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Blueberry production in northern NSW

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Introduction

Blueberries are a native fruit of North and South America, Asia and Europe. They were first introduced into Australia in the early 1970s. The cold climate 'Northern Highbush' varieties are suited to Victoria, the southern highlands of New South Wales and Tasmania.

By 1978 it was recognised that the warmer climate 'Southern Highbush' and Rabbiteye varieties from the southern states of America would grow on the New South Wales North Coast and produce high value, early season fruit.

The season starts in June with small amounts of fruit, peaks in October/November and continues into December/January, depending on the year. (Rabbiteye peaks in December/January.) As new varieties are released, a consistent supply of blueberries will be available throughout the season.

Varieties

The commercial blueberry industry in North America began from selections of wild plants of the Highbush species *Vaccinium corymbosum* and *V. australe* made by FV Coville in 1909. Since then, breeding and selection have produced a wide range of Highbush cultivars suited to regions of cold winters. The Rabbiteye blueberry *V. ashei* is native to the warmer southern states of the USA (Florida, Georgia, Alabama) and commercial cultivars have been bred and selected to suit regions where winters are milder. Southern Highbush cultivars (*V. corymbosum hybrids*) are a third group of cultivars suited to warmer and milder climatic regions.

The NSW north coast blueberry industry is based on varieties of both the Southern Highbush and Rabbiteye varieties. The Northern Highbush is not suited to subtropical areas as they have a higher chill requirement. Only a few selections have proven to be of commercial value:

- Southern Highbush varieties are Sharpeblue, Misty and Biloxi
- Rabbiteye varieties include Climax, Powderblue, Tiffblue, Brightwell and Premier.

Over the next few years, newer varieties will be released from current breeding programs and they will replace some of the existing varieties. These newer varieties will have the benefit of a number of improved characteristics such as greater disease resistance, increased yield, larger berry size and more even ripening. Many of these varieties have Plant Breeder's Rights (PBR) attached and growers may only be able to gain access to them by entering into licensed agreements with plant breeders.

Intending growers should discuss varietal suitability with reliable nurseries and officers of the NSW Department of Primary Industries, (NSW DPI) to ensure their suitability for a particular location.

Climate

Blueberry varieties require differing amounts of chill hours for normal flower and fruit development.

Figure 1. Southern Highbush blueberries showing 'bloom' on fruit

Generally, this is the cumulative number of hours below 7.5°C in autumn and winter. Southern Highbush varieties generally require 250–450 chill hours.

However, due to early flowering of blueberries on the North Coast, growers need to avoid frost prone areas as this may damage foliage, flowers and fruit.

Whilst local knowledge of frost frequency and severity can be useful it is better to use devices such as thermographs, digital data loggers or maximum/minimum thermometers to determine if the specific area is frost prone.

Hail prone areas should be avoided as hail can not only ruin the current crop but damage buds for the following year's crop and also predispose plants to disease.

Site selection

Selecting a suitable site for blueberry production is extremely important. By selecting a suitable site, many potential problems can be avoided. The main criteria for assessing the suitability of an area for blueberry growing are soil type, water availability, aspect and slope.

Soil type

Blueberries prefer a deep, well-drained soil such as coarse sandy loam or Krasnozem, high in organic matter but low in clay. On poor sites, growth is weak and production is low. Plantings on poorly drained, compacted soils are less vigorous and they may develop root problems resulting in plant losses.

Blueberries grow on a wide range of soils but prefer a well drained acid soil with pH (water) of 4.5–5.2 for Highbush and up to 5.5 for Rabbiteye varieties. Soils high in organic matter (above 5%) are preferred as they retain nutrients in the root zone rather than allowing them to be leached.

The water table in the soil should be at least 90 cm below the surface during the wettest part of the year. This is essential as blueberry roots will rot if water logged. A poorly drained soil will allow root diseases to flourish and may cause plant death.

Avoid heavy soils. Soils must be well aerated at all times for optimum plant growth. Soils with a high clay content or those that become compacted may result in poor plant growth.

Water and irrigation

Blueberry plants have a shallow, fibrous root system and as such require supplementary irrigation throughout the growing season. Water storage facilities of 2–3 megalitres per hectare are required for blueberry production.

Growers should have their water supply tested to ensure its suitability for blueberry irrigation. This is especially important for bore water during times of drought as the quality can change rapidly, making it unsuitable. Blueberries are sensitive to saline water. Water with a salt reading less than 0.45 dS/m (decisiemens per metre) is suitable for blueberry production.

Irrigation systems should be designed by professionals to ensure that all plants receive the optimum amount of water. The irrigation system is also generally used for nutrient application which is called 'fertigation'. Over-watering creates anaerobic soil conditions which lead to root diseases.

