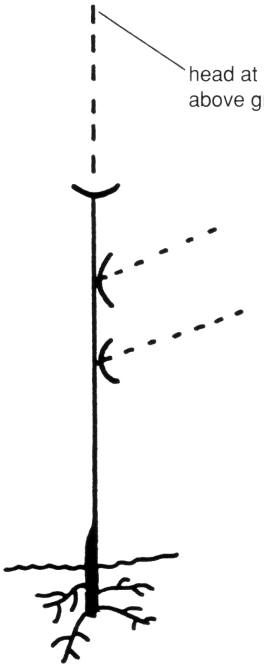
d) **Planting year treatment of feathered tree for vertical axis**

4.5.5.1
e, f

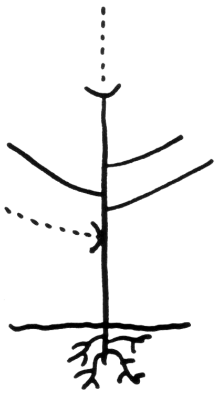
Post-Planting Treatment of Whips and Feathered Trees of Pears and Soft Fruits

4.5.5.2
a - c

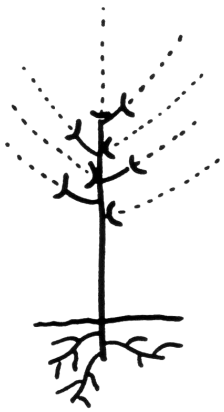
e) Leader treatment of feathered trees on vertical axis



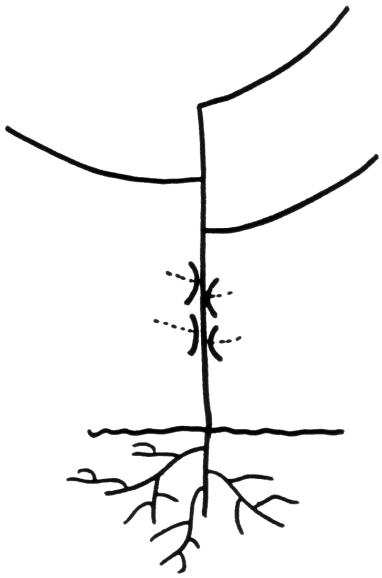
f) Feathered trees lacking good feather arrangement



a) Pruning feathered trees for central leader



b) Pruning feathered peach trees to modified open centre



c) Additional treatment to note for all tree fruits and training systems

For other varieties, heading back should not be necessary if the trees have good root systems, replant problems have been taken care of, the trees are planted early, and management is good. If these conditions have not been met, however, and past experience has been of poor tree growth, then heading may at least help the trees get off to a better start. Head feathers back to about 12” to 15” long.

For complete details on pruning apple trees, refer to *Pruning the Slender Spindle* by Oberhofer, *Pruning and Tree Training Techniques for High Density Slender Spindle Orchards*, OVTFA, 1994, and the OVTFA/BCMAFF video *Pruning the Slender Spindle.*

4.5.5.2 Soft fruits and pears

Pears are normally trained to a central leader (see diagram a, p.36).

- If whips are planted, head back leaders to 32” to 34”.
- If feathered trees are used, remove low feathers (to 20” above ground level).
- Select 4 to 5 well-spaced feathers and remove all others.
- Depending on strength of feathers, head back the leader 8” (weak feathers) to 3’ (strong feathers) above the highest, full-length (8-10”) feather.

Cherries are normally trained to a modified central leader or a central leader.

- If whips are planted, head back leader to 36”.
- If feathered trees are planted, first remove low feathers; choose 4 to 5 well-spaced feathers.
- Spread any sharp-angled feathers.
- Head leader back to about 3’ above top feather.

Apricots, prunes, and plums are normally trained to a modified open centre tree.

- Treat trees as whips; that is remove any feathers, and head back to 32” to 36” above ground level.

Peaches are normally trained as a modified open centre tree (see diagram b, p.36). Nursery trees are usually feathered.

- Remove all feathers below 20” above the ground
- Choose 4 to 5 well-spaced feathers between 18” and 32” above ground level and remove all others.
- Remove leader at the top feather.
- Cut feathers back to 2 to 3 buds (see diagram c, p.36).

Short cuts when installing trellis can result in a short life for system.

4.6 Support Systems

Posts and trellises are usually installed after the trees are planted. Do this as soon as possible after planting is completed.

