

Low chill stonefruit information kit

Reprint – information current in 1998



REPRINT INFORMATION – PLEASE READ!

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This publication has been reprinted as a digital book without any changes to the content published in 1998. We advise readers to take particular note of the areas most likely to be out-of-date and so requiring further research:

- Chemical recommendations—check with an agronomist or Infopest www.infopest.qld.gov.au
- Financial information—costs and returns listed in this publication are out of date. Please contact an adviser or industry body to assist with identifying more current figures.
- Varieties—new varieties are likely to be available and some older varieties may no longer be recommended. Check with an agronomist, call the Business Information Centre on 13 25 23, visit our website www.deedi.qld.gov.au or contact the industry body.
- Contacts—many of the contact details may have changed and there could be several new contacts available. The industry organisation may be able to assist you to find the information or services you require.
- Organisation names—most government agencies referred to in this publication have had name changes. Contact the Business Information Centre on 13 25 23 or the industry organisation to find out the current name and contact details for these agencies.
- Additional information—many other sources of information are now available for each crop. Contact an agronomist, Business Information Centre on 13 25 23 or the industry organisation for other suggested reading.

Even with these limitations we believe this information kit provides important and valuable information for intending and existing growers.

This publication was last revised in 1998. The information is not current and the accuracy of the information cannot be guaranteed by the State of Queensland.

This information has been made available to assist users to identify issues involved in low chill stonefruit production. This information is not to be used or relied upon by users for any purpose which may expose the user or any other person to loss or damage. Users should conduct their own inquiries and rely on their own independent professional advice.

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Queensland Government



Growing **THE CROP**

This section is our recipe for growing and marketing a commercial crop of low chill stonefruit. To keep the section as brief as possible and easy to follow, we give little explanation with the recommendations. Where more information may help, we refer you to other sections of the kit. Symbols on the left of the page will help you make these links.



Getting the crop started

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How to get ready for planting, and planting the crop



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Things to do while trees are growing to bearing age



Managing bearing trees

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Things to do during the production cycle of bearing trees

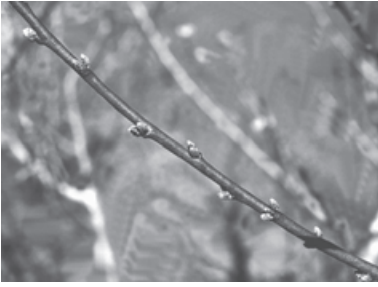


Harvesting and marketing

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The steps from harvesting to marketing

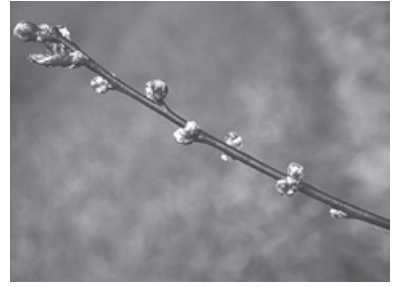
Important stonefruit terms



Dormancy



Budswell



Budbreak



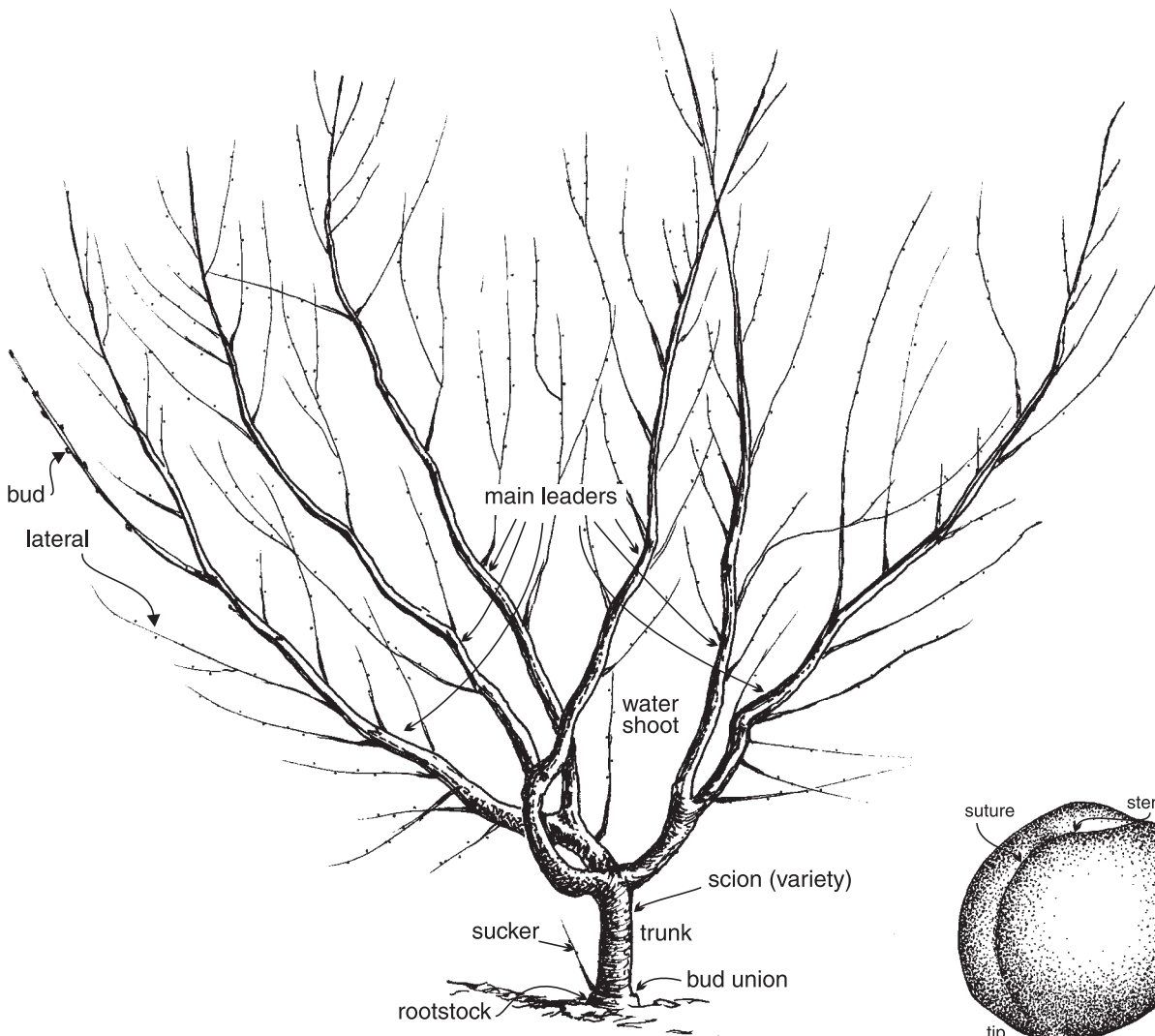
Full bloom



Petal fall



Shuck fall



Parts of the low chill stonefruit tree and fruit



Getting the crop started

Setting up an orchard that will be profitable in the long term requires careful planning. Mistakes made at this stage are difficult and costly to correct. There are 15 important steps.

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Plan the orchard layout

Planning the orchard is a complex procedure and we recommend that you get some expert assistance. This is available free from extension officers of the Department of Natural Resources (Queensland) and NSW Agriculture (New South Wales). Here is a brief overview of what's involved in planning an orchard layout.

Get a map of the intended orchard site and mark on it existing features such as roadways, standing timber, gullies, slope direction etc. On the map develop a plan showing access roads, buildings, windbreaks, tree rows, surface drains to control runoff, dam sites and so on. Your aim is

to achieve maximum productivity with minimal environmental impact. There are several important points to consider.

- **Provision for windbreaks.** Windbreaks are vital as wind damages fruit and reduces its quality, and may cause structural damage to the tree. As the major damaging winds come from the south-east and the west, windbreak protection on at least these sides of the orchard is essential. Use existing stands of timber where possible, otherwise plant windbreaks well before the orchard is established. Expert advice on windbreak design is available from treecare officers of the Department of Natural Resources (Queensland) and officers of the Department of Land and Water Conservation (New South Wales).
- **Surface drains.** Uncontrolled water runoff removes valuable topsoil and exposes roots to desiccation. It may also pool within the orchard, causing waterlogging and root rot. Drains are essential to carry water safely through the orchard. A drainage system normally consists of a diversion drain at the top of the orchard, contour drains or v-drains within the orchard, and stable waterways to carry the water to a dam or watercourse.
- **Slopes.** Slopes of up to 15% are preferred as these are less susceptible to soil erosion, allow flexibility with row layout, and enable tractors and machinery to be operated safely across the slope. Slopes greater than 15% should be avoided, but if used, require specialised design advice.
- **Row direction and length.** Try to run rows in a north-south direction where possible, particularly for orchards using the palmette training system. This maximises light interception for the trees. However, row direction needs to suit the design needs of the irrigation system. Consult a qualified irrigation designer for assistance. On slopes of up to 15%, rows can be run across the slope or up and down the slope. On slopes above 15%, rows must be run up and down the slope to allow safe machinery operation. Try to get long rows as these are preferred for machinery efficiency. However, breaks in the rows are needed to facilitate efficient harvesting.
- **Watercourses and dams.** Gullies, creeks and depressions should be disturbed as little as possible. Leave a buffer of trees along gullies and creek banks to keep them stable. Do not plant orchard trees where runoff naturally concentrates in gullies or depressions. Seek professional advice on dam siting and construction from water field officers of the Department of Natural Resources (Queensland) and from irrigation officers of NSW Agriculture (New South Wales).
- **Roadways.** It is important to have all-weather access to the orchard for spraying, harvesting and other operations. Locate access roads on ridgelines wherever possible
- **Room for netting support.** At least a six metre wide space is required around the orchard or each block to allow for anchor posts

a key issue



Orchard layout
Section 4 page 16

more info



Netting suppliers and
contractors
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for the overhead netting system. Seek advice from a netting consultant or contractor early in the orchard design process.

Figure 1 is an example of how these factors are integrated into an orchard design plan.

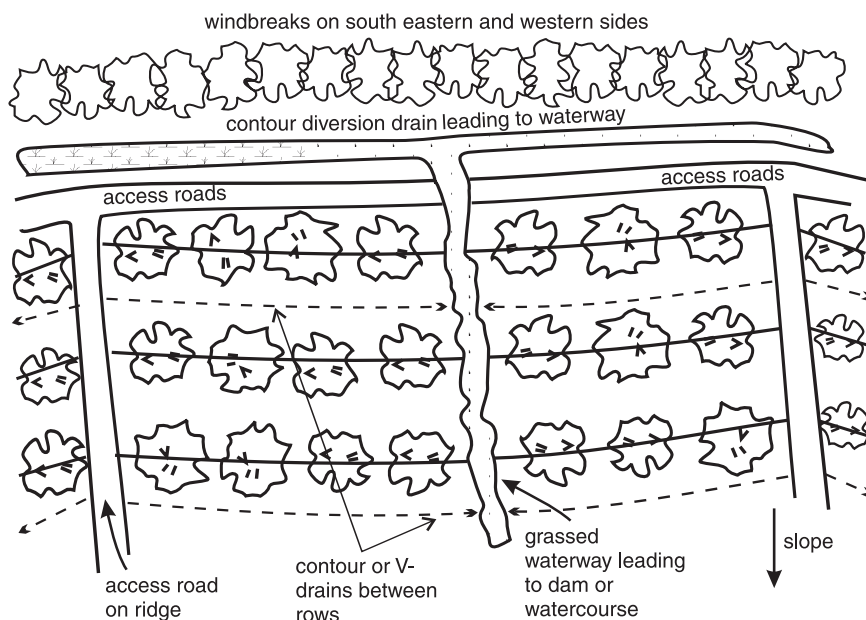


Figure 1. An example of an orchard design plan

Choose varieties and tree spacing

Varieties

The varieties you choose will depend on three main factors:

- **The amount of chilling your farm receives.** This limits your choice to varieties within this chilling range.
- **The market window you are aiming for** — early, mid or late season market.
- **How much you want to spread your risk and labour inputs over a range of different varieties.**

In general, no one variety will suit the needs of the average grower. A selection of two, three or more varieties is recommended. Table 1 lists the varieties we suggest you consider. Don't rely solely on these suggestions. Seek opinion from experienced extension officers, growers, consultants and marketeers. Growers investigating the export market should also consult exporters and export organisations.

more info



Sources of advice
Section 6 page 11



a key issue

 Selecting varieties
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Table 1. Varieties we suggest you consider

	Areas with 50 to 150 chill units e.g. Mareeba, Bundaberg	Areas with 150 to 300 chill units e.g. Nambour, Alstonville, Coffs Harbour	Areas with 300 to 450 chill units e.g. Kingaroy
Peaches	Flordaprince	Flordaprince*	Flordagold*
	Flordaglo*	TropicBeauty*	Flordastar
	TropicBeauty	Flordagem	TropicBeauty
		Newbelle	Fla. 3-2
Nectarines		Fla. 3-2	Forestgold
	SunWright*	SunWright*	SunWright
	Sunraycer	Sunraycer	Sunraycer
		Sunblaze	Sunripe*
		Fla. 82-17N	Fla. 82-17N
Plums	Gulfruby	Gulfruby	Gulfruby
	Fla. 8-1	Fla. 8-1	Fla. 8-1

* best proven performance based on yield, earliness, fruit quality

Note that new varieties are continually becoming available. Be prepared to try these in small numbers.

