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Raspberry growing in NSW

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Raspberries are members of the *Rubus* genus, which also includes trailing brambles such as blackberry and Loganberry. There are also Australian species of raspberry, but apart from the Atherton wild raspberry (*Rubus fraxinifolius*) these are not grown commercially. Most commercial varieties of raspberry are bred from *Rubus idaeus* (from Europe) and *R. strigosus* (from North America).

Australia produces about 2000 tonnes (0.58 % of world production) of *Rubus* fruits annually, compared to a total world production of

340,000 tonnes. Most of this is produced in Victoria.

The major impediment to increasing production in NSW is climate, as many areas of NSW have summers that are too hot and dry to produce good quality berries. However, some locations can produce high yields of good quality fruit, provided they have mild summer temperatures averaging less than 30°C. Locations such as the northern, central and southern tablelands of NSW are suitable.



THE PLANT

Raspberry plants are perennials, with the roots living for many years. The cane or stem, lives for two years, with new canes (primocanes) produced each year from underground roots or cane buds.

Canes are upright or semi-erect and may reach a height of 2.5 m or more. Stems may have sharp, strong thorns or spines, scattered weak prickles or be thornless. Leaves are mostly trifoliate, ovate and deciduous.

The fruit is an aggregate composed of 75 to 125 drupelets that are held together by their geometrical symmetry and a network of fine, small hairs. When harvested, the receptacle or core remains on the bush, giving the fruit a hollow centre.

POTENTIAL MARKET

This must be considered carefully before planting. Prices can be good for fresh fruit, especially early in the season, and during autumn. Raspberries can be produced from June through to April/May. Prices for the late December to January period are usually lower, especially for poor quality berries.

Transport must be reliable to ensure that berries get to market in good condition. Refrigerated transport is needed if it is a long way to the market. Sale to local outlets overcomes most transport issues, but potential volume of sales will probably be limited.

A 'pick your own' enterprise needs to be located near a major town or city or along a major thoroughfare, with plenty of passing traffic. Locations near major tourist attractions would be ideal. At times, picking labour may be plentiful (customers) but other operations such as a sales outlet and farm tours will add to the permanent labour required. A core group of pickers and an alternative market will still need to be maintained when tourist interest is low.

Vertical integration into processed products may also be an advantage, as jams and frozen products could be marketed well into the off season. For a processing enterprise, access to freezing or processing facilities is almost essential.

ESTABLISHING A PLANTING

Site selection is crucial when establishing a raspberry planting, as plants need to remain profitable for some years.

Climate

The ideal climate is one with a relatively cool summer, a rain-free harvest period (rain at harvest can cause soft fruit and rots) and a cool winter to give uniform bud break. Ideally root temperatures for raspberries should not exceed 24°C. Raspberries require a set chilling period in winter for normal bud break and flowering. Opinions vary on the critical temperature needed to achieve good chill. Accumulated hours below 7°C are used in this publication. The number of chill units (cu) varies per variety from 250 to 1600 hours. The chilling requirement determines which cultivars can be grown in a district, as poor and extended bud break often results from inadequate chill. This condition which is commonly called 'blind bud' can also result from disease.

Avoid planting in low-lying areas to reduce the risk of frost damage. Plants must be protected from hot, dry winds that reduce cane growth and damage developing fruit. Continued wind exposure often leads to soft, small, poorly coloured and scalded fruit. Fruiting laterals can also be broken in strong winds. Warmer environments also favour pest and disease build up, especially where harvest coincides with the wet season.

Irrigation

In most areas irrigation is essential during the fruiting season. Check quality and quantity of irrigation water before planting.

Soil

Raspberries require soil that is well drained, but has good water holding capacity. Soil pH should be between 5.5 and 6.5. Avoid planting in very light sandy soils and heavy clays.

Potential growing areas

Raspberries can be successfully grown in two types of environments. Traditionally they are grown in districts such as Armidale, Orange and Batlow where there is a sufficient cold winter temperature to meet dormancy requirements. Raspberries can be grown in warmer climates such as the mid-north and north coast regions of NSW using an annual long cane system of

production. The economics of producing in warmer areas using this system need to be carefully investigated because of the higher production costs.

SOIL PREPARATION

A soil test is the first step in preparation to determine suitability for raspberry production and identify the need for amendments. Once this has been done, weeds must be controlled before planting. It may take 12 months to adequately remove woody or persistent weeds. A registered knockdown herbicide may need to be used.

Cultivation and planting a green manure crop prior to planting will improve soil structure and water holding capacity. Organic fertilisers and composted organic matter mulches could be used to condition the soil. Lime or dolomite will be needed if the soil pH is below 6.0.

A second application of knockdown herbicide may be needed to control weeds again before planting. Mulching will help to reduce annual weed growth, conserve soil moisture and stabilise soil temperature.

PRODUCTION SYSTEMS AND VARIETIES

Three production systems are used.

