Rasberries and blackberries: Establishment and management

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Cultural requirements

Raspberries require well drained, deep soil. They do not tolerate heavy clay soils, or shallow soils, or prolonged water stress. They can tolerate heat in summer, but hot wind will devastate new growth and economic viability. The floricane fruiting (spring and summer) raspberries require adequate winter chill to fully and evenly break dormancy in spring. They are therefore unsuited to coastal areas of temperate Australia, or any subtropical regions. The primocane fruiting raspberries have a lower chill requirement and will crop in warm temperate regions. The cultivated blackberries will grow on a wide range of soils provided that drainage is adequate. Their winter chill requirements are lower than floricane fruiting raspberries. The late season thornless cultivars have a high water requirement for adequate growth and will not perform well on soils which dry out in late summer.

Site selection

The general limitations to Rubus (raspberry and blackberry) production are outlined above. Provided that these conditions can be met, the site should be chosen firstly for protection and secondly for slope.

The site must have adequate wind protection. Under extreme conditions, wind damage is obvious, as broken laterals and tattered leaves, however losses are more commonly experienced before damage is obvious. Wind stress more frequently causes plants to appear unthrifty - leaves, canes, fruit and fruiting laterals are smaller than on sheltered plants, and response to fertiliser or irrigation is poor. Raspberries tend to produce excessive numbers of short thin canes in windy conditions.

The primary factor dictating row orientation is slope. Rows should be established up and down hills, and not across hillsides. Where the choice exists, rows should be oriented north-south, for even interception of sunlight. East-west rows will ripen earlier on the sunny side by up to ten days, and risk greater sunburn damage to fruit on the north-facing side. South facing slopes are preferred to north-facing slopes, to (1) reduce exposure to north winds in summer, and (2) reduce soil and air temperatures.

Frost is not a problem to Rubus crops, and neither is snow, unless it falls after bud burst and breaks canes. Loganberries, and the American thornless blackberry cultivars will all benefit from afternoon shade, as they are sensitive to sun-scald, which causes individual drupelets to turn pink and appear burnt, or cooked. Sunscald can

affect autumn raspberries, but they are less sensitive than the late - season blackberries. Some commercial growers construct shade protection in the form of individual row covers, or alternatively mount shade cloth over entire plantings.

Gentle slopes are to be preferred to flat country unless drainage is perfect. Steep slopes cost money.

Plantation layout

The opportunity to plan a plantation entirely free of constraints rarely arises; usually, topography and existing farm features such as windbreaks, tracks and boundaries define some limits to future plantings. Where it is possible, rows for hand harvesting should be no longer than 70 m. If the field dictates rows longer than 70 m, rows should be broken in the middle to facilitate traffic between rows. Without such breaks, pickers may be forced to walk long distances. Depending on region, blocks should not be longer or wider than 150 – 200 metres, to allow for windbreaks. Where possible, favour square blocks, particularly on slopes where irrigation layout is complicated by pressure differences. On slight slopes or flat fields, a ratio of length to width of 2:1 offers an optimal compromise between efficient tractor use and trellis construction (both optimised by few long rows) and irrigation establishment and pumping costs (optimised at square blocks). For most berry growing enterprises, the most frequent need to move from one area to another will arise at harvest time. A berry crop may be picked over 6 - 10 times, and require 3 - 4 visits on each harvest day. It is therefore imperative that the shortest working distances be from packing shed to fields. Ideally, the packing shed will be situated in the middle of the blocks or fields of berries.

Leave headlands of 10 m by boundary windbreaks, and 8 m elsewhere.

Rows are established at spacing of 2 - 3 m. There are two considerations which determine row spacing, namely the machinery which must travel between rows, and secondly the influence of alleyway width on plant growth.

Tractors and 3-point linkage machinery such as sprayers are available to suit alleyway widths from as narrow as 2 m. Harvesting machines currently require rows to be 3 m apart. Raspberries will benefit from close row spacing, as the rows of established plants shade the soil and reduce soil temperature, and production per plant as well as per hectare is increased by narrow alleyways.