Rootstocks

Where soil nematodes are known to be a problem, use nematode-resistant rootstocks such as Okinawa or Flordaguard. If in doubt, do a soil nematode test. Otherwise, use coastal peach.

Tree training system, row and tree spacing

The training system you choose will determine your tree spacing. There are two options.

- **Open vase.** The open vase is the traditional system where each tree is free-standing and pruned to the shape of a vase. Its main advantage is that trees produce fruit which can be harvested from ground level. Its main disadvantage is that pruning has to be more carefully managed to maintain light penetration into the tree.
- **Palmette.** With the palmette, trees are planted closer and pruned to grow together into a thin hedgerow. With plums, the hedgerow is supported on a trellis. Its main advantage is that trees are easier to prune and spray. Its main disadvantage is that trees grow taller, making it more difficult to harvest the fruit. Picking platforms or ladders are generally required.

Both systems have their place. On flatter land, the palmette system is preferred. On steep land where it is difficult to operate picking platforms safely, the open vase system is preferred. Table 2 lists suggested row and tree spacings for the two systems.



more info

 Nematode testing
 laboratories
 Section 6 page 8

Table 2. Tree spacing options for low chill stonefruit systems

Training system	Coastal Queensland, northern New South Wales, Atherton Tableland		Inland Queensland	
	Spacing	Trees/ha	Spacing	Trees/ha
Palmette	4.0 m between rows 3.0 m between trees	833	4.0 m between rows 2.5 m between trees	1000
Open vase (sandy soils)	5.5 m between rows 4.5 m between trees	404	5.0 m between rows 4.5 m between trees	445
Open vase (fertile loams/ clay loams)	6.0 m between rows 5.0 m between trees	333	5.5 m between rows 5.0 m between trees	364

Except for plums and Sunbob nectarine, plant each variety in a block of its own. Mixed plantings flower and fruit at different times, complicating crop management. For these varieties, there is no pollination benefit in mixed plantings.

Plums require a polliniser to be planted within the block. One polliniser tree is needed for about each eight trees of the main variety. A suggested layout is shown in Figure 2. For Sunbob nectarine, which is male sterile, plant the polliniser in rows alternated with rows of any other nectarine that blossoms at about the same time.

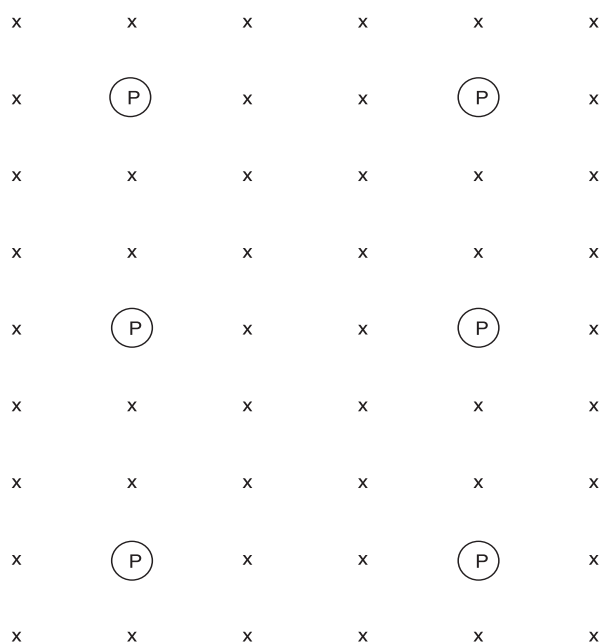


Figure 2. Suggested layout for planting plums (x — main variety, P — polliniser)

Order trees

Once you have chosen your varieties and worked out your row and tree spacing, calculate the number of trees you need. Order your trees from a specialist low chill stonefruit nursery at least 12 months before



Nursery tree suppliers
Section 6 page 5

intended planting. Give preference to nurseries using virus-tested budwood and rootstock seed. Nurseries propagating trees using budwood from commercial orchards can give no certainty on varieties or disease status of their trees. Also give preference to nurseries using non-soil potting mixes and where trees are in the pot for no more than nine months.

When ordering trees, discuss your chosen training system with the nursery so that trees can be produced to conform best with that system.

Nursery production of trees is a specialist job and we do not recommend that you try to propagate your trees. However, if you want to learn more about stonefruit propagation, some basic information is provided elsewhere in this kit.



Propagation
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Clear the land, leaving appropriate windbreaks

Start any land clearing at least 12 months before planting. Identify and mark strategically placed existing stands of timber to act as perimeter windbreaks. Before clearing, seek professional advice from treecare officers of the Department of Natural Resources (Queensland) and officers of the Department of Land and Water Conservation (New South Wales). Also check with your local or state government authority for any tree clearing ordinances that may exist. Then clear and stickrake the land where necessary. Stack the timber into windrows for burning. Don't push it into gullies and depressions. Leave gaps in the windrows every 30 m to allow safe removal of runoff water.

Mark out the rows

Rows across the slope are marked parallel to a surveyed key line. Wire is tightly stretched between two people at right angles to the key line and points marked every 20 m along the row (Figure 3).

Rows up and down the slope are usually marked at right angles to the contour or parallel to the longest row.

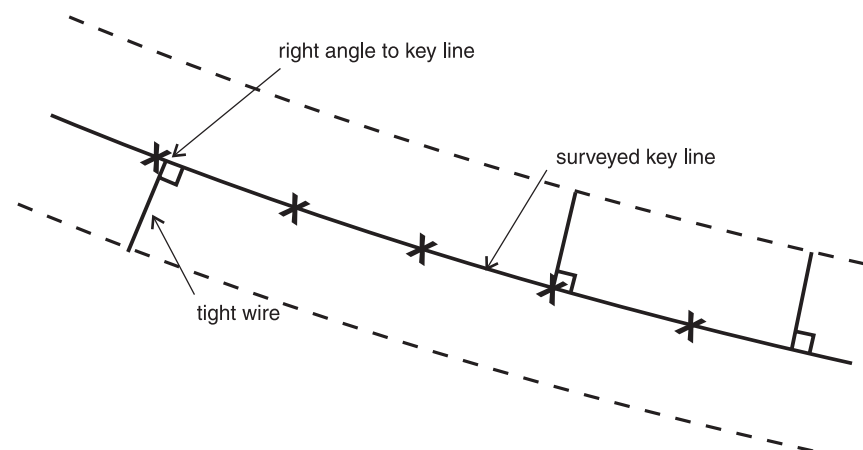


Figure 3. Marking out parallel rows across a slope

Deep rip along the rows

Where the land has been previously cultivated or grazed, deep rip to at least 60 cm along the rows. Ripping will also help with the drainage of wet areas. If ripping downhill, lift the toolbar every 30 to 40 m to avoid subsequent water scouring down the rip lines.

Build contour drains/v-drains to control runoff

Main diversion drain above orchard

On sloping land, construct a major contour diversion drain above the orchard to divert water into a stable waterway or dam. The drain should have a gradient of 1 to 5% and be large enough to handle water from the catchment above. Keep the steeper sections of the drain furthest from the waterway or dam, unless you have very stable clay soils. Establish a creeping grass such as carpet grass, couch, African star grass or kikuyu in the drain channel to prevent scouring.

Contour drains and/or v-drains within the orchard

There are two options to control waterflow and provide drainage within the orchard.

- Build major contour drains at least every 50 m or so down the slope. These are built to similar specifications to the main diversion drain.
- Build shallow, wide v-drains in the centre of the interrow area. V-drains have a maximum excavation of 20 cm and are usually built by a grader or tractor-mounted blade.

For rows across the slope, v-drains are constructed every second or third row (Figure 4). Soil from the drain is moved onto the proposed downhill tree line (Figure 5).

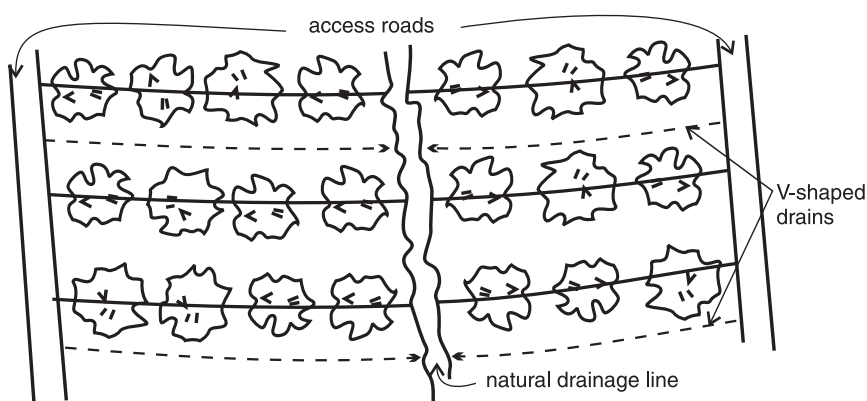


Figure 4. Across slope rows (plan view)



Erosion control
structures
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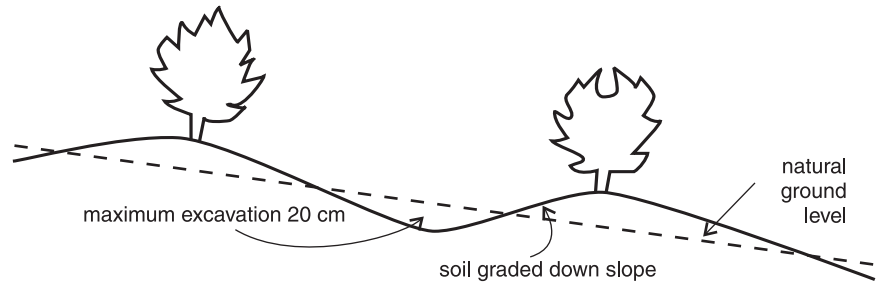


Figure 5. Across slope rows (cross-section view)

For rows up and down the slope, v-drains are constructed in every interrow area to control side slope runoff and to prevent water scouring down the tree rows (Figure 6). Soil from the drain is moved both ways onto the proposed tree lines (Figure 7).

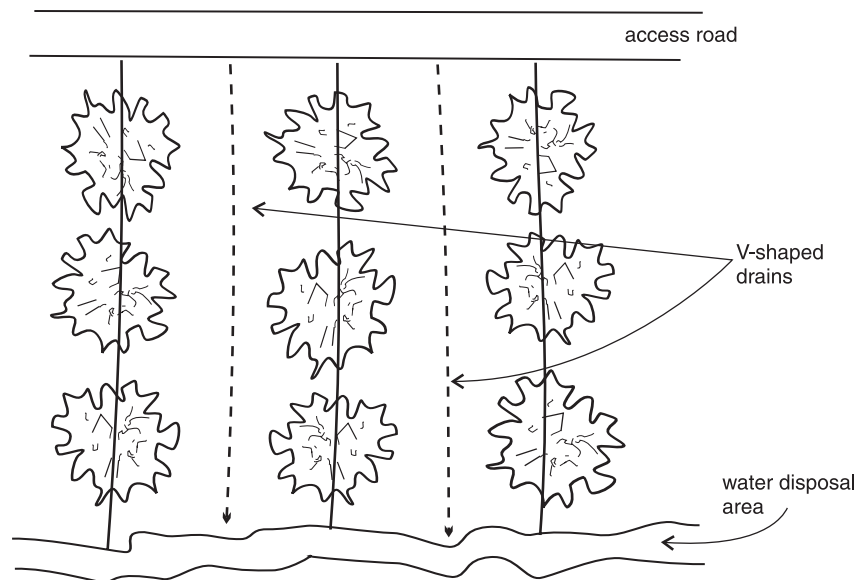


Figure 6. Down slope rows (plan view)

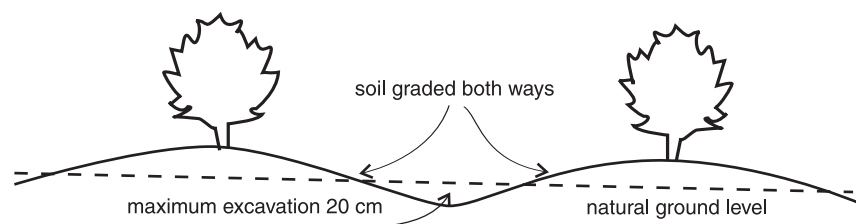


Figure 7. Down slope rows (cross-section view)

Immediately after building v-drains, grass all disturbed areas to minimise erosion. Carpet grass, couch and kikuyu are commonly used. Consider a taller growing grass such as Rhodes grass as this can later be a valuable source of grass mulch for under the trees.