1. Summer cropping, although some varieties used in this system (called dual varieties) produce a second crop in autumn. (see Table 1).
2. Autumn cropping, and
3. Long cane production that produces fruit in winter and spring.

Autumn cropping and long cane production systems treat raspberries as an annual crop and have potential in warmer districts where winter chilling is insufficient to produce normal bud break and flowering, for example in coastal districts.

Summer cropping and varieties

This system follows the natural growth cycle of the raspberry. In the first year, vegetative canes (primocanes) are produced. These canes then go through winter dormancy, flower, fruit and die in the second year. While the 2-year-old canes (floricanes) are in production, new primocanes arise from the root system and will bear the following year. From the second year onwards, a raspberry planting will have both types of canes. Most summer cropping varieties will average 10–12 tonnes of fruit per hectare.

Tulameen

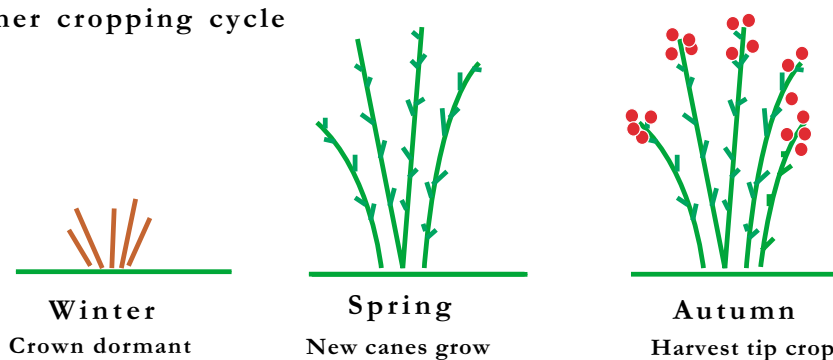
Vigorous upright canes with spines at the base. Open growth habit. Fruit is large, red, firm and glossy. Fruit is of good quality, has good shelf life and is also suitable for processing. It has

Table 1. Raspberry maturity periods based on the cool temperate environments of the Orange area on the Central Tablelands. The extent of the autumn cropping season depends on frosts. Autumn production on dual cropping varieties varies from season to season.

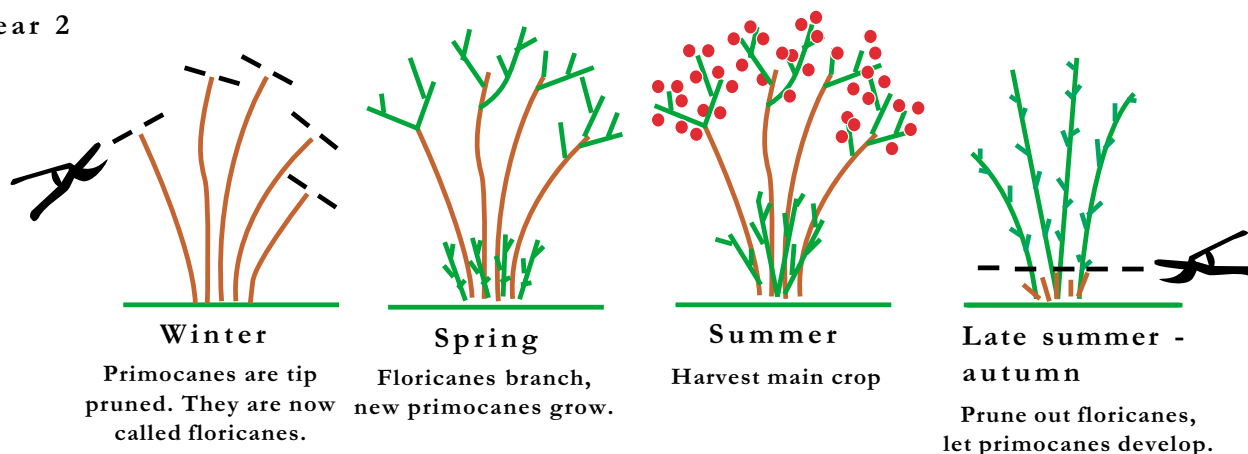
	December				January				February				March				April			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Summer cropping																				
Skeena																				
Chilliwack																				
Willamette																				
Nootka																				
Tulameen																				
Meeker																				
Autumn cropping																				
Autumn Bliss																				
Heritage																				
Bogong																				

Figure 1. Summer cropping cycle e.g. Willamette

Year 1



Year 2



also been used for long cane production.

Willamette

December to January (mid season) crop. Fruit medium to large, firm and medium to dark red. Fruit goes dark after harvest. Susceptible to blind bud when chill is not adequate. Canes are tall, floppy and spiny. Sucker growth may be excessive in the first few years. Willamette is moderately tolerant of heat, drought and poorer soil types. It can also produce a primocane crop in autumn.