Peak water demands occur during the periods of fruit set and fruit growth. Inadequate watering in the final 2–3 weeks of fruit growth can seriously reduce berry size and lead to small fruit and fruit not ripening. Another critical period is February and March when floral initiation for the following season's crop occurs. Inadequate irrigation in heatwave conditions will result in wilting and dieback of tender shoots and shrivelling of berries which then drop. During periods of high temperatures it may be necessary to irrigate twice a day.

Good filtration is essential to ensure that all algae and sediment is removed to avoid blockages which could lead to plant deaths. Regular flushing of the filter and irrigation system will ensure that plants get adequate water for their demands at all stages of growth. A rule of thumb guide for irrigation is to allow for 25 mm per week during the growing season with bursts of up to 38–40 mm in the final two weeks of fruit growth. Minimal irrigation is required during winter. A mature plant requires 100–150 litres of water per week. This is best applied in small amounts on a regular basis to keep the root zone at optimum moisture levels. Avoid over-watering young plants once they are established.

There are many devices that will assist the grower with water scheduling. Some of this sophisticated equipment is very costly but tensiometers are relatively cheap and accurate if they are properly installed and maintained.

Aspect

A north to north-easterly aspect is preferable to give maximum sunshine hours and the earliest production. Whilst other aspects can be used you will find south-facing slopes will be cooler and hence produce a later crop. South-facing slopes are also more prone to frost and severe wind damage. Planting on gentle slopes allows cold air to drain out of the orchard and helps to reduce the potential for frost damage. Tall timber belts at the bottom of the slope can act like a dam wall and cause cold air to back up and can push frost back into lower areas of the crop. Cutting breaks through the timber will avoid this.

Shelter

Exposure of plants to hot drying winds can cause desiccation of young shoots and flowers, resulting in dieback and early fruit drop. This is most likely to occur when irrigation has been inadequate. Adequate shelter from strong winds is essential. If not available naturally, windbreaks should be planted ahead of crop establishment. Consult your local NSW DPI horticulturist for suitable species. Remember to irrigate and manage windbreak trees as you would any other crop. Most windbreak species require regular canopy management to maintain height and growth at lower levels.

Site preparation

Establishing an orchard is costly, and this investment can be jeopardised if sound planning and management strategies are not adopted. Refer to Primefact 133 *Establishment and production costs for blueberry*

A complete soil test is essential to determine any nutrient deficiencies or imbalances. These are best carried out prior to mounding as this ensures a thorough mixing of the soil. Information on soil sampling can be obtained in the NSW DPI publication *Soil Sense – Soil management for north coast farmers.*

Soil improvement is advisable. Ideally, soil preparation should commence a full 12 months before planting. This allows for correction of nutrient deficiencies, weed control, improvement of soil organic matter content and structure.

Current industry best practice is to herbicide and then cultivate the whole site to eradicate all vegetation before sowing a green manure crop. Sow a green manure crop appropriate to your district and time of year. Top-dress with a fertiliser as determined by the soil test. Growing a green manure crop will benefit the soil by building up the organic matter, and will assist in weed control. Allow the green manure crop to grow for up to six months but cultivate before flowering commences. Plough or rotary hoe the green manure crop and then form beds using an offset disc plough or a bed former. A cover crop should then be sown in the inter-row to stop erosion.

Bedding up ensures adequate drainage, particularly on flat land. The planting beds should be 1.2–1.4 m wide at the base and 0.4 m to 0.6 m high at the centre. This allows machinery access between the rows. The inter-row space is best sown as a grassed area which can be mown and the cuttings used as extra mulch around the plants.

Some specialty machines can lay irrigation lines on top of the bed and install plastic mulch over it at the same time. If this machinery is not available then install irrigation manually prior to putting plastic mulch over beds and securing. Some growers use natural mulch instead of plastic to suppress weeds. These include products such as hardwood woodchips and pine bark fines. Install irrigation prior to planting to ensure plant losses do not occur.

Figure 2. Machines laying plastic mulch and irrigation on mounds.

Planting

Growers need to order plants at least 12 months ahead of planting to ensure the plants are available when needed. Growers need to order the right number of plants of each variety to ensure they have the correct varietal mix for pollination. Plantings usually consist of alternate rows of two varieties that flower at the same time. Some plantings may have two rows of one variety followed by a single row of the other variety.

Plant spacing will vary depending on variety. Generally for Southern Highbush, plant in rows 3 m apart with plants spaced at 0.8 m to 1 m within rows (3700–3300 plants/ha). Rabbiteye varieties, due to their greater vigour, are planted at 1.2 m to 1.4 m spacings within rows (2500–2100 plants/ha). Fruit and flowers on young plants should be removed prior to planting and for the next 12–24 months, to promote vegetative growth. Failure to do this will lead to poor plant growth and predispose them to diseases such as *Phomopsis spp*.