Plant windbreak trees

Where windbreak trees are needed to supplement natural timber, plant trees at least 10 to 15 m from the low chill stonefruit tree rows

to allow space for machinery access and construction of the netting support, and to reduce competition for water and nutrients. Seek advice on selecting trees for windbreaks from treecare officers of the Department of Natural Resources (Queensland) and officers of the Department of Land and Water Conservation (New South Wales). Most specialist native plant nurseries also provide advice on selecting trees for windbreaks.

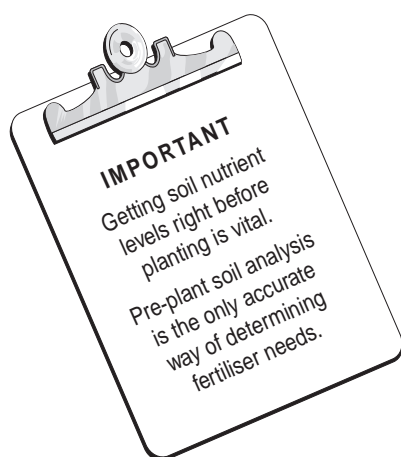
When planting windbreak trees, deep rip rows to at least 60 cm before planting. If ripping downhill, lift the toolbar every 30 m to prevent water scouring down the rip lines. Plant the trees four metres apart. Mulch well with coarse straw. Install a separate irrigation line to keep the trees well watered. Regular applications of small quantities of a mixed tree fertiliser will promote rapid growth. Maintain a weed-free area around the trees.

Do a soil analysis and apply required fertilisers

Buy a soil sampling kit from your local farm supply store. Follow the sampling instructions and send the sample away for analysis. Results should be back in about two weeks and will be interpreted by the laboratory analysing your sample. As a guide, the optimum soil nutrient levels to aim for are shown in Table 3.

Table 3. Optimum soil nutrient levels for low chill stonefruit

Element	Optimum soil levels
pH (1:5 water)	5.5 – 6.5 (5.0 – 5.5 for krasnozems soils)
pH (1:5 CaCl ₂)	4.5 – 5.0
Organic carbon (Walkley-Black)	more than 2.0% C
Nitrate nitrogen (1:5 aqueous extract)	more than 20 mg/kg
Phosphorus (Colwell)	60 – 100 mg/kg P
Potassium (exchangeable)	more than 0.5 meq/100 g K
Calcium (exchangeable)	more than 5 meq/100 g Ca
Magnesium (exchangeable)	more than 1.6 meq/100 g Mg
Sodium (exchangeable)	less than 1 meq/100 g Na
Chloride (1:5 aqueous extract)	less than 250 mg/kg Cl
Conductivity (1:5 aqueous extract)	less than 2 dS/m
Copper (DPTA)	0.3 – 10 mg/kg Cu
Zinc (DPTA)	2 – 10 mg/kg Zn
Manganese (DPTA)	4 – 45 mg/kg Mn
Iron (DPTA)	more than 2 mg/kg Fe
Boron (hot calcium chloride)	0.5 – 1 mg/kg B
Calcium:magnesium ratio	3 – 5:1
Total cation exchange capacity	more than 7
Cation balance (%)	calcium 65 – 80; magnesium 10 – 15; potassium 1 – 5; sodium less than 5



Soil samples should be analysed at least six months before planting. Discuss your results with your local farm supply agent and work out what fertilisers are required. Apply these fertilisers over the orchard site.

Cultivate strips along the tree rows

Cultivate two metre wide strips along the tree rows. As well as incorporating the fertiliser, cultivation along the tree rows aids tree establishment and reduces initial weed competition. It is very important that less soluble fertilisers such as lime, dolomite, gypsum, superphosphate, copper and zinc are well incorporated before planting. Tined implements or a Turborota are preferred for cultivation. Don't overuse a rotary hoe as it can lead to soil compaction and soil structural problems, as well as causing later settling of the tree row below ground level. This settling may cause subsequent soil erosion from water movement along the row. Minimise cultivation of other areas of the block to reduce soil erosion.

Grow a green manure crop in the strips

Where possible, grow a green manure crop in the cultivated strips. Use hybrid forage sorghum for spring or summer plantings, and oats in autumn or winter. A side dressing of urea or nitram two weeks after crop emergence will promote good growth. Slash when the green manure crop is 1.5 m high and disc into the soil.

Erect trellises (for plums on palmette only)

The palmette trellis consists of a vertical wire trellis about 2 to 3 m high with four or five wires about 75 cm apart. The trellis has large diameter (125 to 150 mm) treated pine or hardwood end posts with suitable stays and strainer assemblies and either steel fencing posts or smaller diameter wooden posts as intermediate posts. These are spaced about 15 m along the trellis. Wire is normally 2.5 mm high tensile fencing wire.

Figure 8 is an illustration of a palmette trellis used for stonefruit.

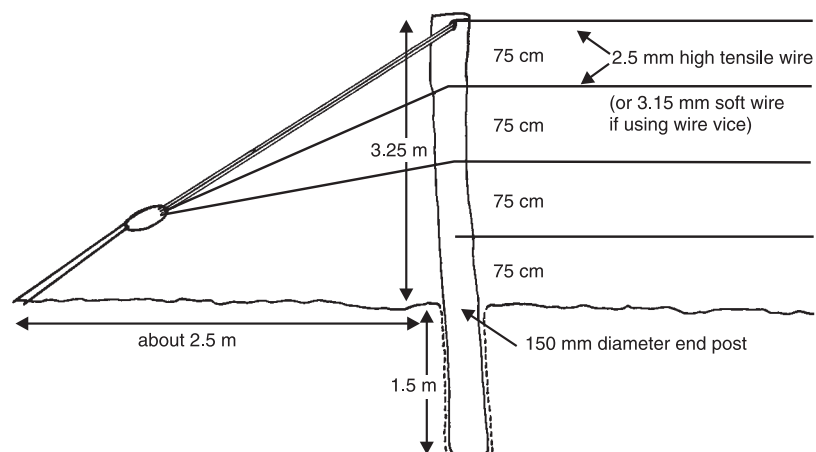


Figure 8. Palmette trellis (courtesy Roy Menzies, NSW Agriculture)

Mark out the tree plant sites

Mark out the tree plant sites with a peg. In small orchards where organic materials are available, apply to each tree plant site either 10 L of poultry manure, or 2 L of pelleted poultry manure, or 20 L of filterpress (mill mud), or 40 L of an organic manure such as cow manure. Spread over a two-square-metre area at each site **at least three months** before planting and immediately incorporate into the soil. Spread a coarse mulch such as sorghum stubble 15 cm deep over each site. **Do not place fresh manure or organic materials into the planting holes at or near planting.**

Install the irrigation system

Install an irrigation system on the basis of an irrigation design plan prepared by a qualified irrigation designer. There are two options.

- Under-tree minisprinklers with a micro-spray or micro-jet feature. The micro-spray or micro-jet is used for the first two years to limit water throw. Use sprinklers with an output of 80 to 250 litres per hour. Models that minimise ant colonisation are preferred. In the design of the irrigation system remember to allow capacity for the extra sprinklers to water your windbreak trees.
- T-tape trickle systems. For young trees, use one row of tape. When trees are about three years old, install a second row of tape on the other side of the tree row. Trickle systems need to be well designed to operate effectively and must be properly maintained to prevent blockages. High level filtration with sand filters is essential.



Plant the trees

When you receive your trees, make sure they have good leaf colour, are free from diseases and pests (particularly San José scale), and have been hardened to full sunlight. Don't accept trees that are stunted, root bound or yellow.

When to plant

Container-grown trees can be planted at any time of the year, providing frost is not a problem, adequate water is available and tree guards are used. Some growers prefer to plant in September as the tree can grow to full maturity within just 12 months. However, as the weather at this time of year is generally hot and dry, planting site preparation is more critical and trees have to be looked after more carefully following planting.

The preferred planting time is February, using trees budded or grafted in October–November. This takes advantage of the normally good soil moisture from the summer wet season. If trees have to be stored while awaiting more favourable planting conditions, hold trees in a well protected area, preferably away from soil by placing on plastic sheeting or concrete. Maintain a careful watering program as trees can easily

bake in the summer sun and die. Use tank or town water, not dam water. Watch out for spider mites and spray every three weeks or so for rust disease.

Trees that have been stored under shadecloth should be hardened up before planting by gradually moving them into stronger light over a two-week period.

Planting procedure

One to two days before planting, water thoroughly to wet tree sites to 30 cm deep. Do not plant trees during the hottest part of the day. Follow these planting steps.

1. Dig a hole slightly deeper and wider than the bag. Do not use posthole diggers or augers. Do not place fertilisers or organic materials into the hole.
2. Remove tree from bag. Examine the root ball and straighten or trim large roots sticking out at the bottom. Gently tease out the roots at the bottom of the root ball and shake away a little of the potting mix from the fibrous roots at the top of the root ball.
3. Place tree in the hole, ensuring that it will be planted to the same depth as in the nursery bag. Half-fill hole with soil, gently pressing the soil into contact with the root ball. Fill hole with water. This helps to bring the soil into close contact with the root ball. Allow water to drain before completing filling.
4. Firm soil down gently with your hands (preferably do not use your feet) and leave a slight basin around trees to hold water. Water again.
5. Mulch trees with a coarse mulch such as cereal or legume stubble 10 to 15 cm deep. Keep the mulch 10 cm away from the trunk to avoid collar rot. Figure 9 shows a correctly planted tree.
6. Where perimeter windbreaks are poorly developed, use tree guards 1.5 m high. These guards also give some protection against hares and wallabies. Use old fertiliser bags or a cheap shadecloth around wooden stakes. Four stakes should be placed in a one-metre square around the tree. Alternatively, three stakes can be used to form a triangular guard. Where good wind protection is available, trees can be protected from hares and wallabies by loosely wrapping the trunks with either polythene tree protector sleeves or one thickness of sisalation (Figure 10). This also reduces suckering and protects the bark from herbicide damage.
7. It is good practice to stake the trees (Figure 11). This prevents crown damage and possible infection by trunk canker. Drive wooden stakes into the ground outside the root ball of the tree. Place loops of strong rubber or nylon loosely around the trunk and the stakes. Maintain the staking for at least the first 12 months.
8. Carefully inspect trees for San José scale and, if detected, spray immediately after planting.
9. Water the trees twice a week for the next four weeks.



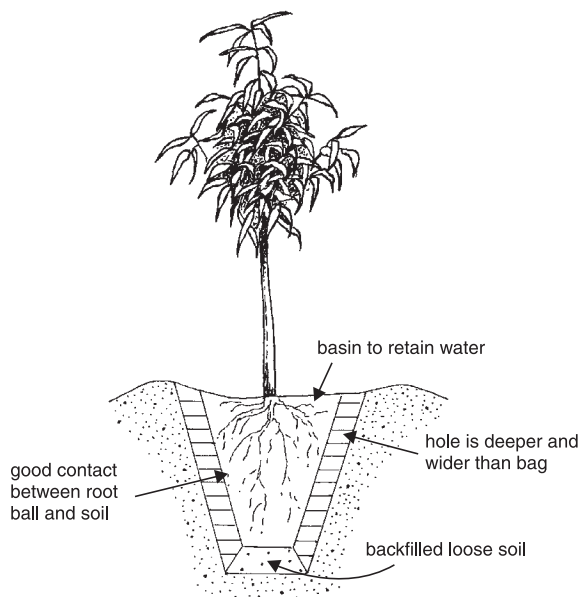


Figure 9. A correctly planted tree



Figure 10. When tree guards are not used, wrap the trunk in either a polythene tree protector sleeve or one thickness of sisalation to protect it from animal and herbicide damage

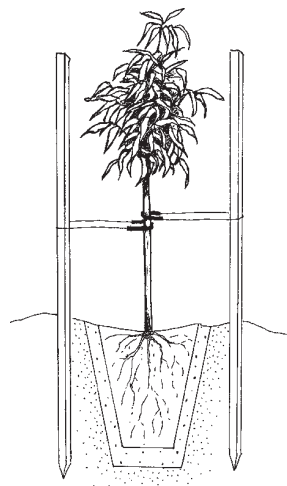


Figure 11. Staking for newly planted trees



Managing young trees

During the first two years, the aim is to grow a strong, well structured tree that will produce well in future years. There are five important operations.