Serpell's Willamette

A Victorian variant of Willamette, it has thornless canes. Some canes will revert back to thorns. Suited to areas with medium chill (600 cu). Otherwise a very adaptable variety. Mid season crop. Currently distributed under a non-propagation agreement.

Chilliwick

Mid season crop. Fruit is long and firm with good resistance to rot. Colour varies from red to dark red. It has good shelf life. Canes are tall and spineless. Moderately susceptible to disease in cooler areas. Suitable for areas with medium to low chill (600 cu). Where chill is inadequate, it is suited for 'long cane' production in coastal areas.

Meeker

Late season variety with a medium to low yield of medium sized fruit. Very uniform size, and colour at harvest. Canes are very spiny and not as tall as Willamette. Chilling requirements are too high for coastal production (900 cu).

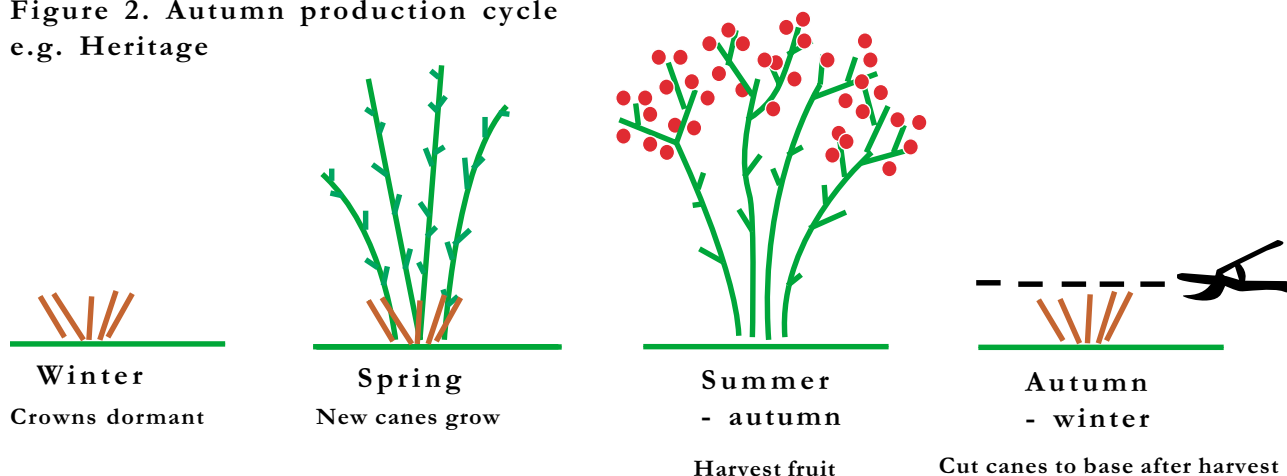
Nootka

Mid season, high yielding, bright red fruit that retains gloss and colour after harvest. Also produces a good autumn crop. It has a medium chill requirement (800 cu).

Autumn cropping and varieties

These late fruiting varieties produce primocanes that flower and fruit in a single year. The growth, fruiting and harvest occur within a 9-month cycle. New canes start growing in spring and reach 1.5 m tall in summer. As the day length begins to shorten in autumn, the terminal bud flowers. Fruit is produced throughout autumn until the first frosts in winter. After the final harvest pruning is done by mechanical means. No canes need to be left for the next year. Primocane varieties have some potential for warmer areas, as root buds require less chilling to produce new canes. Yield is usually between 2–6 t/ha.

Figure 2. Autumn production cycle
e.g. Heritage



Heritage

Produces strong, moderately thorny canes that are partially self-supporting. The fruit is small to medium sized, firm with fair flavour. It yields well and produces fruit from January until the first frosts. In cooler areas fruit may cease ripening before harvesting is completed.

Harvest can be delayed in warmer areas if the canes are tipped, as fruit on the top of untipped canes is more prone to sunburn. However, fruit size may be reduced as more flowering laterals are produced.

Autumn Bliss

Suitable for better soils. Canes are thorny, and of moderate height. Fruit are softer and lighter in colour and ripen earlier than Heritage. Hard to pick if not fully ripe, as it does not separate from the core easily. Fruit quality and yield may also decline over several seasons. Sold under a non-propagation agreement.

Bogong

A Victorian bred cultivar, with almost thornless canes, of moderate size. Fruit is large and harvests well at the firm ripe stage. Bogong has

excellent fruit quality and flavour. Susceptible to root diseases in wetter conditions and not suitable for poorer soil types (weak growth). May sometimes produce crumbly fruit. It crops March through to April. Currently sold under a non-propagation agreement.