Highbush and Rabbiteye varieties are best planted in late winter or early spring while plants are dormant or before new growth begins. Low chill cultivars, which are evergreen, may be planted at anytime but late winter and early spring are both ideal. This will ensure good root development and rapid shoot growth.

Plants should be watered immediately after planting and in lighter soils mulch can be applied to help avoid moisture loss. Keep plastic or woodchip mulch 40 mm away from the stems at all times as they may cause fungal disease problems.

Experienced growers replant Highbush varieties every 6–8 years and Rabbiteye varieties every 10–12 years under good management.

Nutrition

Local plant nutrition practices for blueberries are not well understood and more research is needed. Many of the nutrition programs are based on North American data. However, regular annual leaf and soil analyses can help to determine the correct nutrition program required for your orchard.

Current best practice in the blueberry industry is to supply nutrients to plants via the irrigation system, which is called 'fertigation'. Proprietary products are used and then adjusted for shortfalls as determined by leaf tissue analysis. More accurate nutritional information relating to varietal differences will emerge as growers become more experienced. There are a number of liquid fertiliser products on the market that are suitable for blueberries that have a 3:1:1 or 3:1:2 N:P:K ratio.

The optimum pH range for blueberries is from 4.5 to 5.2. Soils that have a pH level greater than 5.5 will often lead to the development of chlorosis and iron deficiency, leading to reduced growth. The use of fertilisers based on sulfur and ammonium sulfate to reduce soil pH on marginally high soils has been effective although it is important to start the treatments 12 months before planting. On very acid soils, particularly below pH 3.5 to 4.0, good results have been achieved from the application of agricultural lime or dolomite applied 12 months before planting.

Crop nutrient replacement

This strategy relies on replacing nutrients to the orchard that are exported annually by the removal of fruit, leaves and prunings. It must also account for nutrient losses through leaching, fixation and volatilisation. The fertiliser program should be developed for individual orchards in conjunction with soil and leaf tissue analysis as well as the annual crop production.

Table 1. Annual fertiliser program using liquid fertiliser applied once per week.

Element	Annual total of element required per hectare (kg)
Nitrogen (N)	121
Phosphorous (P)	83
Potassium (K)	55
Calcium (Ca)	15
Magnesium (Mg)	10
Sulphur (S)	37
Zinc (Zn)	0.8
Boron (B)	0.5

Table 2. Foliar nutrient level for blueberry

Element	Low	Adequate	High
Nitrogen %	1.7	1.8–2.1	2.5
Phosphorous %	0.1	0.12–0.4 *0.08–0.17	0.8
Potassium %	0.3	0.35–0.65 * 0.28–0.6	0.95
Calcium %	0.13	0.4–0.8 * 0.24–0.7	1
Magnesium %	0.08	0.12–0.25	0.45
Sulphur %	0.1	0.125–0.2	0.3
Manganese (mg/kg)	23	50–350	450
Iron (mg/kg)	60<	60–200	400
Zinc (mg/kg)	8<	8–30	80
Copper (mg/kg)	5<	5–20	100
Boron (mg/kg)	20	30–70	200

* Indicates level for Rabbiteye varieties

(C.C.Doughty, E.B.Adams, L.W.Martin, 1981. *Highbush blueberry production in Washington and Oregon*)

Leaf tissue analysis

The timing of sampling and the selection of suitable leaves is important to obtain results that can be used to interpret the nutrient status of the plant. The optimum period for sampling blueberry leaves is following harvest. Leaves are taken from hardened 'first flush' laterals just below the fruit clusters. The mid leaves of these laterals should be sampled.

Mulching

The majority of growers use either plastic or organic mulches to protect the raised beds, control weeds, and reduce moisture loss from the root zone. Weedmat is the most popular plastic mulch due to its strength and its ability to allow some rainfall to permeate once it has aged. Some growers place woodchips around the planting hole,

but it is important to ensure that the woodchip does not contact the plant stem as this encourages fungal growth which may result in plant death.

Growers using woodchip rather than plastic mulch need to ensure that they design their beds correctly to keep the mulch from slipping off. An additional problem with woodchip is that pickers disturb the layer which can then collapse into the inter-row leaving the raised bed open to weed growth and moisture loss. Wood mulches gradually break down and have to be continually replaced. Wood mulch, however, provides the added advantage of increasing soil organic matter levels, allowing rain penetration and keeping the root zone cool.