Fertilising	16
Watering	17
Training and pruning	18
Weed control and mulching	20
Pest and disease control	21

Fertilising

If you followed the recommendations for tree site preparation earlier in this section, no fertiliser will be needed for the first few months or until trees start to put on new growth. Then start applying small amounts (about 80 kg of a 13:6:12 N:P:K mixed fertiliser per hectare) every six to eight weeks during the first year. This may be stopped during winter. During the second year, apply fertiliser as shown in Table 4.

Table 4. Fertiliser rates during the second year

Time of year	Rate of 13:6:12 N:P:K mixed fertiliser (kg/ha)
Bud movement	95
September	40
December	80
March	55

Low chill stonefruit will generally set their first significant crop at the end of the second year. As excess vigour during the cropping cycle is undesirable, ease back nitrogen application towards the end of the second year to avoid excess nitrogen in the tree as it begins to settle into cropping.

Spread the fertiliser in a broad ring around the tree extending 50 cm beyond the canopy. Keep fertiliser 10 cm away from the trunk.

Fertiliser may also be applied through the irrigation system (fertigation). Some commercial preparations are specially made for fertigation. Inject the fertilisers when you have almost finished irrigating to avoid leaching of nutrients. Irrigate for another 10 minutes after fertigating to flush any remaining fertiliser out of the irrigation lines.

more info



Tree site preparation
this section
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Watering

During the first two years, use the minisprinkler in the micro-spray or micro-jet mode to limit the spread of water. Towards the end of the second year, change it back to the minisprinkler mode to increase the diameter of watering and encourage roots to spread. Figure 12 shows the set-up for a minisprinkler watering system.

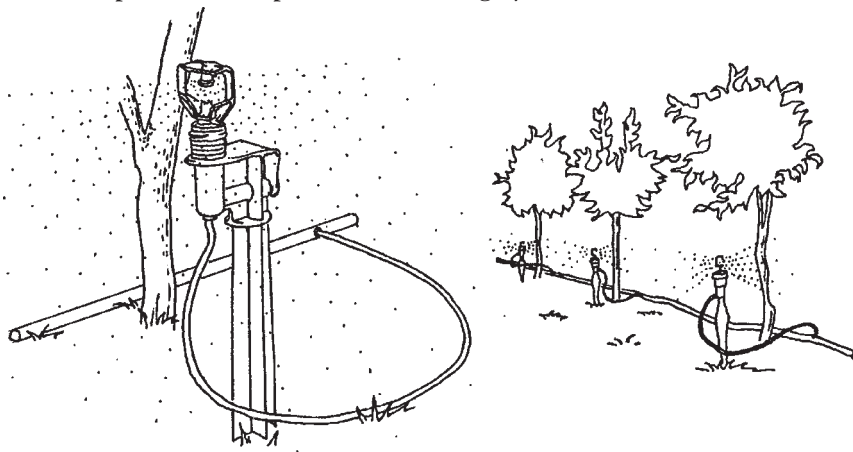


Figure 12. Minisprinkler watering system for young trees

After planting, water regularly as required up until about April. Depending on rain, up to 20 L of water per tree may be required two or three times per week. Watering can then be suspended until the trees resume active growth in about August-September.

Monitoring soil moisture

Once the trees are established, it is difficult to know how much water to apply. Too much can lead to waterlogging and root rot and too little can stress the trees and stunt growth. Common sense is required, but irrigation management can be improved greatly by basing watering rates and frequency on a soil moisture monitoring system. There are four main options and each has its pros and cons. They are:

- tensiometers
- soil moisture sensors
- neutron probe
- capacitance probe, e.g., Enviroscan.

Table 5 provides a broad annual guide to water requirements for bearing trees (second year onwards) on a palmette system in coastal New South Wales.



Monitoring soil
moisture
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Table 5. Water requirements for bearing trees (ignoring rainfall), coastal New South Wales

Month	Water requirement (mm per week)
August	15
September	20
October	25 – 30
November	30
Summer prune	
December	25
January	20
February	25
March	20
April to July	no irrigation necessary

Training and pruning

Training and pruning is different for the two main training systems — palmette and open vase. In simple terms, palmette trees are close planted and pruned to grow together along the row to produce a continuous hedgerow of trees. For peaches and nectarines, the hedgerow is freestanding; for plums it is supported by a trellis.

With the open vase system, each tree is pruned to a shape like a vase or inverted hollow cone.

For both systems, the task for the first year after planting is to develop the basic structure of the tree so that by the end of the first year, it is about the right size and shape.

Palmette training and pruning

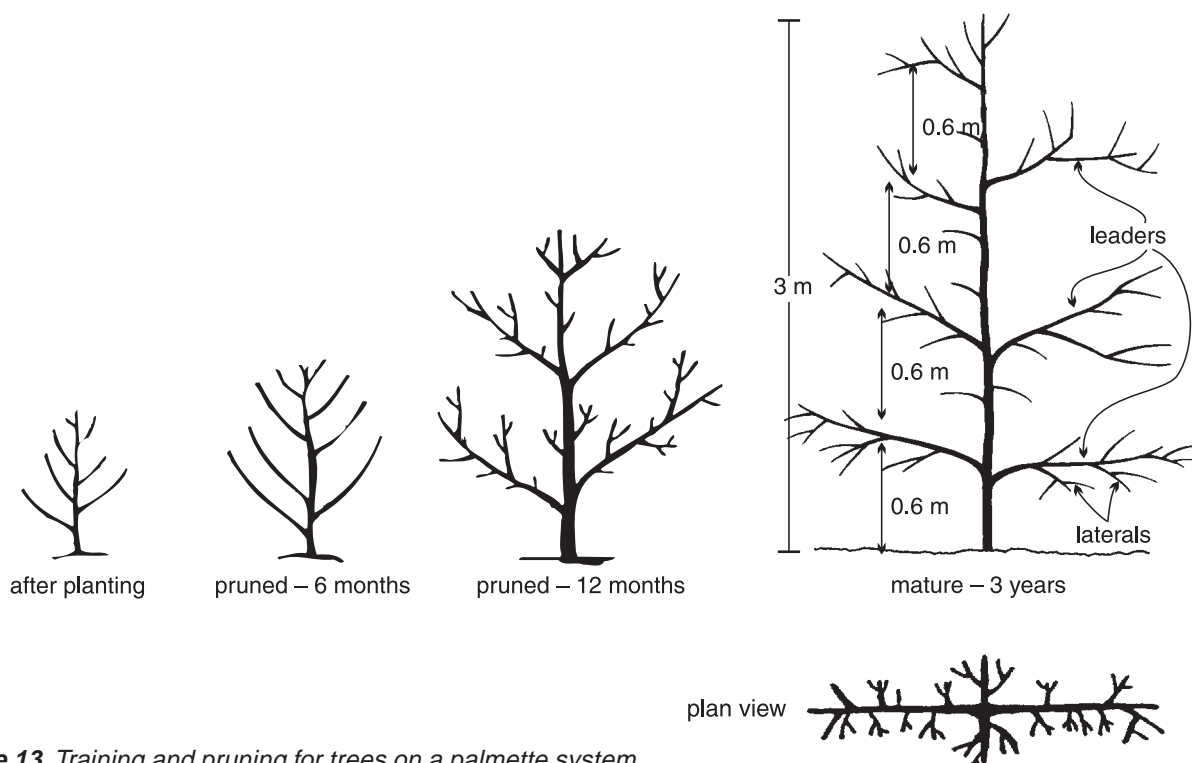


Figure 13. Training and pruning for trees on a palmette system



The tree is pruned to allow the main branches (called leaders) to grow only along the row to form a hedgerow about 1 m wide and 2.5 to 3 m tall. Figure 13 shows the beginning and end result. Here are the steps involved.

Step 1. After planting

If the tree does not have any shoots within 450 mm of the ground, cut off the main stem or central leader at this height. If the tree does have good shoot growth below this point, do not prune the central leader. Instead, remove shoots growing out into the interrow areas. Leave all shoots growing along the row. Some of these might need to be pruned to an underneath lateral to keep these leaders at about 45° to the trunk.

Step 2. About six months after planting

Trees should be about 1.5 m tall. Remove side shoots and suckers within 300 mm of the ground.

Step 3. About 12 months after planting

The trees should now be large enough to enable you to select the leaders. Selectively remove some shoots (leaders) on either side of the central leader so that remaining leaders are spaced about 0.6 m apart. This will form the permanent framework. Fruiting laterals will be produced on this framework. Start to prune as for bearing trees.

more info  Pruning bearing trees
This section page 26

Open vase pruning

The aim of open vase pruning is to get three or four main scaffold branches (called leaders) originating at a point on the trunk about 450 mm from ground level. These limbs are angled away from the centre of the tree so that the centre is open. Fruit is then borne on laterals growing on these limbs. Figure 14 shows the beginning and end result. Here are the steps involved.

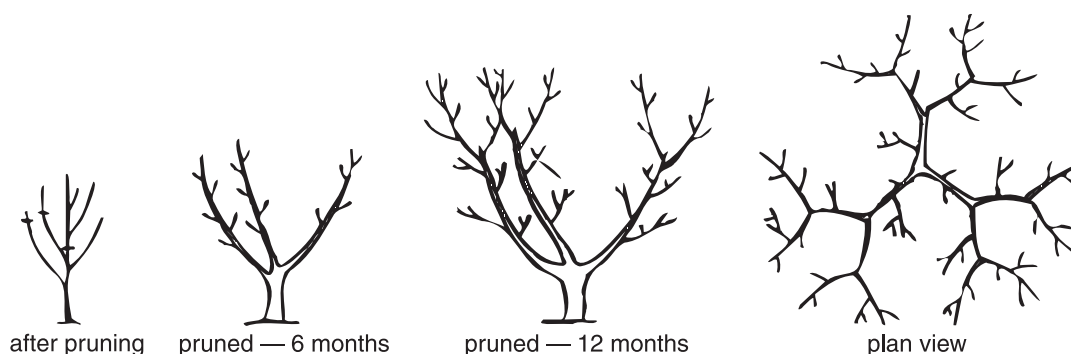


Figure 14. Open vase pruning for the first year

Step 1. After planting

Nursery trees usually carry several small, well spaced shoots around a central stem (often called the central leader). Start pruning as soon as

growth starts after planting. Do not prune weak trees until they are well established.

Select three or four shoots evenly spaced around the central leader up to about 450 mm from the ground. Remove the central leader just above the highest of the three or four shoots if this has not already been done. If the shoots on the young plant are too high, prune the plant back to 450 mm high and wait for new shoots to come from below the cut. Do not tip-prune the selected shoots (leaders) unless one or two are much longer than the others. Prune these back to a strong, outside vegetative bud.

Step 2. Up to six months from planting

Regularly tip leaders to a strong outward vegetative bud to ensure they continue to grow at about a 45° angle.

At about six months, if water and nutrition have been adequate, the tree should be about shoulder height (1.5 m tall). The leaders can now be pruned back to two outward facing vegetative buds at just over a metre high. This stimulates the growth of two growing points from each leader to give six to eight leaders on the tree.

Step 3. Twelve months from planting

The tree should now be just over two metres tall. Start to prune as for bearing trees.



Pruning bearing trees
This section page 26

Weed control and mulching

Newly planted trees find it difficult to compete with weeds for water and nutrients. Weed control immediately near the young trees is vital. Mulch and spot spray under and around the trees. The mulched/sprayed area should extend to just beyond the dripline of the trees, making it roughly two metres wide. Maintain a grassed area in the interrow between the mulched/sprayed strips.

Besides reducing weeds, mulching increases soil organic matter, improves soil structure and reduces root temperature fluctuations. It also increases water retention and may reduce irrigation frequency and amount. If a light-coloured mulch is used, it may also help to hasten fruit maturity.

Apply mulch 10 to 15 cm deep in spring after the soil has warmed up and trees have started to grow again. Keep it well away from the trunk to avoid collar rot.

Mulch may be bought in or grown on site. If bought in, coarse hay or straw such as sorghum stubble is preferred. The grassed interrow area is a valuable source of on-site mulch. Rather than keeping the grass short, delay slashing until the grass is 15 to 20 cm high. This ensures there is enough grass available for use as mulch. Too frequent slashing

is costly, contributes to compaction and favours unproductive grasses and weeds. Use side delivery mowers to direct the slashings under the trees.

The grassed interrow also eliminates dust, and provides pollen as a food source for predatory mites, which are important to the success of integrated pest management.