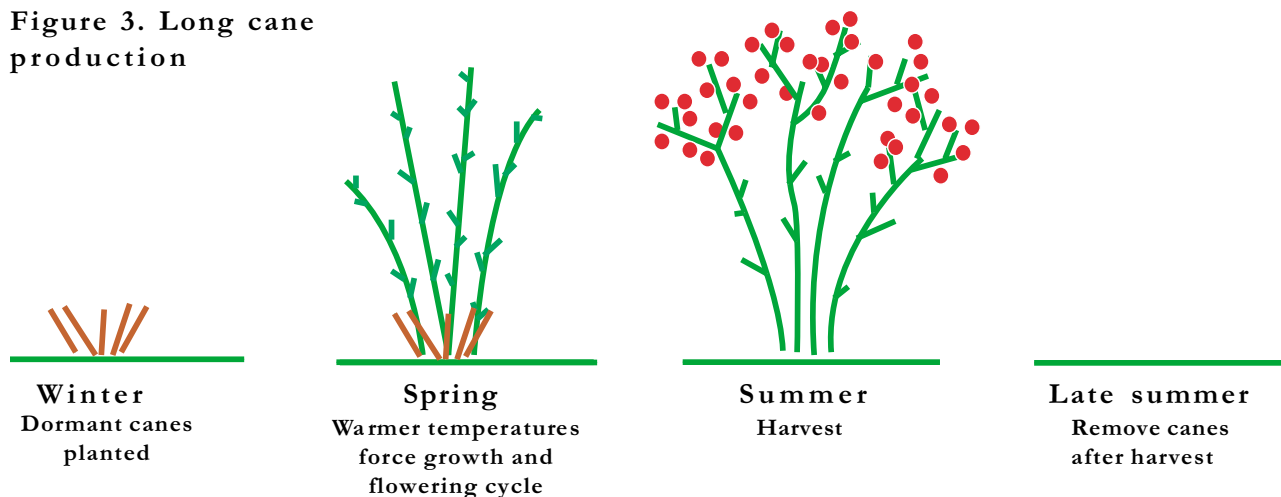
Long cane production and varieties

This production method is suitable for warmer, coastal areas where adequate winter chill is not achieved. This technique provides out of season production with plants treated as annuals.

In traditional long cane production, plants are grown in cooler districts, and go through the chilling period over winter. Dormant one-year canes with a good root system are sent to the grower and the canes are planted in June. The warmer temperatures force the growth and flowering cycle, and fruiting occurs about two months after planting.

A more recent technique involves the cool-storage of canes at 0–2°C to accumulate chilling and enable planting at various times of the season. For this technique the canes can be

Figure 3. Long cane production



removed from storage at staggered times to provide fruit production from June/July to October/November. Cool storage of dormant canes provides opportunities for planting at other times of the season with more opportunities for marketing. For example, planting in late spring or early summer can enable winter production. Overseas this technique has been used in conjunction with greenhouse hydroponics to grow berries in winter when there is snow outside.

The canes are removed after harvest and the block is spelled for the following year. Production costs are significantly higher than in a perennial planting and must be offset with good prices to be profitable.

Growers need to experiment in their own situation to determine if long cane production is feasible in their area.

Chilliwack and *Tulameen* are suitable for this technique.

PURCHASING PLANTING MATERIAL

To avoid disease problems, new plantings should only be established using material that has been provided through the Raspberry Certification Scheme. The Australian Rubus Growers Association runs the scheme. Purchasing material through this scheme also ensures that plants are true to type.

Contact the Australian Rubus Growers Association for details on phone: (03) 5634 7526 or fax: (03) 5634 7526.

PLANTING DESIGN

The two main planting designs are hedgerow and stool.

Hedgerow

In the hedgerow system canes are planted 20–30 cm apart, with the width of rows contained to 10 cm (see figure 4). New canes will develop filling in the gaps between the planted canes. When this happens canes are thinned to 10 to 16 per metre, depending on vigour. Varieties such as Meeker, Willamette and Nootka adapt readily to the system, and will fill in the gaps quickly. Hedgerows are usually spaced about 2 m apart depending on the width of machinery available.

Advantages

- Plants establish high cane numbers quickly
- Suckers only need to be controlled between rows

Disadvantages

- Less air movement between plants may result in fruit rots
- It is hard to see where one plant stops and another starts, making cane counting at pruning difficult

Stool

In the stool system all the canes from the one plant are tied together in clumps (called a stool). Canes are initially planted 60–80 cm apart in the row, and are allowed to grow out to a diameter of 15–20 cm. Usually 8–10 fruiting canes are left per stool. Stool rows are usually spaced about 2 m apart depending on the width of machinery available.

Advantages

- Good air movement between plants, less chance of fungal disease
- Easy to judge cane numbers per plant.

Disadvantages

- Lower cane numbers in the first few years
- Need to remove canes between stools.

TRELLISING

Traditional stool system

The traditional trellis uses two wires set to a height of 1.2 m. In dual crop varieties such as Willamette, old canes are pruned out at harvest and the young canes bundled up again.