- Use properly treated posts.
- Posts for slender spindle and super spindle plantings are usually pounded in, but for vertical axis, augers are necessary because the posts are longer.
- When pounding posts in, place small end down; when setting posts by hand, place large end down.
- In trellis plantings, space row posts evenly between trees.
- When installing posts for slender spindle, leave about 4” between the tree and the post.
- Place posts so that the prevailing winds move the tree away from the post.
- As soon as supports are installed, tie trees to the post, or wire; on slender spindle trees, tie so that there is about a 3” gap between the tree and the post.

For complete details on support systems, refer to K. Bert van Dalfsen, *Support Systems for High Density Orchards,* BCMAFF.

5.0 HELPING THEM GROW

Once the trees are planted, considerable care and attention are needed to get them growing well. The aim should be to have at least 2’ of terminal growth on whip branches in the first season. To achieve this, particular attention must be paid from the beginning to nutrition, pest control, irrigation, weed control, and unwanted growth.

5.1 Nutrition

5.1.1 Using fertigation

- If using fertigation, see Peter Waterman, Fertigation Guidelines in High Density Apples and Apple Nurseries in the Okanagan Similkameen available from BCMAFF offices.

- In addition to fertigation, apply foliar nutrient sprays at about 10-day intervals starting when the new growth is about 5” long; complete by mid July to ensure that trees do not grow too late into the fall.
- 6 to 8 sprays will be needed; use nitrogen, zinc, and magnesium in all applications; in the third or fourth application, add foliar boron to the mix.

The following chart lists rates for the various nutrients:

Material	Rate Dilute Application	
	Per 100 L	Per 100 gals
zinc chelate	200 gms	2 lbs
magnesium sulphate	1 kg	10 lbs
urea (45-0-0)	1/2 - 1 kg	5 - l0bs
	depending on vigour; use lower rate when fertigating	depending on vigour; use lower rate when fertigating
boron (spray type) to be applied only once	100 gms	1 lb

5.1.2 Not using fertigation

- Apply nitrogen to soil, 2 applications 3 to 4 weeks apart.
- Start applications 2 to 3 weeks after trees start showing growth.
- Use 2 or 3 oz (56 or 84 gms) of 34-0-0 or 46-0-0 per tree, or 15.5-0-0 at 5 oz (141 gms) per tree.
- Do not apply nitrogen after mid July as this could encourage late season growth which is susceptible to damage from low temperatures.
- Scatter nitrogen evenly around trees rather than leaving it in lumps; roots can burn from heavy concentrations of salt watered into the root zone.
- Follow the foliar nutrient program as given in section 5.1.1, p. 31.

5.2 Pest Control

Pests and diseases can affect the growth of young trees more than they would mature trees. For example, insect and powdery mildew levels considered safe for mature trees can often inhibit the growth of young trees. The most notable problems are mites, leafhoppers, aphids, leaf miners, and powdery mildew, but fireblight has become a problem with some of the new apple varieties.

Ensure good pest control by knowing the insects and following control recommendations in the Tree Fruit Production Guide. Sprays for powdery mildew, however, should be applied more often on vigorously growing trees than suggested in the production guide as the new growth must always be protected. Start the mildew program at the tight cluster stage of buds.

5.3 Irrigation

Irrigation of newly planted trees must be timed according to soil moisture conditions. Never allow the soil to dry out as trees that are set back in growth will grow poorly, if at all, through the rest of the season.

On the other hand, be careful not to over-irrigate, especially early in the season as waterlogged soil can kill trees. During the season, irrigate newly planted trees more often with less water per application than for established trees as the former's roots are still shallow.

5.4 Weed Control

Poor weed control is one of the main reasons for poor tree growth. Weeds compete with trees for water and nutrients, and inhibit tree growth. Keep the newly planted trees free of weeds through August.

Poor weed control results in poor growth.

Weeds can be controlled by hand, tillage, mulching, herbicides, or a combination of these. Because newly planted trees can be easily damaged, extra care must be taken with any method when tilling, hoeing, or spraying chemicals. Some growers have successfully used Heal and Seal as a trunk protectant to increase the safety of using Gramoxone and Roundup.

5.5 Unwanted Growth

Shoots will develop from the trunk below where branches are desired; that is, lower than 20” above the ground. Remove these regularly when they are about 3” long. Otherwise, they take vigour away from where it is needed and wanted.

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