Blackberries cannot be managed at such narrow spacings, and they tolerate higher soil temperatures. The trailing blackberries can be managed at 2.1 m spacing, but the semi-erect blackberries require at least 2.4 m spacing, as the canopy of the semi-erect blackberries spreads wider than the canopy of the trailing blackberries.

Windbreaks

There are several good publications available on design, establishment and species selection of farm windbreaks, and the information offered here is solely an outline to direct consideration of appropriate windbreaks.

There are several regions of Australia where soils, rainfall and climate are ideally suited to berries but where few are grown, due to persistent wind. In such places, fields cannot be larger than 100 x 50 m before plants show wind damage. Yield suffers before damage is visible. There are very few regions where large (over 5 ha) plantings can be successfully grown without windbreaks. In a DEPI field site where plants were established in 120 m rows perpendicular to a large established windbreak, cane height was reduced by 40% at the windy end of the rows.

Windbreaks are designed as either boundary windbreaks of multiple layers of plants of differing heights, or subdivisional windbreaks of a single row of one species.

Boundary windbreaks usually comprise a tall species, such as a tall Eucalypt of 20 - 30 m height, an intermediate species such as a smaller Eucalypt or Casuarina, and a third row of a tall shrub such as an Acacia, Melaleuca, or Callistemon. Sub-divisional windbreaks are usually compact trees chosen more for density than spread, such as Eucalyptus nicholli. The New Zealand practice of using hybrid willows (Salixmatsudana x alba) e.g. "Aokaotere", "Moutere" etc which require root and limb pruning has not been adopted in Australia, and the willow hybrids have not found favour because of their tendency to drop their leaves in late summer unless they are well watered. The most successful exotic for subdivisional windbreaks is Populus yunnanensis, the Yunnan poplar, which retains its leaves for longer than the more common European poplars, and does not sucker.

There are no universal windbreak species. Consult local tree planters to determine the species most appropriate to your needs. Windbreak trees should be regarded as a crop. They will repay adequate soil preparation and weed control, and usually benefit from wind protection themselves. When newly planted, protect with polythene tree tubes, up to 900 mm high, which are held rigid with stakes around young trees. Use the same pre-plant soil preparation as you would for a berry crop. Once the windbreak is 4 – 5 years old it will become self-mulching and weed control will no longer be necessary.

Soil preparation

The aim of soil preparation is to produce a weed-free soil of optimum pH, fertility and soil structure. The inputs and effort required to achieve this objective depend on soil type and history of use. The following notes refer to establishment from pasture. Soil preparation should commence at least twelve months prior to planting, to allow adequate time to establish:

- complete eradication of perennial weeds, such as sorrel and couch grass
- optimal pH of 6.0 - 6.5
- optimal structure, via organic matter and timely working to a fine tilth.

A soil test should be used to determine whether liming is required, and the land ploughed and cultivated in conjunction with weed suppression measures. Several companies offer soil tests of differing levels of detail and price. Given the cost of fertiliser that can be wasted through ignorance, soil tests are cheap and excellent value. Check with local suppliers for registered herbicides appropriate for the weeds present. Once the crop is established, weed control is much more time consuming and dangerous to crop health, and in the case of some persistent perennial weeds it is never entirely successful post-planting.

Green manure crops should be established in the autumn or winter one year prior to planting the berries; obtain the Agnotes on green manures, or check with local suppliers to determine regional best practices for green manure crops. Cereals, lupins, ryegrass, and mixtures such as oats and field peas, or oats, peas and rape are commonly used. As a guide, oats and peas are commonly used at 50 kg peas plus 100 kg oats per ha, and rye corn at 50 kg/ha. Remember that a green manure crop must be grown as a crop to be at all useful; pH adjustment and adequate fertility must be achieved prior to planting the green manure crop.

Once the green manure crop is incorporated, the soil should be left fallow. If time permits, a second green manure crop can be managed between spring incorporation of the first green manure crop, and final planting. Annual rye grass can serve well in this situation as it matures quickly if sown in early autumn, and decomposes quickly prior to planting. Use the soil preparation at this time for thorough weed suppression, especially of troublesome perennial weeds such as sorrel and couch grass.