Alternatively a trellis with one horizontal wire can be used. Canes are bundled together, and tied to the wire with baling twine for support.

Advantages

- Easy to train

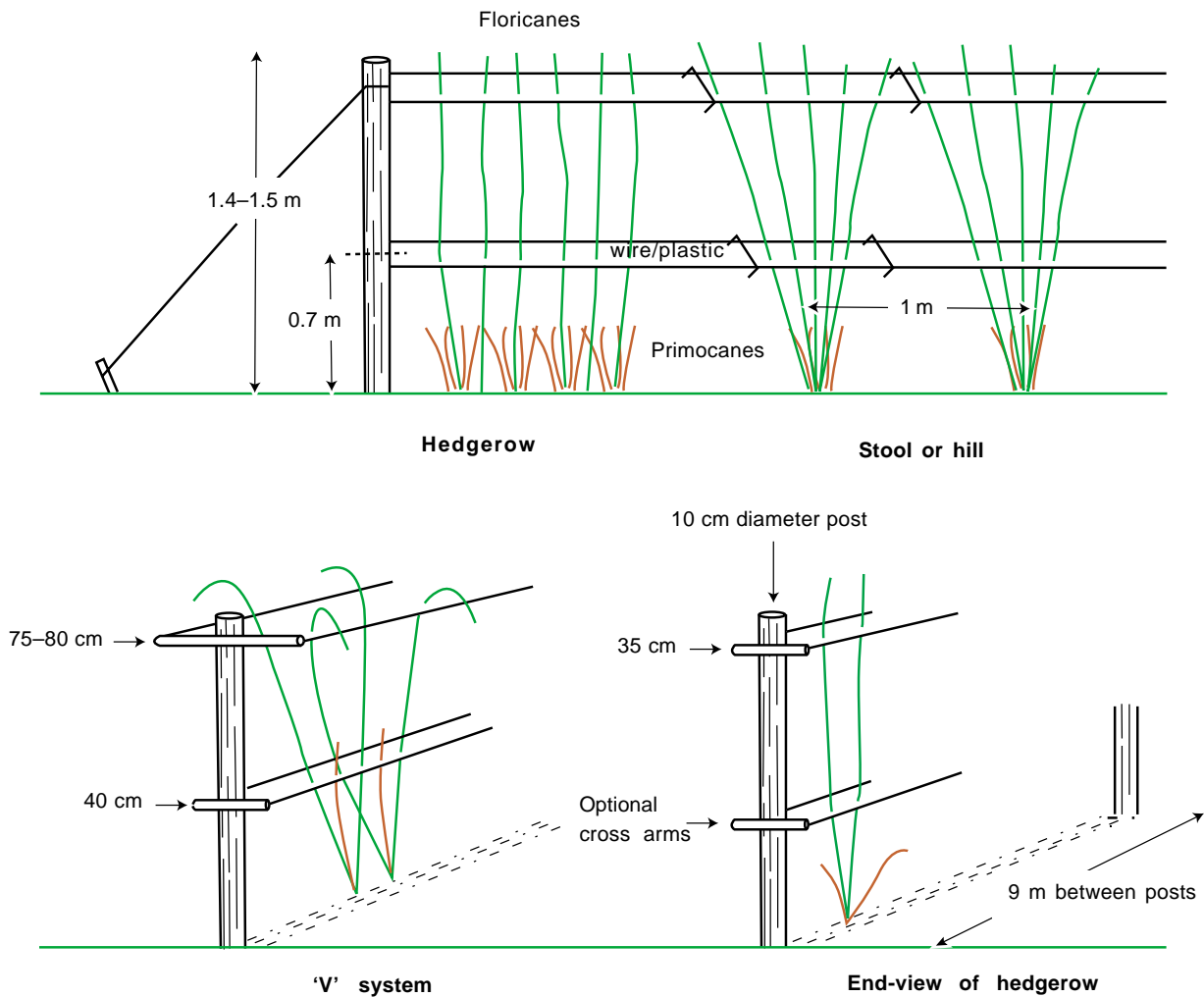
Disadvantages

- Canes in the centre of the bundle may not break buds properly
- Picking is slower
- Young canes may flop over into the row

Hedgerow System

Canes are held by two wires 10 cm apart and 1.4 m above the ground. Canes are inserted by unclipping one of the wires, moving canes into

Figure 4. Trellising and training systems for raspberries



position. The wire is then clipped on again. The two wires can be clipped together every couple of metres for more support. If posts are 10 cm diameter, cross beams may not be necessary. Plants grown in the stool design can also be supported in this way. This can overcome the problems associated with tight bundles.

V Trellis

Can be used for both hedgerow and stool plantings. Two wires, held apart 75 to 80 cm by a crossbeam (see figure 4) support plants. Additional wires may be used further down the posts for more support. If fruit is to be harvested mechanically for processing, then the 'V' must be narrow (less than 30 cm at a height of 1.2 m).