Where weeds grow through the mulch, either hand weed or spot spray carefully with herbicides. Do not allow the herbicide to contact any green part of the tree, including the trunk. To minimise drift, use a shielded, low pressure fan or flood nozzle or a rope wick applicator. Trunk protection as shown in Figure 10 also helps to prevent herbicide damage. For young trees, use the herbicides listed in Table 6. Herbicides such as glyphosate and glufosinate-ammonium (Basta) are not recommended at this stage because they pose too great a risk of damage should herbicide drift onto the developing trunk and leaves of young trees.



Table 6. Herbicides for weed control in young trees

Chemical	Weeds controlled	Products	Registered	
			Qld	NSW
paraquat	Most grasses and some broadleaved weeds	Paraquat	Yes	Yes
		Gramoxone	Yes	Yes
		Para-Di	Yes	Yes
		Nuquat	Yes	Yes
		Uniquat	Yes	Yes
		Maxitop	Yes	Yes
paraquat + diquat	Most grasses and broadleaved weeds	Sprayseed	Yes	Yes
		Tryquat	Yes	Yes
fluazifop-p	Grasses only	Fusilade	Yes	Yes
haloxyfop	Grasses only	Verdict	Yes	Yes

Do not cultivate within at least one metre of the tree. Stonefruit have a shallow root system which can be easily damaged. Do not use brush cutters because of the risk of damage to the trunk.

Pest and disease control

Pests

The main insect dangers for young stonefruit trees are San José scale, white peach scale, oriental fruit moth, two spotted mite and Monolepta beetle. All are sporadic problems, so routine spraying is not recommended. Familiarise yourself with the damage from each pest (Section 5, *Problem solver*) and apply control measures as required (details also in *Problem solver* and *Problem solver handy guide*).

Diseases

The main disease problems at this stage are rust, shot hole, bacterial spot and leaf curl. Regular spraying for these diseases during the active growth season of spring, summer and autumn is essential.

more info



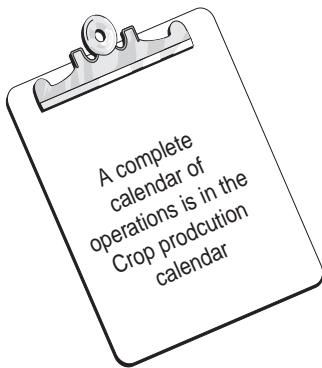
Pest and disease control
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Managing bearing trees

Once trees get close to bearing at the end of the second year, the management focus changes. Before bearing, the aim is to build a strong healthy framework. In bearing trees, the aim is to achieve maximum production of quality fruit, to manage vegetative growth and to maintain a healthy root system.

High performing trees follow a definite crop cycle of leaf growth, flowering and fruit development. The aim of management is to manipulate fertilising, watering and other operations to maintain the trees in this desired cycle. There are eight important operations.



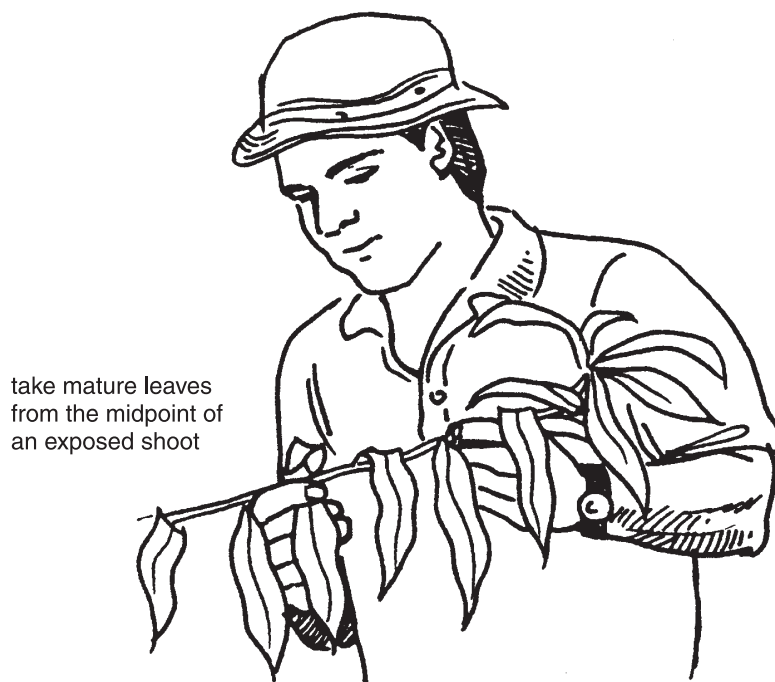
Fertilising	22
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Fertilising

At the end of the second year, the tree is ready to carry its first major crop. Fertiliser application should then be based on leaf and soil analysis. Monitoring of leaf and soil nutrient levels is most important as it makes sure that you apply the right amount of fertiliser to maintain optimum tree growth and fruit quality. This maximises your profit as well as preventing potential environmental problems with excess fertiliser leaching into streams and groundwater.

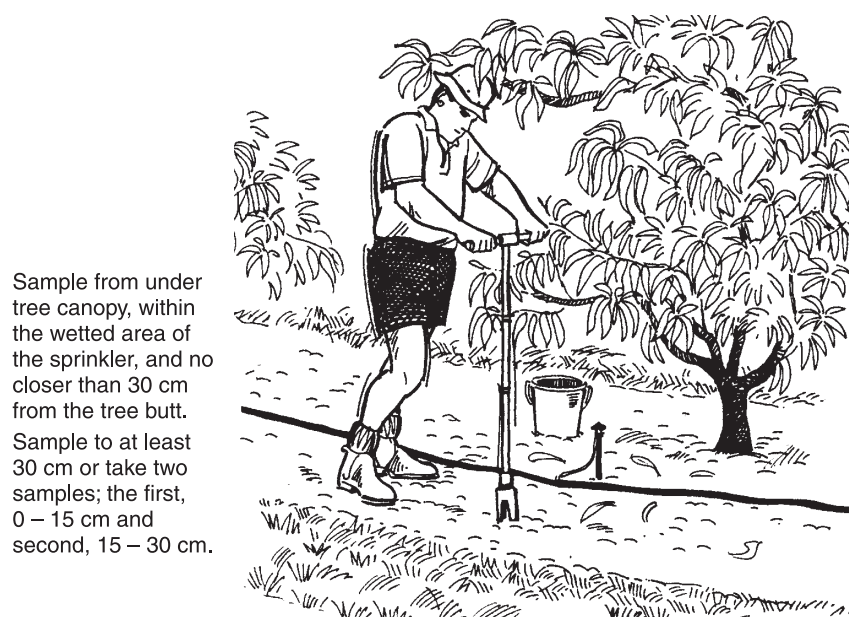
Do a leaf and soil analysis at the end of the second year and then every year at about two weeks after harvest. Leaf and soil sampling kits are available from most rural supply stores. Simply follow the instructions.

Sample mature leaves from the midportion of current season, non-bearing shoots (Figure 15). Take soil samples from under the tree canopy, within the wetted area of the sprinklers, and no closer than 30 cm from the tree trunk (Figure 16).



take mature leaves from the midpoint of an exposed shoot

Figure 15. Leaves to sample for leaf analysis



Sample from under tree canopy, within the wetted area of the sprinkler, and no closer than 30 cm from the tree butt. Sample to at least 30 cm or take two samples; the first, 0 – 15 cm and second, 15 – 30 cm.

Figure 16. How to take soil samples

The optimum ranges for leaf and soil nutrient levels are shown in Tables 7 and 8.

Table 7. Optimum leaf nutrient ranges

Nutrient	Optimum range	
	Trees treated with Cultar	Trees not treated with Cultar
Nitrogen (% N)	2.96 – 3.18	3.49 – 3.71
Sulphur (% S)	0.18 – 0.2	0.18 – 0.2
Phosphorus (% P)	0.17 – 0.26	0.23 – 0.32
Potassium (% K)	2.23 – 2.64	2.23 – 2.64
Calcium (% Ca)	1.53 – 2.03	1.23 – 1.56
Magnesium (% Mg)	0.58 – 0.62	0.33 – 0.37
Zinc (ppm Zn)	28 – 32	28 – 32
Copper (ppm Cu)	7.9 – 10.9	7.9 – 10.9
Sodium (% Na)	0.011	0.011
Chloride (% Cl)	0.09 – 0.11	0.04 – 0.06
Iron (ppm Fe)	45 – 160	45 – 160
Boron (ppm B)	29 – 43	29 – 47
Manganese (ppm Mn)	46 – 162	46 – 162

Table 8. Optimum soil nutrient ranges

Element	Optimum soil levels
pH (1:5 water)	5.5 – 6.5 (5.0 to 5.5 for krasnozems soils)
pH (1:5 CaCl ₂)	4.5 – 5.0
Organic carbon (Walkley-Black)	more than 2.0% C
Nitrate nitrogen (1:5 aqueous extract)	more than 20 mg/kg
Phosphorus (Colwell)	60 – 100 mg/kg P
Potassium (exchangeable)	more than 0.5 meq/100 g K
Calcium (exchangeable)	more than 5 meq/100 g Ca
Magnesium (exchangeable)	more than 1.6 meq/100 g Mg
Sodium (exchangeable)	less than 1 meq/100 g Na
Chloride (1:5 aqueous extract)	less than 250 mg/kg Cl
Conductivity (1:5 aqueous extract)	less than 2 dS/m
Copper (DPTA)	0.3 – 10 mg/kg Cu
Zinc (DPTA)	2 – 10 mg/kg Zn
Manganese (DPTA)	4 – 45 mg/kg Mn
Iron (DPTA)	more than 2 mg/kg Fe
Boron (hot calcium chloride)	0.5 – 1 mg/kg B
Calcium: magnesium ratio	3 – 5: 1
Total cation exchange capacity	more than 7
Cation balance (%)	calcium 65 – 80; magnesium 10 – 15; potassium 1 – 5; sodium less than 5



Fertiliser management
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To work out what fertilisers need to be applied, compare your leaf and soil analysis results with these standards. Only apply nutrients when your leaf and soil levels need to be adjusted to bring them into line with the standards.

In fertile soils, nitrogen is probably the only nutrient that needs to be added each year. In less fertile sandy soils, phosphorus, potassium, calcium and magnesium, as well as nitrogen, may need regular adjustment.

Once you have worked out which nutrients need adjustment, rates of fertiliser use are best based on the philosophy of replacing those

nutrients removed in the fruit, leaves and prunings. This has already been calculated for crops of varying yield and adjusted to take account of pruning and nutrient losses from soil leaching. As an example, a broad fertiliser program for a crop yielding 25 t/ha is shown in Table 9. The figures assume full nutrient replacement is required. In reality, nitrogen may be the only nutrient required.

Table 9. Fertiliser program for an orchard yielding 25 t/ha

Orchard on palmette — density of 1000 trees per hectare (spacing 4.0 m x 2.5 m)				
	July	November	January	March
Either				
mixed fertiliser 12:5:14 N:P:K	175 g/tree	75 g/tree	75 g/tree	175 g/tree
Or				
straight fertilisers				
urea	50 g/tree	20 g/tree	20 g/tree	50 g/tree
muriate of potash				70 g/tree
superphosphate				120 g/tree
Orchard on open vase — density of 400 trees per hectare (spacing 5.0 m x 5.0 m)				
	July	November	January	March
Either				
mixed fertiliser 12:5:14 N:P:K	435 g/tree	185 g/tree	185 g/tree	435 g/tree
Or				
straight fertilisers:				
urea	120 g/tree	50 g/tree	50 g/tree	120 g/tree
muriate of potash				175 g/tree
superphosphate				300 g/tree

Apply lime or dolomite and trace elements according to leaf and soil analysis results.

Placement

Mature tree roots extend into the middle of the row so the whole of the orchard should receive some fertiliser. Set up the fertiliser spreader to place most of the fertiliser under the tree canopy.

Watering

Continue using the soil moisture monitoring devices (tensiometers, soil moisture sensors, neutron probe or Enviroscan) recommended earlier for young trees as a guide to watering rates and timing.

To give you some idea of what to expect, Table 10 provides a broad annual guide to water requirements for bearing trees (second year and onwards) on a palmette system in coastal New South Wales.



Irrigation management
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Table 10. Water requirements for bearing trees (ignoring rainfall) on a palmette system in coastal New South Wales

Month	Water requirement (mm/week)
August	15
September	20
October	25 – 30
November	30
Summer prune	
December	25
January	20
February	25
March	20
April to July	no irrigation necessary

There are three periods when good soil moisture from either rain or irrigation is absolutely critical:

- from two weeks before flowering to three weeks after flowering;
- from four weeks before harvest to harvest;
- from December to March to allow the development of good fruiting wood for the next season.