If animal manure is available, it should be incorporated before establishing the green manure crop, so that it is well broken down before establishing the berries. Rates of farm-yard manure as high as 70 tonnes/ha are used overseas where feed-lot manure is available.
In autumn of the establishment year, a further soil test should be used to determine the proportions of N: P: K to be applied pre-planting, and the possible requirement of additional lime. Lime should be applied in autumn, and incorporated. This cultivation will also kill weed seedlings. Fertiliser should not be applied at the same time as lime, but several weeks later, to avoid chemical reactions between lime and fertiliser which can lead to loss of N through volatilisation of ammonia. Apply NPK fertiliser as recommended by the soil-testing company and incorporate. All varieties will grow in acid soils, but optimum yields are attained at pH 6.0 - 6.5. In soils such as kraznozem soils, which "lock " phosphate into insoluble and unavailable forms, some growers drill bands of superphosphate 300 mm on each side of the planting line prior to planting.

Given the high returns possible from raspberries, it is possible in some areas to ameliorate poor soils sufficiently to support raspberry production, through the use of lime, gypsum, and massive quantities of organic matter. However such an approach cannot economically support production for sale through wholesale markets. Heavy clay soils can, with much amelioration, support good growth of raspberries, but plantings tend to be short-lived as organic matter decays and the soils gradually compact.

Planting material

It is important that only healthy stock should be used to establish a plantation. The Agnote Raspberries and cultivated blackberries: use of healthy planting material outlines the reasons for the establishment of the Rubus multiplication scheme currently managed by the Australian Rubus Growers Association. Multiplication from established blackberry stock is simply achieved by covering canes with a 50 mm layer of stable manure in autumn and allowing roots and new shoots to develop at the nodes, or alternatively by simply allowing cane tips to form roots and new shoots where they touch the ground. Tip-plants are dug in late winter. Raspberries are propagated either by breaking up old crowns, or by digging suckers along the rows of established plants. Before propagating your own plants, ensure that the stock plants are not subject to any law or contract restricting propagation; many Rubus cultivars are sold under commercial contracts which specifically forbid self-propagation. Most Rubus plantings will last over ten years in good soils, so it pays to start with stock of the highest possible quality, even if the initial price is higher.

Bed preparation

Blackberries

It is conventional practice on well drained soils to grow blackberries without hilling. If in doubt, hill beds rather than plant on a flat unhilled bed.

The alternatives are to: grade the plantation into a "saw-tooth" bed structure, which will facilitate mowing between rows, or (2) to plough up raised beds, and leave the alleyway flat for either mowing or tilling to control weeds. The saw-tooth land form is more commonly seen in orchards, and is achieved by ploughing on to the bed centre with a disc plough, and following with a grader blade. Raised beds are formed using a Merbein plough, or bed former. If polythene mulch is to be used, it is generally applied over raised beds. Both land forms aim to raise the top of beds, at the planting row, about 300 mm above the lowest point at the centre of alleyways. All options have their limitations, and the choice depends on soil type, topography, rainfall patterns and intended harvesting methods. It is advisable to discuss these options with established growers in your area, or a similar region.

Blackberry plants are established at 1.5 - 2 m spacing in rows 2 - 3 m apart, dependent on the machinery to be used for subsequent management operations. Once established, they need protection from weed competition and water loss from the soil surface. This is most effectively achieved using black polyethylene mulch film, similar to that used for strawberry production. The alternatives are: woven polyethylene fabric, which has a longer life but costs much more; straw or stable manure mulch, which is entirely beneficial but very expensive in labor costs; or bare soil, kept bare by chemical or mechanical weed control.

Polyethylene can be laid by hand, but for larger areas a tractor -mounted machine is preferable. The machine can be hired from some polyethylene suppliers or a contractor may be hired to form and mulch the beds. Where polythene is to be used, beds should be formed and rolled several weeks before applying the mulch film, to allow soil to consolidate so that the mulch film will remain tight.