Advantages

- Fruit is easy to locate on the outside of the trellis by hand pickers

- Primocanes can grow up though the centre, and are less likely to be damaged by pickers

Disadvantages

- Higher cost, as it requires more materials
- End posts must be stronger and well secured to cope with the greater crop load

PRUNING

Pruning and training of raspberries is an important aspect of production. At present most systems require substantial manual labour for this task.

Pruning usually commences soon after harvest. Removal of old canes as soon as possible after harvest is an essential part of disease control. Small, thin or broken primocanes should also be removed. Aim to achieve a cane density of 10 per stool or 10 canes per metre of

hedgerow. The density range can vary with the cultivar e.g. 12 canes/metre for Willamette to 15 canes/metre for Chilliwack.

When training new canes, wires are used to hold larger canes together rather than individually tying canes. Raspberries produce best on large diameter canes with short internodes. When the canes become dormant they are tipped, or pruned to shoulder height. This allows laterals to produce fruit in easy reach of pickers. Tipping helps to remove the thin tips of canes that tend to produce smaller and crumbly fruit. Removal of excess fruit buds helps to achieve good fruit size. Up to 30% of cane length can be removed without adverse effect.

In dual cropping varieties tipping is not recommended, as it removes the second crop. However, after harvest of the first crop, these canes can then be shortened to a more accessible height. Tipping may not be economically justified if fruit are mechanically harvested for processing.

Sucker Control

Summer pruning is aimed at controlling unwanted primocanes or suckers that grow outside the row or stool. If not removed, they will interfere with harvesting. Pruning also reduces competition early in the season. Suckers can be controlled by the following methods:

- Driving a slasher as close as possible to the floricanes
- Using a brushcutter to mow the suckers
- Using a herbicide registered for the purpose of raspberry primocane control

A row of Raspberry canes. Primocanes have been chemically removed on the left -hand side.



A motorised platform can be used between the rows to allow workers to sit near ground level for pruning out canes. Pneumatic secateurs can also be fitted to the platform, which may be towed behind a tractor. The platform can also be used to carry waste canes away for disposal. Such a platform will also be useful for topping canes.

Platforms are a much better alternative to ladders, and can be moved along the row at a slow walking pace. A planting of 4 hectares or more justifies the time and expense of building a platform.

Before any platform is purchased or fabricated, growers should seek advice from Work Cover NSW to ensure that it will meet Occupational Health and Safety guidelines.

IRRIGATION

In most soil types the raspberry will grow most of its roots within the top 20 cm of the soil. In deep fertile soil, roots can penetrate 75 to 100 cm.

Irrigation frequency will depend on the soil type, rainfall and the amount of evaporation. Soil moisture should be monitored to ensure efficient irrigation; tools such as tensiometers are useful. Light textured soils may need more frequent applications of smaller volumes compared to clay soils that have a greater water holding capacity.

Raspberry plants hate 'wet feet' so it essential not to over irrigate. The most common irrigation system used now is drip or mini-sprinkler. It is essential that filters are regularly checked and cleaned, to avoid blocked drippers. These systems have several advantages.

- Most efficient use of water
- Water is applied only to where it is needed
- Allows for harvesting and spraying while irrigating
- Foliage is not wet, sprays are not washed off and fungal diseases are reduced
- Low labour cost—no need to shift pipes

It might be necessary to install a secondary overhead watering system, if frost is a problem. This may also be used during summer to cool

the crop on hot days. It is essential that adequate water be supplied at flowering, fruit set and before the first pick when berries are filling.

FERTILISERS

Nitrogen is needed for strong cane growth, but other elements are also necessary.

Phosphorus is needed for root growth, seed formation and fruit ripening. Only small amounts are needed, and deficiency is rare.

Potassium balances growth, improves fruit quality and can increase disease resistance. Deficiency presents as poor cane growth and marginal leaf scorch.

Magnesium is an essential ingredient in chlorophyll. Leaves become yellow when deficient.

Trace elements such as manganese, boron and copper are not usually deficient.

Symptoms of nutrient deficiency vary and may not show until the problem is severe. Symptoms may need to be confirmed by leaf analysis.

After canes have started to grow nitrogen, phosphorus and potassium are applied at about 50 g/m² in an 8:4:8 ratio. From the second year onwards, rates can vary according to those in Table 2.

Table 3. Leaf Analysis Guidelines for Raspberry, Raspberry, Red (*Rubus idaeus*)

Growth stage: Two to three weeks after final pick.

Plant part: 5th–12th leaves from the terminal 150 mm of the primocane.

How established: Synthesis of North American (cv. Willamette) and British (cv. Lloyd George) data by Temple Smith (1983). The important references are Bould (1968), Chaplin (1980), Chaplin and Martin (1980), Hughes *et al.* (1979), John *et al.* (1976a), Kowalenko (1981) and Ramig and Vandercaveye (1950). Weir and Cresswell (1993) present a table which calls for slightly lower P, K, Mg and higher Ca values.