Pruning

Pruning is an important step in producing highly productive stonefruit trees. It has four important purposes:

- keeps the tree at a manageable size;
- allows light and spray material to penetrate all parts of the tree;
- stimulates the production during spring and summer of replacement fruiting wood for the following season;
- removes excess fruiting wood during winter.

Pruning strategy

One year after planting the tree should be just over two metres tall. The main aim now is to encourage new fruiting wood (laterals) to grow within the body of the tree.

Prune three times throughout the year (spring, mid-summer and winter). The technique is similar for both palmette and open vase trees.

Spring pruning

Prune trees about one month before harvest, generally from mid-September to mid-October depending on the variety. The aim is to open the canopy to allow light and spray to penetrate easily to the fruit. This is a light pruning only.

At spring pruning

- Prune out strong growth from tree centres. Leave weak lateral growth on leaders to protect limbs from sunburn.



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pruning
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- Top trees to the framework height (palmette) or reaching height (open vase).
- Remove all watershoots more upright than 45°C. Make the cut where the shoots join the leaders.
- Remove suckers.

Summer pruning

Summer-prune two to three weeks after harvest. Prune early varieties by mid-November.

The aim of summer pruning is to allow light to penetrate the tree. This ensures good flower bud development, and induces the growth of new fruiting wood close to the leaders for the next season. **Do not prune heavily.**

At summer pruning

- Remove strong water shoots in the tree centre. Leave weak lateral growth to protect limbs from sunburn.
- Top trees to the framework height (palmette) or reaching height (open vase).
- Remove some laterals if growth is excessive.
- Do not allow old fruiting wood in the body of the tree to develop into heavy branches. Where potentially fruitful new laterals have been produced along an old lateral, remove wood outside the selected new growth (Figure 17). Where there is no new growth, prune the old spent wood to a stub carrying two or three buds. These generate growth in the following few months and fruit the next season.
- Remove old fruit and dead shoots.
- Remove all growth including suckers within 500 mm of the ground.

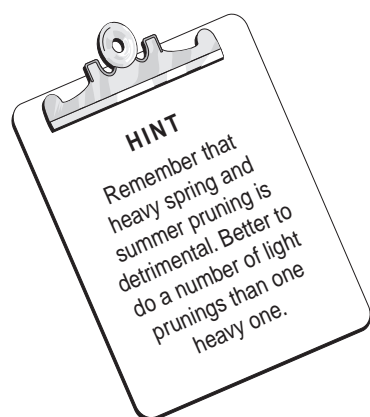


Figure 17. *How to summer-prune laterals*

Winter pruning

The main purpose of winter pruning is to remove a part of the fruiting wood produced during spring, summer and autumn. This reduces the amount of fruit thinning required later.

Early maturing varieties can be pruned in early June or even late May provided the weather is cold enough not to break dormancy. Otherwise, prune in late June or early July.

At winter pruning

- Remove strong secondary laterals that are competing with main leaders (Figure 18).
- Remove strong watershoots not required as replacement wood.
- Top trees to the framework height (palmette) or reaching height (open vase).
- Remove all growth within 500 mm of the ground.
- Remove every second or third lateral, particularly on nectarines which produce many short laterals.
- Tip laterals over 400 mm long to remove some flower buds by cutting off about one-third of the lateral. More fruitful varieties, in particular nectarines, can be tipped more severely. Short, sturdy spurs should not be cut back.
- In palmette trees, prune the lower leaders back if they are too vigorous (Figure 19).

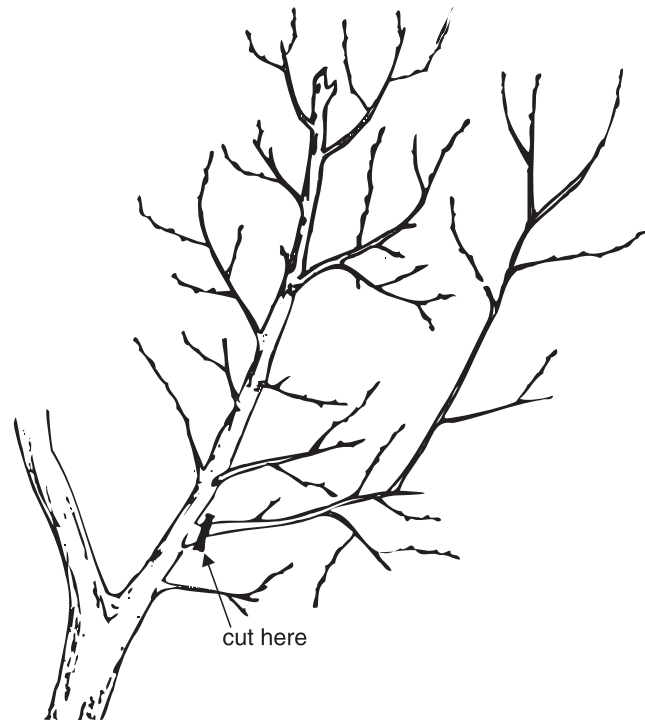


Figure 18. Remove vigorous laterals that compete with the main leaders

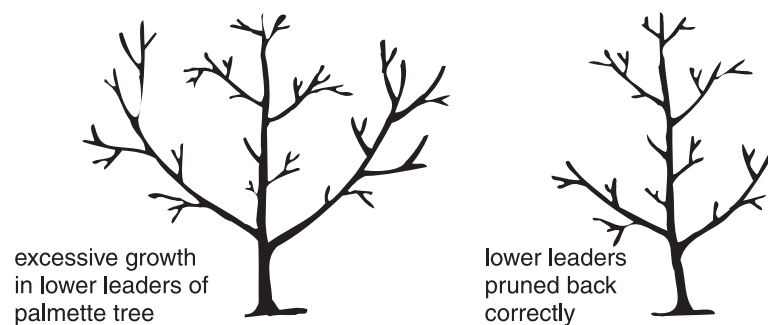


Figure 19. Pruning lower leaders in palmette trees

Pest and disease control

Insect pests and diseases are likely to attack the crop and the approach to controlling each is different.

Insect pests

The modern approach to insect pest control involves monitoring trees at regular intervals to determine when pests are present. Only when they are present and at damaging levels (called action levels), are chemicals or other control measures applied.

Because monitoring is complex, we recommend you use professional pest monitoring services. A broad program of insect pest control based on monitoring and action levels is shown in Table 11.

Diseases

The approach to disease control is different to that for insect pests. Disease organisms are microscopic and their arrival and build-up in the crop cannot be as easily monitored. In most cases, control means routine preventive spraying to protect the crop from possible infection. A broad program of disease control is shown in Table 11.



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Table 11. General insect pest and disease control program. (Trade names, rates, withholding periods and registration status of all chemicals for the different stonefruits are listed in the Problem solver handy guide)

Timing	Essential sprays			Optional sprays, depending on whether pest is present (check by monitoring)		
	Problem	Preferred chemical or other treatment	Comments	Problem	Preferred chemical or other treatment	Comments
Early bud movement (July)	Leaf curl and shot hole	chlorothalonil (not registered on nectarines – use copper or dithianon)	Apply 1 spray at budswell (2 sprays a week apart if budswell is variable).	Bacterial spot and canker	copper oxychloride	Apply one spray at budbreak if twig cankers present.
Flowering (August)				Blossom blight	chlorothalonil Alternative chemicals: benomyl captan (NSW only) carbendazim iprodione procymidone propiconazole triforine	Check flowers for blossom blight, (see photo in Section 5, <i>Problem solver</i>). If present, spray at 10% blossom, full bloom, and petal fall. Where benomyl or carbendazim are used, apply once at full bloom. Alternate use of different fungicides to avoid disease resistance developing.

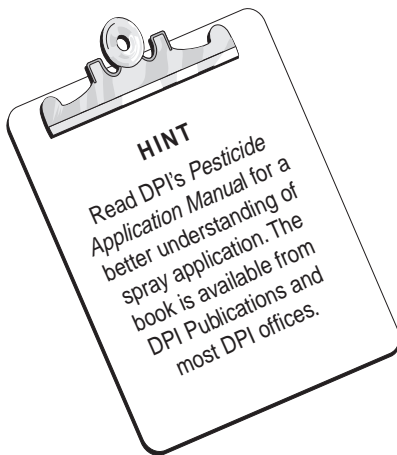
Table 11. cont.

Timing	Essential sprays			Optional sprays, depending on whether pest is present (check by monitoring)		
	Problem	Preferred chemical or other treatment	Comments	Problem	Preferred chemical or other treatment	Comments
Flowering (August) <i>cont.</i>				Thrips	endosulfan tau-fluvalinate (nectarines only)	Check for thrips at one quarter bloom and full bloom. If 10% or more of trees infested, spray late in the evening.
				Bacterial spot (plums only)	phosphorous acid (Qld only)	Spray at late petal fall where bacterial spot is a problem.
Fruiting (September–November/December)	Rust and shot hole	chlorothalonil mancozeb dithianon	Apply every 3 weeks. Chlorothalonil and dithianon are the safest to use as they are less toxic to predatory mites, and less likely to cause spray burn. Do not mix mancozeb with fenthion as spray burn may result.	San José scale	chlorpyrifos	Check trees in September for signs of live scale. If detected, spray at high volume to thoroughly wet trunk and branches. Re-check six weeks later and re-spray if live scale still present.
				Fruit fly	Bait spray chlorpyrifos plus yeast autolysate Cover spray fenthion trichlorfon	Hang fruit fly traps in late August, and check regularly for presence of fruit flies. Spray when any trap catches more than 20 fruit flies over 3 to 4 days, or if you find fruit with stings. Remember to empty traps after recording. Apply 50 mL of the mixture to the lower leaves of each tree every 7 days. Re-apply after rain. Stop bait spraying 4 weeks before harvest and switch to cover sprays. Spray every 7 days until harvest. Spray the whole tree.
				Rutherglen bug	endosulfan trichlorfon (NSW only)	Check leaves and fruit once a week for signs of bugs and spray if 5% of fruit are infested or swarms of bugs are present.
				Mites	Release predatory mites Chemicals: propargite fenbutatin-oxide tebufenpyrad (peaches only)	Each week collect 2 leaves from each of 20 randomly selected trees per hectare and examine for mites. When mites are present on about 20% of the leaves, release predatory mites. If mites are present on more than about 60% of the leaves, first spray and resume monitoring.
				Brown rot	As for blossom blight above or dithianon	Check fruit once a week for early signs of brown rot. If detected, spray at 3 to 4 weeks and again 1 to 2 weeks before harvest. Dithianon and chlorothalonil are preferred where predatory mites are being used.

Table 11. cont.

Timing	Essential sprays			Optional sprays, depending on whether pest is present (check by monitoring)		
	Problem	Preferred chemical or other treatment	Comments	Problem	Preferred chemical or other treatment	Comments
Fruiting (September–November/ December) <i>cont.</i>				Lightbrown apple moth	azinphos-methyl fenthion (NSW only) <i>Bacillus thuringiensis</i>	Check fruit once a week for holes or chew marks. Spray when 5% or more of fruit show fresh injury.
				Oriental fruit moth	fenthion azinphos-methyl	Check shoot tips regularly for signs of damage. Spray when 10% or more of tips are damaged.
				Red shouldered leaf beetle	carbaryl (Qld only) methomyl (NSW only)	Spray immediately when beetle swarms are detected on trees.
				Bacterial spot (plums only)	phosphorous acid (Qld only)	Spray at 3 to 4 weekly intervals where bacterial spot is a problem. Note 28 day withholding period.
After harvest to leaf fall (November–December to May)	Rust and shot hole	chlorothalonil mancozeb dithianon	Apply every 3 weeks. Use dithianon if rust is severe. Dithianon and chlorothalonil are the safest to use as they are less toxic to predatory mites, and less likely to cause spray burn. Do not mix mancozeb with fenthion as spray burn may result.	Mites	Release predatory mites Chemicals: propargite fenbutatin-oxide tebufenpyrad (peaches only)	Every 2 weeks, collect 2 leaves from each of 20 randomly selected trees per hectare and examine for mites. When mites are present on about 20% of the leaves, release predatory mites up to the end of February. If mites are present on more than about 60% of the leaves up to and beyond the end of February, spray.
				Oriental fruit moth Scales	fenthion azinphos-methyl petroleum oil	Check shoot tips regularly for signs of damage. Spray when 10% or more of tips are damaged.
Dormancy (May–June)	Brown rot	Prune off infected twigs and mummified fruit. Burn or bury.	Essential to lessen the risk of brown rot in subsequent flowers and fruit.			Check trees thoroughly for signs of live scales. Spray infested trees. It is very important to use the correct rate. Mark infested trees with tape and re-check in September. Do not apply 2 full strength oil sprays in the same year as trees may die or suffer severe dieback.
	Bacterial spot	Copper oxychloride	Spray trees once at about 30 to 50% leaf fall to protect the leaf scars from infection.			