Some growers avoid polythene mulch due to the problem of removal and disposal once the material begins to disintegrate; the savings in weed control must be assessed before embarking on this strategy.

Raspberries

Bed shape can be either "saw tooth" as described above for blackberries, or raised beds with flat alleyways. The latter method is more common, and preferable for mechanical harvesters. Raspberries are grown in some soils without hilling at all, however the current concerns regarding root rots and the insurance offered by raised beds may see hilling become the norm.

Raspberries are not normally grown through black polythene mulch. In cool climates this practice is very cost-effective for 3 - 4 years, but then presents the complication that the plastic deteriorates, leaving a mass of roots exposed , which sucker profusely and show unusually shallow soil penetration, and are thus prone to drying out. In warmer climates, black polythene has the additional disadvantage of heating the soil beyond the optimal soil temperature for raspberry roots of 16 degrees. Other forms of mulch such as straw can be used; they are expensive to handle due to the volume required, but are effective in retarding soil moisture loss, and suppressing weed growth. Nitrogen (N) is tied up in microbial decomposition of some organic mulches, and made temporarily unavailable to the crop; beware of creating a N deficiency through the use of mulches deficient in N such as sawdust, without adding a supplement.

Planting

Blackberries

Planting is carried out in July - September. Planting distance is dependent on variety and trellis system to be used; see the agnote Cultivated blackberries: pruning and training. Conventional 1.8 x 2.7 m spacing requires 2050 plants per hectare. Plants should be buried to the same depth at which they grew in the nursery.

Planting holes can be cut in black polyethylene mulch film with a sharpened tin, or sharpened piece of 100 mm water pipe, or burnt with a proprietary gas-powered burner. The object of cutting a neat hole is to avoid sharp corners or simple slits, which provide a focal point for tension, and subsequently allow tearing of the mulch film. Rooted cuttings should be trimmed back to two buds. Reject any thornless Boysens, Logans or Youngs which have reverted to the thorny forms. Where polythene mulch is not used, pull a furrow and plant into the furrow, and smooth the surrounding soil when the new plants are in position

Raspberries

Raspberry canes are buried to the same height as they grew in the nursery (recognised by soil on the plants). It is normal practice to leave the "handle", or short piece of cane, attached to the root system, although its yield is of no value. Some growers prefer to cut the handle off the roots once the canes are established in the planting furrow, however no advantage has been demonstrated for either removing or retaining. Raspberries can also be established from root pieces alone, and from small suckers.

Spacing depends on preferred management options; for hedgerows, canes are planted at 250 - 300 mm spacing, and for stoolbeds at 600 - 800 mm. Refer to the Agnotes Raspberries: cane management of maincrop cultivars for discussion of these options for spring –summer cropping raspberries. The autumn-fruiting raspberries are established as hedgerows.

Planting density depends on the expected yields in the first fruiting season; by the second fruiting season, a well-grown plantation will have achieved optimal cane density through the natural propensity of raspberries to"fill in the gaps". To achieve high yields in the first fruiting season, stoolbeds (separate crowns, as distinct from a continuous row of canes) are established using two canes at each planting site. At 3 m row spacing, one hectare comprises 3300 m of row, which requires 3300 x 1/0.6 (the 0.6 = crowns at 600 mm or 0.6 m spacing) = 5500 crowns per ha. At 800 mm spacing, there are 4125 crowns per ha. The economics of using one or two canes per crown are strongly influenced by local conditions; there is no overall correct practice. In some regions, establishment is always slow, and two canes per crown will not result in rapid establishment; in others, establishment is so rapid that two canes per crown are unnecessary.

Autumn -fruiting cultivars are planted at 250 - 300 mm spacing, at one cane per site. At 300 mm spacing , one hectare will require 3300 x 1/0.3 = 11,000 canes. You should determine current best practice for your area before ordering canes.

Trellis construction

Refer to the Agnotes, Raspberries and Cultivated Blackberries: trellis construction for notes on the principles of trellis construction. Specific details for each crop are discussed in Raspberries: cane management and Cultivated blackberries: pruning and training.