Nutrient Concentration Range

Nutrient	Deficient	Marginal	Critical (deficiency)	Adequate	High	Toxic or Excessive	Comments
N (%)			2.3	2.4–4.0			
P (%)	< 0.2		0.2	0.3–0.6			
K (%)	< 1		1.5	1.5–3.0			
Ca (%)	<0.5			0.6–2.5			
Mg (%)	<0.25		0.3	0.4–1.0			
Cu (mg/kg)	<1			2–50			Excess may be due to fungicide residue
Zn (mg/kg)	<13			34–80			Excess may be due to fungicide residue, or foliar nutrient sprays
Mn (mg/kg)	<20			80–300	>1000		Excess may be due to fungicide residue, or foliar nutrient sprays
B (mg/kg)				25–80			Leaves are not reliable indicators of B toxicity as B is mobile in raspberry. Fruit samples collected at maturity may be more reliable (Brown 1996). Standards are not presently available. In non fruiting or slow-growing trees there may be no opportunities for B redistribution and classic B toxicity symptoms may occur. Kowalenko (1981) found inconsistent B concentrations in leaves within and between seasons and casts doubt on the use of B levels in leaves for predicting B fertiliser requirement. The fact that B is mobile may explain this observation.

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Table 2. Fertiliser guidelines

Age	Nitrogen	Phosphorus	Potassium
2 nd year	60- 100kg/ha	40- 60kg/ha	80- 100kg/ha
Mature	80- 140kg/ha	60- 80kg/ha	100- 140kg/ha

Soil and leaf tests are useful to tailor fertiliser needs to the crop. Leaf samples should be taken shortly after harvest (2–3 weeks from final pick), and should be taken between the 5th and 12th primocane leaves. Table 3 contains the leaf analysis guidelines for raspberries.

PESTS AND DISEASES

Insect Pests

Insect pest damage is not usually severe, but some pests become more troublesome in some seasons. Wingless grasshoppers are a major problem and can destroy fruit, leaves and canes. Growers should avoid planting raspberries in areas where wingless grasshoppers are a regular pest; especially where there are no other horticultural plantings.

Rutherglen bug is a sporadic pest that can cause significant damage to ripening fruit in a short period of time. Carpophilus beetle may be a problem when berries are grown near stone fruit and citrus. Removing rotten fruit helps to control them. Other pests include light brown apple moth, two spotted mite, plague thrips, scales and Queensland fruit fly.

Wingless Grasshopper *Phaulacridium vittatum*

Host plants

Grasshoppers breed in pastures, but will feed on a wide range of plants.

Description

Adults are 12–18 mm long and grey-brown, usually with short non-functional wings. A few insects will have functional wings. The young stages are mainly grey brown and are wingless. The insect over-winters in the egg stage. There is one generation each year.

Damage

Damage to berry crops occurs from early to mid summer onwards, when hoppers move from pastures and weed growth that has dried out. They feed on leaves and berries. If in

large numbers, they can defoliate the vines.

Control

Spraying the plants with a suitable insecticide can protect them for short periods of up to a week. Boom spraying a barrier strip 20 to 50 m wide on headlands or pasture around the planting will delay re-infestation.

Rose Scale *Aulacapsis rosae*

Host plants

Roses, raspberries, black berries and loganberries.

Description

Female insects are flat, white, rounded and 2.5 mm across. Male scales are smaller and narrow. Eggs are laid in batches of 40. A second batch is not uncommon. Crawlers are pale red in colour. The females live for almost a year; several generations may be present at the one time. If numbers are high enough the scales will form a white crust on the bark.

Damage

Scale insects suck sap from the canes of the raspberry plant. If left unchecked canes will weaken and become less productive.

Rose scale on raspberry canes



Control

Pruning out badly affected canes. Spray with a registered insecticide.

Rutherglen Bug *Nysius vinitor*

Host plants

A wide range of weeds and crop plants.

Description

Adult bugs are about 5 mm long with narrow bodies. They are grey-brown, with silvery wings folded flat over the back when at rest. The young stages are reddish brown, pear shaped and wingless. The adults breed mainly on weeds. In some years they become a serious problem when the weeds dry out and the bugs migrate onto crops.

Damage

The bugs suck sap from the foliage, which wilts. They also feed on developing berries, leaving them shrivelled and malformed.



Fruit damaged by Rutherglen Bug. Note discoloured sections on ripening berries.

Control

Spraying the crop and nearby weeds with a suitable insecticide can be effective. Repeat treatments at short intervals are needed in plague conditions, when re-infestation occurs rapidly.

Diseases

The major diseases are cane spot and spur blight, which can be readily controlled. Other diseases such as rust, crown gall and botrytis rots are common. In recent years phytophthora has caused major damage, as it is not easily controlled.