Note: NSW growers should use this table as a guide only. For specific recommendations use *An orchard protection guide for deciduous fruits in NSW* (available July 1998).



Pesticide application and safety

For small orchards, pesticides can be applied using a hand gun. The gun is connected by a hose to a tank holding the pesticide. The tank is drawn behind a tractor or on the back of a trailer. For larger orchards, a tractor mounted air blast unit is recommended. A separate smaller spray unit is required for applying herbicides and a coarse spray hand gun is needed for applying fruit fly bait sprays.

Spray equipment must be well maintained and calibrated regularly to ensure sufficient chemical is applied to each tree. Operators should have a full understanding of the equipment and the principles of spray application to maximise efficiency and minimise spray drift.

Before using any chemical, always read the label and follow its directions. Observe full safety precautions including the use of safety equipment and protective clothing.

Spray compatibilities

It is often convenient to mix spray materials and apply them in the one operation. This saves time and may be done safely with some of the sprays in Table 13. However, our knowledge of the compatibility of every spray used is incomplete and we recommend that you follow the advice on the labels of the chemicals you are using.

Protection of fruit from birds and flying foxes

Crop damage from birds and flying foxes can vary from nil in most years to almost total destruction of individual orchards in other years. The degree of attack seems to depend on environmental conditions which reduce the pollen and nectar supplies in native flowers and native fruits. Clearing of forests has probably increased the incidence of attack in more recent years.

The recommended solution is to completely enclose the orchard with netting supported on poles and wires above the trees. Where hail is a problem, choose netting that also provides protection from hail.

Many other deterrents and methods have been tried but are relatively ineffective when birds and flying foxes are sufficiently hungry. Recently developed electronic scaring devices are more effective but do not offer the same long term advantages as netting.

Fruit thinning

If left to bear naturally, most low chill stonefruit varieties will set too many fruit. This results in reduced fruit size, poor skin colour and increased potential for insect and disease damage. To avoid this, the number of fruit must be reduced. Careful winter pruning will remove some of the potential crop but blossoms and fruit will need thinning during flowering and after fruit set.



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Thinning
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The aim is to reduce the natural set of up to 2000 to 3000 fruit per tree to about 300 to 400 (open vase) and 150 to 200 (palmette). This is roughly equivalent to about two to three fruit per 30 cm lateral or one fruit every 15 cm (a hand width) along the lateral.

Time of thinning

Thinning is best done as a two-stage process:

- first thinning during blossoming;
- the second thinning after fruit set.

Thinning should be fully completed well before seed hardening begins (about 40 days after full bloom). In coastal areas, this is about early September. Fruit can be 1 to 2 cm in diameter by this time. Seed hardening is indicated when the seed becomes 'crunchy'. The earlier you thin, the greater the increase in size of remaining fruit.

Method of thinning

There are no thinning chemicals suitable for low chill stonefruit; all thinning is done by hand.

Weed control and mulching

Maintain the interrow grass sward and continue mulching and spraying for weeds as outlined under *Managing young trees*.

Keep the under-tree area mulched with a cereal stubble or similar material for about 30 cm outside the edge of the canopy. This controls most weeds and minimises the use of herbicides. Apply a 10 to 15 cm deep layer of mulch each spring.

Remember that until shading occurs, slashings from the interrow area can provide a valuable source of mulch.

Use herbicides to kill any weeds that grow through the mulch and along the edge of the mulched area. Apply when the weeds are actively growing. Take care to prevent contact with low hanging leaves. Minimise drift by using shielded, low-pressure fan or flood nozzles.

Table 12 lists herbicides preferred for use. A sound strategy is to continue to use the knockdown herbicides such as paraquat or paraquat/diquat mixtures with the odd application of glyphosate or glufosinate-ammonium (Basta) to clean up any weeds that are difficult to control. Residual herbicides are available but should be used with care.



Table 12. *Herbicides preferred for use in bearing orchards*

Chemical	Weeds controlled	Products	Registered	
			Qld	NSW
paraquat	Most grasses and some broadleaved weeds	Paraquat	Yes	Yes
		Gramoxone	Yes	Yes
		Para-Di	Yes	Yes
		Nuquat	Yes	Yes
		Uniquat	Yes	Yes
		Maxitop	Yes	Yes
paraquat + diquat	Most grasses and broadleaved weeds	Sprayseed	Yes	Yes
		Tryquat	Yes	Yes
fluazifop-p	Grasses only	Fusilade	Yes	Yes
haloxyfop	Grasses only	Verdict	Yes	Yes
glyphosate	Grasses and broadleaved weeds	Glyphosate	Yes	Yes
		Glypho	Yes	Yes
		Glyfos	Yes	Yes
		Roundup	Yes	Yes
		Ranger	Yes	Yes
		Sanos	Yes	Yes
		Touchdown	Yes	Yes
		Ricochet	Yes	Yes
		Harpoon	Yes	Yes
		Ken-up	Yes	Yes
		Pacer	Yes	Yes
		Roundup Dry	Yes	Yes
ammonium	Grasses and broadleaved weeds	Wipe-out	Yes	Yes
		Basta	Yes	Yes

Windbreak maintenance

Deep rip at least every second year between the windbreak trees and the stonefruit trees to reduce competition for water and nutrients. Where netting is used, rip outside the netting structure, taking care to stay outside any buried stays. Otherwise, rip at least two metres outside the edge of the stonefruit canopy. If spreading foliage is reducing access to the trees, trim the sides of the windbreak trees.



Harvesting and marketing

To turn out a quality product, you have to pay particular attention to eight important operations in harvesting and marketing.

Harvesting	35
Pre-cooling	36
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Dipping	37
Insecticide treatment (if required)	38
Sorting and grading	38
Refrigeration	40
Marketing	40

Harvesting

Assessing when fruit is ready for harvest

Fruit maturity is assessed by visual indicators. These are:

- **Yellow-fleshed peaches and nectarines** — unblushed skin changes from green to yellow.
- **White-fleshed peaches and nectarines** — skin develops a cream tinge. In some varieties, a definite aroma develops.
- **Nectarines** — the skin blush becomes dull at the same time as the background colour changes. Maturity of highly coloured nectarine fruit can be assessed by the dullness of the blush, as the area of unblushed skin is very small.

Fruit ripens from the tip towards the stem. When a change in background skin colour approaches the shoulders of the fruit, it is mature enough to pick. The fruit should still be firm. If the fruit is picked before this stage it will lack flavour and juice, and may also shrivel before reaching the consumer.

If fruit is left on the tree until the tip softens, it may again lack flavour and juice. These fruit will also be more prone to handling damage.

Be cautious when assessing maturity of highly coloured peaches such as Flordagold and Flordaprince. The attractive red skin blush usually



develops well before the fruit is mature enough to be picked. The red skin blush is not a sign of maturity; look for a change in the background skin colour as described previously.

Harvesting

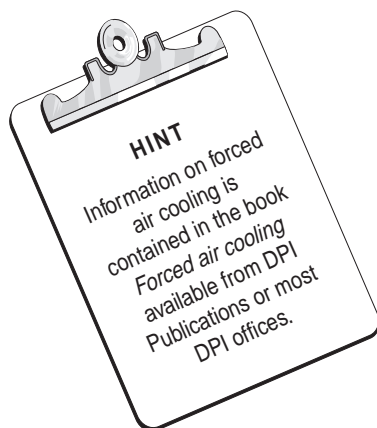
Some varieties mature their crop within a week, others will extend over three weeks. Once harvesting has started, harvest trees at least every two to three days.

Harvest early in the morning, before about 10.00 a.m., when fruit is cool and bruising less likely. A less preferred alternative is to harvest in the evening when temperatures have cooled. Do not harvest if temperatures are above 35°C.

To harvest fruit, hold each fruit fully in the hand and use a swift circular movement as it is pulled from the tree. Make sure that pickers' fingernails are kept short to avoid damaging the fruit.

Harvest into picking bags, crates, 18 L styrofoam containers or buckets. Harnesses can be made to hold the picking containers. Make sure pickers do not overload picking bags or containers, or drop the fruit or containers when loading onto the field transport. Stonefruit is highly susceptible to bruising.

In the field, keep harvested fruit out of direct sunlight and shade the fruit while it is being transported to the shed. Ensure that fruit reaches the shed within 30 minutes of harvesting, particularly on hot days. Where this is delayed, place wet sacking or cloth over picking containers to keep the fruit cool by evaporative cooling.



Pre-cooling

Fruit that is harvested in the early morning and immediately graded and packed does not need pre-cooling as long as the packed fruit is immediately cooled. Where immediate packing is not possible, pre-cool quickly to about 5 to 10°C. Forced-air cooling systems are recommended to quickly reduce fruit temperatures. Grade and pack as soon as possible so that fruit can be returned to the cold room for further temperature reduction.

Defuzzing

The fine hair or fuzzing present on some peach varieties may look unattractive. The fuzz can be removed by sponge in-line rollers. Varieties that should be defuzzed are Flordaprince and Flordagold. Defuzzing can damage fruit skin, especially the softer-fruited varieties that have started ripening. Fruit must be dipped in a fungicide after defuzzing.

Dipping

The two most common causes of fruit loss during marketing are brown rot and Rhizopus (transit) rot. Infection usually enters through injuries or bruises during harvesting, defuzzing, grading, packing or transport. These diseases are more severe if fruit is moist and warm. Dipping in a fungicide is recommended in at least these four situations:

- fruit that has been defuzzed
- when the weather is wet just before or during harvesting
- when preharvest sprays have not been applied or applied incompletely
- when brown rot or Rhizopus rot have been problems in the field or in previous fruit shipments.

As hot fruit can be easily damaged during dipping, make sure that fruit has lost field heat (fruit temperature below 30°C) before dipping.

Table 13 lists chemicals registered for postharvest treatment. Trade names and rates are listed in the *Problem solver handy guide*. Mixtures are often used because the chemicals have different spectrums of activity against the rots. Vary the chemicals used from time to time to avoid the development of disease resistance to them. Resistance can also be minimised by not using the same fungicide for dipping and for the preharvest orchard sprays.



Management of post harvest chemicals
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Table 13. Postharvest fungicide treatments

Fungicide	Registered		Effective against	
	Qld	NSW	Brown rot	Rhizopus rot
carbendazim	Yes	Yes	Yes	No
dicloran	Yes	No	No	Yes
iprodione	Yes	Yes	Yes	Effective suppression
procymidone	Yes	Yes	Yes	Effective suppression
triforine	Yes	No	Yes	No

Use wetting agents according to label directions only. Pre-mix the required amount of fungicide in a small amount of water as a slurry before making the dip. Do not add the fungicide directly to the dipping tank. If dips are not prepared correctly, fruit may be damaged or unacceptable residues may be left on fruit surfaces. Keep the dip continuously agitated so that powdered products are kept in suspension.

Smaller operators can dip fruit by hand using the picking containers and a bathtub or similar. Make sure that the picking containers are clean as soil and other contaminants quickly degrade the dipping chemical. Larger operators will have a dipping or spray line facility incorporated in the grading machine.

Dip fruit for 30 to 60 seconds according to label directions. Avoid skin and eye contact with the dip and use gloves when handling the dip or treated fruit. After dipping, allow fruit to dry before packing.

Make a fresh dip at least weekly and sooner if the dip becomes contaminated with dirt and plant material.

Good control of diseases in the field, field hygiene and maintaining a clean packing shed will help reduce postharvest rot problems. Place all rotten and discarded fruit in containers and remove from the shed daily. Do not leave discarded fruit on floors under machinery. Disinfect the shed and machinery before each season and more regularly if fruit rot is a problem.

Insecticide treatment (if required)

When fruit must be dipped or flooded for fruit fly for sale interstate, apply as the last treatment before packing. Insecticides are often mixed with the fungicide but always follow the label directions.



Interstate quarantine requirements
This section page 41

Sorting and grading

Discard fruit that has unhealed skin cracks and cuts, skin pulled away from the stem end, and split stones. Also reject badly misshapen fruit with long tips and soft sutures. Grade fruit for size, colour and superficial skin blemishes. Small operators do this manually. Larger operators use a grading machine for the size grading. Size grading machines must be well padded, have slow belt speeds and traverse short distances to avoid bruising and blemish of fruit. Make sure sorters and graders have good lighting.