Irrigation

Overhead sprinkler irrigation can be used where water and pumping costs are minimal, and is preferred for late season varieties grown on light soils with low moisture retaining capacity. In all other circumstances, microspray or trickle irrigation are the preferred choices.
The design of trickle irrigation systems is discussed in the Agnotes related to design of Low-flow irrigation systems. Most major suppliers of irrigation equipment operate a design service.

Water application should be governed by tensiometers, which are purchased from irrigation suppliers. Where drippers are used in conjunction with black plastic film, drippers should be situated between plants as well as at crowns; water can be led under the black plastic by means of extension tubes to which are fitted button drippers. Where in-line drippers are preferred, the irrigation line will need to be laid underneath the plastic, as for strawberries.

During peak demand, a plantation may require 4 litres per hour per metre of row for up to 8 hours per day. Inadequate watering will result in reduced fruit size plus reduced growth of new canes, and a subsequent loss of potential yield in the next season.

Fertilising

The principle behind fertilising is to replace those elements removed as fruit plus those elements, which are tied up in canes, and subject to a slow recycling process. The balance required should be determined by leaf analysis in February but will in general involve approximately equal proportions of NPK. The quantity will depend on local factors, but will usually be from 50 to 100 kg a.i. N (active ingredient Nitrogen) per hectare. As an example, 100 kg a.i. N as NPK - 8:11:10 would require 1250 kg/ha or 400g/m of row. Inappropriate fertiliser practice can waste much more money than is saved by not paying for leaf analysis.

Inorganic fertilisers are usually applied in split applications, starting in August - September, and again in November - December. Autumn-fruiting cultivars are sometimes "topped up" with side-dressings during fruiting in February - March. Excessive rates of N will cause fruit to become soft; lack of fertiliser will reduce fruit size. Do not fertilise too late into the growing season or cane growth will remain soft until winter, risking winter injury from frost and in some cultivars, reduced spring bud burst through failure to become dormant early enough in winter to accumulate winter chill. Where drip irrigation is used, fertiliser can be added via the irrigation system. This practice is sometimes known as "fertigation". It offers the most precise and continuous form of fertilising. There are few elements, whose solubility in well-managed soil that would otherwise support Rubus crops, is so low that they require to be applied as a foliar spray. Check the unit price of each element in foliar nutrient sprays before embarking on foliar nutrient application.

Organic manures should be applied in August to allow time for decomposition to release nutrients to plants. Where organic manures are used as a mulch, more than one source or form may be required to avoid imbalance and subsequent loss of potential yield.

Do not apply NPK fertiliser only into planting holes where black plastic mulch is used; it can be broadcast along the edges of the mulch and allowed to leach into the root zone of the plants.

Weed control

Weed growth in planting holes is minimised by the use of mechanical tillage, and/or herbicides, prior to bed formation, when the field is bare of crop plants. The importance of pre-planting weed control cannot be overemphasised, as once the crop is planted the problem of weed suppression is more difficult. Weed control in the absence of polythene mulch is more difficult; there are no post-emergence herbicides currently registered for use with Rubus plants which may safely be sprayed on the crop. Consult your farm chemicals supplier for herbicides which may be used around Rubus crops.

There are no pre-emergence herbicides registered for weed suppression immediately after planting the crop.

Glyphosate is registered for use around raspberry crops over three years old, but extreme care must be used not to spray the crop. In the relatively mild winter conditions of Australia, Rubus plants never achieve a sufficiently deep dormancy to be unaffected by systemic herbicides. The difficulty lies in avoiding small semidormant shoots at ground level; these shoots will translocate glyphosate to the mother plant and cause considerable damage.

Alleyway management

Where crop plants are mulched with polythene, alleyways are generally maintained as grass sward. There is some interest overseas in evaluation of the most appropriate species for alleyway cover, based on considerations of green manure value, competition for moisture, ability to suppress weed growth, and possible allelopathic effects on soil-