Wilting and death of foliage caused by *Phytophthora*.

Phytophthora Root Rot, *Phytophthora fragariae* var. *rubi*

Host plants

Raspberries.

Damage

Phytophthora fungi attack the roots, causing them to rot. Feeder roots become scarce and root buds may also be killed. The fungus can spread up through the crown, killing canes.

Appearance

Symptoms appear when the plant is in full growth, usually in spring or early summer. At this time fruits are also developing. The tips of the new canes (primocanes) wilt and the leaves die from the edges inwards. The tissue staying alive may become water-soaked. If floricanes are infected the flowering laterals either do not emerge, or wilt before fruit sets. The disease is favoured by wet conditions.

Control

Ensuring that the planting site is well drained will help avoid the problem. Raspberries resistant to the disease are currently being bred in Victoria.



Anthracnose spots on raspberry leaves.

Cane Spot (Anthracnose) *Elsinoe veneta*

Host plants

Loganberries and raspberries.

Appearance

This fungal disease appears on the canes as many grey sunken spots with purple margins. The spots, which are 1.5–3 mm in diameter, sometimes occur on the leaves. Spots may be numerous and join together to kill large areas of the bark. The fungus over-winters in primocanes and fallen leaves. Anthracnose or cane spot is present in most plantings.

Control

All varieties are susceptible, but it can be controlled with registered chemicals and removal and burning of old fruiting canes after harvest.

Spur Blight *Didymella applanata*

Host plants

Raspberries and loganberries.

Appearance

The symptoms are most obvious in late summer and autumn when reddish-brown, shield shaped areas spread around the base of leaves and buds on primocanes. The infected areas become silvery grey and black fruiting bodies appear on the surface. The fruiting buds are killed, but the canes survive. Spur blight may often be the culprit of poor bud break in floricane crops.

Control

Spur blight can be controlled with an appropriate fungicide. Infected canes should be removed and destroyed if fruiting bodies are present.

Raspberry Bushy Dwarf Virus (RBDV)

Host plants

This is the most common virus disease reported in *Rubus* crops. It is carried in pollen, and is spread by bees and other insects.

Symptoms

Yellow flecks or splashes on the leaves and poor drupelet set. Fruit are crumbly and malformed. The yellow discoloration distinguishes it from damage caused by sucking insects or senescence.

Control

Viruses are incurable in the field, and infected bushes should be destroyed after testing confirms the virus. All plants should be purchased through certification schemes to avoid the problem.

HARVESTING AND MARKETING

Labour requirements

Raspberries are a labour intensive crop, especially at harvest. Picking usually occurs every two to four days depending on temperature. One hectare of raspberries needs up to 20 to 30 pickers for hand harvesting at peak times.

The harvest season may last between 4 and 12 weeks, depending on the variety and season. Winter pruning and tying may take 125 to 150 hours per hectare. Experienced berry fruit pickers are often hard to find and new staff will take time to train. The industry standard for picking rate is about 10 punnets per hour.

Mechanised harvest is limited to larger enterprises that produce for processing. Shelf life is shorter for mechanically harvested fruit. An enterprise needs to be at least six to eight hectares before mechanical harvest is feasible.

Packs of early raspberries ready for sale.



It should be noted that if processing is the eventual aim, then an on-farm freezer unit is also needed.

Maturity indicators

The fruit is picked at three-quarter colour. The fruit should separate easily from the core, but be firm enough to handle easily. Fruit can be packed directly into punnets in the field, but for best quality and market prices, some shed grading is advisable. Ideally fruit should be packed and cooled within two hours of picking.

Packaging

Raspberries are packed in 200 or 250 g punnets. Nine to twelve punnets (with lids) are packed per tray. Soft berries will not travel well and the fruit will settle during transport. Punnets or trays are packed into cardboard cartons for transport.

REFERENCES

- CSIRO 1997 *Plant Analysis- an interpretation manual*. 2nd edition, CSIRO publishing. Australia.
- Jennings, D.L. (1988). *Raspberries and Blackberries: Their breeding, Diseases and Growth*. Academic Press.
- McGregor, G (2001). *Blowing a Raspberry at Phytophthora*. Good Fruit and Vegetables. April 2001
- McGregor, G *et al* (2000). *Raspberries and cultivated blackberries: pests and diseases- Agriculture Notes*. Natural Resources and Environment. Victoria.
- McGregor, G (1996). *Raspberry varieties- Agriculture Notes*. Natural Resources and Environment (NRE). Victoria.
- Menzies, A.R. *Raspberry Growing in New South Wales, Agfact H3.1.46* first edition 1986. NSW Agriculture.
- Thwaite, W.G. and Wakefield, S.M. *Insect pests of berry fruits, Agfact H3.AE.2* first edition 1985. NSW Agriculture.

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