Grade standards

There are currently no enforced grade standards. Growers should set minimum grade standards in consultation with their intended market. A good place to start is the current gazetted minimum standards for export fruit as published in the *Export control (fresh fruits and vegetables) orders: Schedule 20* for peach/nectarine. These set minimum requirements for fruit as:

- intact
- sound
- clean
- mature and firm
- practically free from sunburn and free from other disorders
- free from abnormal external moisture
- free from foreign smell or taste
- free from unhealed cracks.

The standards classify fruit into three classes, as shown in Table 14.

Table 14. Summary of export standards for peach/nectarine

Class	Standards
Extra Class	<ul style="list-style-type: none"> Well formed and typical of the variety. Practically free from defects and blemishes, other than very slight blemishes that do not affect the keeping quality of the fruit or the general presentation of the produce in the package. Free from damage caused by pests and diseases. Free from splitting at the stem end. Fruit to be graded for size with a minimum diameter of 50 mm measured at the equatorial section of the fruit with an allowable variation of 5 mm.
Class 1	<ul style="list-style-type: none"> Reasonably well formed and typical of the variety. Reasonably free from defects and blemishes provided that: <ol style="list-style-type: none"> they do not affect the general keeping qualities of the fruit; blemishes do not exceed 1.0 sq. cm in total area on any one fruit; blemishes of an elongated shape do not exceed 1 cm in length. Practically free from damage caused by pests and diseases. Free from splitting at the stem end. Fruit to be graded for size with a minimum diameter of 50 mm measured at the equatorial section of the fruit with an allowable variation of 5 mm.
Class 2	<p>Fruit which is not suitable for Extra Class and Class 1, with freedom from any serious defects, but may have:</p> <ul style="list-style-type: none"> Reasonable defects in shape, development and colour provided the fruit retains its general characteristics. Reasonable splitting of the stem end provided this does not affect the keeping quality or unduly impair the general presentation of the produce in a package. Skin blemishes that do not affect the keeping quality or unduly impair the general presentation of the produce in a package provided that: <ol style="list-style-type: none"> blemishes of an elongated shape do not exceed 2 cm in length; the total area of blemishes does not exceed 2 sq. cm on any one fruit. Minimum diameter of 45 mm measured at the equatorial section of the fruit with an allowable variation of 10 mm.

Packing

The preferred container for low chill stonefruit is the standard single layer tray. This is made of either fibreboard or styrofoam with internal dimensions of 450 mm x 290 mm x 70 mm. It holds 3 to 4 kg of fruit. Sometimes a 10 kg polystyrene bulk pack is used for smaller fruit. Do not pack soft-fruited varieties in bulk packs as fruit can bruise.

The single layer tray is fitted with a plastic liner containing deep round cups to hold the fruit. These are available in a range of counts from 42 to 13.

Pack the fruit in the cups stem-end down with the suture uppermost and the tip inclined slightly back. Packing fruit with the tip directly up will predispose it to damage. Ensure that all fruit faces in the same direction. Make the best use of the colour of the fruit to give an impression of overall uniformity of the pack.

Carton marking (trade description)

The following information must be PRINTED or STAMPED (not hand written) on the end of the carton.

PEACHES (or NECTARINES)			
Packed by: Ima Goodgrower Prickle Farm Gondwanaland QLD 1234			
Variety	Count	Class	Size
Flordaprince	1	20	76 mm

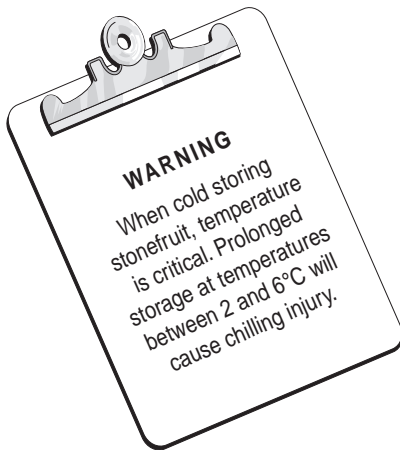
Export cartons will also need an export packing shed number and the name of the exporter. For the full marketing requirements, buy a copy of the *Export control (fresh fruits and vegetables) orders* from the Commonwealth Book Store, Brisbane.

Refrigeration

As soon as packing is completed, cool the fruit as rapidly as possible to the temperatures shown in Table 15. Forced-air cooling is recommended. Cold storage at these temperatures will reduce the development of postharvest brown rot and *Rhizopus* rot. These specifications should be used as a guide only and may vary slightly with different varieties. Remember that the storage temperature is critical as prolonged storage at temperatures of between 2 and 6°C will cause chilling injury.

Table 15. Cool storage of stonefruit

Fruit	Storage temperature (°C)	Relative humidity (%)	Period (weeks)
Peaches	0	90 to 95	2 to 3
Nectarines	0	90	1 to 2
Plums	-0.5	90 to 95	1 to 4



Marketing

Transport

Over 90% of Queensland's fresh fruit is transported to markets by road. Most trailers carry 20 pallets of fruit. Ensure that fruit is maintained at the correct storage temperature on its journey to market.

Marketing

There are many options for marketing your fruit. These are the main ones.

Domestic capital city produce markets. Most low chill stonefruit is sold fresh in major capital city produce markets. Fruit is consigned to wholesale agents who sell your fruit on commission and keep a percentage of the proceeds. Most fruit is consigned to the Brisbane, Sydney and Melbourne markets but smaller quantities go to all state



Marketing
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capitals. Wholesale agents are your source of market intelligence. For this reason, the choice of a wholesale agent is extremely important. It is best to deal only with a specialist stonefruit wholesaler. Seek advice on selecting wholesale agents from local growers in your area. Market authorities in each wholesale market have booklets covering market times and rules, along with a list of agents and merchants operating in their market. Also remember that you must meet the quarantine requirements defined by each state.

Marketing groups or cooperatives. Join a marketing group or cooperative where fruit may be jointly packed and marketing decisions are made on a group basis. This is highly recommended as the combined resources and volume of product allow a greater range of marketing opportunities to be explored. It gives individual growers much more marketing power. Marketing groups are recommended where they are available.

Sell direct to major city supermarkets, chain stores and fruit barns. These outlets need a regular supply of uniform quality fruit. This is only an option for very large farms or marketing cooperatives.

Local supply. In the more populated areas, you may wish to organise direct supply to local district retailers. This can be hard work and the costs of organising sales and distributing fruit need to be carefully considered. There is also the possibility, although limited, of direct supply to resorts and restaurants. Where you have good passing traffic, you can also sell fruit on the farm or at a roadside stall. Small growers in tourist areas with good road access may even consider a 'pick-your-own' operation. Check on local authority requirements for signs and parking and take out public liability insurance.

Export. Export has complex and specialised requirements and is normally only available to large growers or marketing groups or cooperatives. It requires strict attention to quality standards and quarantine requirements. Seek the advice of exporters or export market consultants before proceeding.

Whatever market outlet you choose, keep in close contact with your marketer and ask for feedback on the quality of your fruit in the marketplace. Regularly visit the major markets in which your fruit is sold. Be prepared to become involved in the promotional activities of your local stonefruit grower group.



Interstate movement provisions

There are no restrictions on the movement of stonefruit within Queensland except for the quarantine zone restrictions from the Papaya Fruit fly Pest Quarantine Area. Following successful eradication of this pest, the quarantine restrictions will cease towards the end of August 1998.

Restrictions for movement of stonefruit to other states are:

New South Wales

There are no restrictions into most areas of NSW. However, peaches, nectarines and plums without certification are not permitted into the Fruit Fly Exclusion Zone (FFEZ) of the Murrumbidgee Irrigation Area, Sunraysia and the mid-Murray area. The entry requirement for peaches, nectarines and plums into the FFEZ is a postharvest dip in a solution containing 200 mg/L dimethoate. The fruit must be fully immersed for a period of not less than 60 seconds. It must be the last treatment before packing. Check current requirements with a NSW Agriculture inspector (Phone 02 6951 2639).

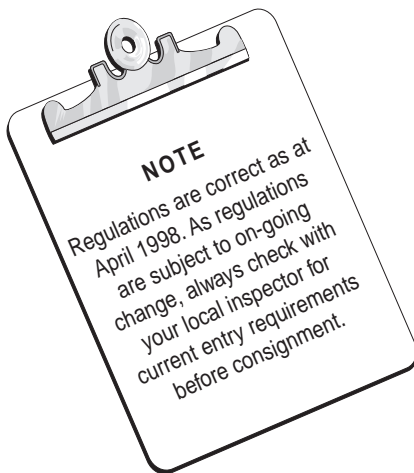
Victoria

There are several options:

- Peaches, nectarines and plums can be dipped or flood sprayed in dimethoate. With dipping, the solution must have a concentration of 200 mg/L and the fruit must be fully immersed for not less than 60 seconds. With flood spraying, the solution must have a concentration of 200 mg/L (400 mg/L may be used for nectarines and plums) and the treatment must be applied to fruit in a single layer as a high volume application of at least 32 L of solution per minute per square metre (16 L per minute per square metre may be applied for nectarines and plums). The treatment must achieve complete coverage of the fruit for not less than 12 seconds (10 seconds may be used for nectarines and plums) after which the fruit must remain wet for a period of not less than 60 seconds. The dipping or flood spraying must be the last treatment before packing.

The existing Victorian Grower Registration Scheme for businesses treating fruit fly host produce and the use of approved grower declaration forms with each consignment is being phased out. From July 1 1998, growers must either be accredited under the Interstate Certification Assurance arrangements ICA-01 (Dipping with dimethoate or fenthion) or ICA-02 (Flood spraying with dimethoate or fenthion), or apply the treatment under supervision by a DPI or NSW Agriculture inspector.

- Specified fumigation treatment with methyl bromide. Businesses must either be accredited under the Interstate Certification Assurance arrangements ICA-04 (Fumigating with methyl bromide), or apply the treatment under supervision by a DPI or NSW Agriculture inspector. Fumigation may only be carried out in registered and tested chambers operated by an authorised fumigator.
- Specified postharvest cold storage treatment. Certification by a DPI or NSW Agriculture inspector is required.



South Australia

There are several options:

- Peaches, nectarines and plums can be dipped or flood sprayed in dimethoate. With dipping, the solution must have a concentration of 200 mg/L and the fruit must be fully immersed for not less than 60 seconds. With flood spraying, the solution must have a concentration of 200 mg/L (400 mg/L may be used for nectarines and plums) and the treatment must be applied to fruit in a single layer as a high volume application of at least 32 L of solution per minute per square metre (16 L per minute per square metre may be applied for nectarines and plums). The treatment must achieve complete coverage of the fruit for not less than 12 seconds (10 seconds may be used for nectarines and plums) after which the fruit must remain wet for a period of not less than 60 seconds. The dipping or flood spraying must be the last treatment before packing.



Either treatment must be supervised by a DPI or NSW Agriculture inspector and a Departmental certificate accompany each consignment. Alternatively, a grower may obtain accreditation under the Interstate Certification Assurance arrangements ICA-01 (Dipping with dimethoate or fenthion) or ICA-02 (Flood spraying with dimethoate or fenthion).

- Specified fumigation treatment with methyl bromide. The treatment must be supervised by a DPI or NSW Agriculture inspector and a Departmental certificate accompany each consignment. Alternatively, a grower may obtain accreditation under the Interstate Certification Assurance arrangements ICA-04 (Fumigating with methyl bromide). Fumigation may only be carried out in registered and tested chambers operated by an authorised fumigator.
- Specified postharvest cold storage treatment. Certification by a DPI or NSW Agriculture inspector is required.

Western Australia

Entry of all stonefruit from Queensland and New South Wales into WA is prohibited because of the existence of brown rot in both states.

Tasmania

Fruit must be dipped in a solution of dimethoate at a concentration of 400 mg/L. When dipping, the fruit must be fully immersed for a period of not less than 60 seconds. In addition, immediately after treatment, the packages must be secured with either carton mesh or shrink-wrapped to exclude fruit flies. Dipping with dimethoate must be the last treatment before packing. Certification by a DPI or NSW Agriculture inspector is required.

Northern Territory

There are no restrictions on the entry of low chill stonefruit into the Northern Territory.

Quality management

Although most domestic markets do not yet demand quality assured fruit, quality assurance is becoming an important marketing tool and will be demanded more and more. Part of this requirement will be to meet the needs for 'safe food standards' that are being demanded by consumers. Markets and importing countries may soon demand assurances for best practices in all sections of the industry. It is important to be ready for this change when it comes and start now to develop a quality management system at the farm level. This will be an added cost, but you should be able to expect a premium price and increased profitability by supplying a product that the market wants.

The best way of getting into quality management is to join one of the marketing groups or cooperatives that have quality assurance schemes.



Quality management
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