Pruning

Pruning is essential to promote strong new wood, manage plant size and maintain fruit quality. Pruning is also carried out to allow better spray penetration and coverage for pest and disease control. It also makes fruit easier to harvest when using mechanical harvesters.

Poorly pruned or neglected bushes become crowded with weak, twiggy growth, produce small berries and fail to develop strong new wood for future production. Pruning is traditionally practised in late winter in cooler regions, although in northern NSW plants can be pruned at any time from the end of harvest. During the first 2 to 3 years, pruning is limited to removing older twiggy growth at the base of the plant and providing a structural framework that keeps lower fruit off the ground. Removing these lower branches also ensures that fruit is not missed by pickers. Strong new growth may be left as replacement wood.

The removal of flowers for the first 12 months will encourage vegetative growth and generate larger bushes in year two. This reduces the stress on young plants which can weaken them and leave them prone to diseases such as *Phomopsis spp.* which may kill the plant.

Mature plants are pruned to remove old canes that have no strong new wood, and weak twiggy growth. It is important to prune systematically to make the job easier and to be sure that production is not lost. First year canes are not branched and will produce very little fruit in the first season, but they are very important for subsequent crops. Fruit is mostly borne on strong laterals and twigs of second and third year canes. Fourth year and older wood is not productive and should be removed. Cut canes back to the ground or a strong new side shoot. By removing one or two old canes and allowing these to be replaced each year, no canes will be over 3–4 years old.

A basic guide to pruning is as follows.

- Remove any canes damaged by disease, insects or mechanical injury.
- Cut out one or two older canes. Choose the least vigorous.
- Remove low branches and short, soft new shoots that develop from the crown late in the season.
- Remove weak, twiggy wood from the top and outer parts of the plant. Be sure sufficient light can penetrate to the centre of the plant. Weak, twiggy wood produces few flower buds and the berries are small.
- If the plants tend to overbear, tip back the fruiting shoots to remove about one third of the flower buds. These are the fat buds on the terminals of the previous season's growth.

Pollination

Studies in America have demonstrated the value of having bee hives in the orchard to improve fruit set. Whilst commercial honey bees are not the best pollinators to use because of their relative size, they do aid in pollination. Two to five hives per hectare should be adequate for most orchards and can be introduced at or before 5% flowering. Further information is available in Primefact 157 *Honey bee pollination of blueberries.*

Other insects and smaller native bees will also assist in pollination.

Highbush cultivars, while self pollinating, will respond to cross pollination (mainly Sharpeblue) and should be planted with another variety to maximise production and fruit size. Rabbiteye cultivars require cross pollination for successful fruit set. Plant two rows of one variety flanked on either side by another variety. Growers should discuss this with their nursery to ensure the flowering times of the varieties overlap adequately to ensure maximum pollination.

Harvesting

With increased plantings and as existing bushes mature, the availability of labour will become a major issue in the blueberry industry. During the orchard planning phase, a reliable labour supply should be considered when deciding how many hectares to plant. This is due to many growers relying heavily on backpackers, students or itinerant pickers to harvest their crop.

Harvesting blueberries by hand is the main method of removing berries for both the fresh domestic and export markets.

Fruit for use in the culinary trade is mechanically harvested and then processed and frozen. Different sections of the culinary market require different berry sizes and therefore grading on size is essential. Fruit is graded to either greater or less than 12 mm. With mechanical harvesting there are

fruit losses both in the field due to berries falling on the ground and during processing due to damaged and immature fruit being collected by the harvester. Losses may be as high as 30% overall. Mechanical harvesters are expensive and cost around $200,000 landed in Australia. The rate of harvest varies with variety and how well the plants are pruned. Machines can harvest up to 1 tonne / hour and their use is only limited by the throughput of the processing packhouse.

Depending on the quality and experience of the labour available, pickers are paid at either a rate per kilogram or a set hourly rate.

Educating pickers on correct picking methods and berry maturity is essential if a high quality product is to be achieved. Pickers also need to be aware of diseased and pest damaged fruit so that product quality is maintained. Failure to do this could jeopardise our export markets. Fruit should not be picked after rain until moisture has dried from the fruit surface. This also applies to early morning harvested fruit which should not be picked until after the dew has evaporated. Field hygiene is also an important issue for pickers. Since fruit is packed without surface sterilising there is a greater chance of compromising food safety if good hygiene procedure is not followed. Many growers have mobile field toilets and hand washing facilities to minimise this risk during harvest.

Depending on the time of the year, fruit is harvested every 4–14 days. Hand harvest rates vary from 3–14 kg/hour with an average of 4–8 kg/hour depending on age of plants, variety and the uniformity of the ripening.

Hand harvesting of berries is an intensive operation involving continuous hand-eye coordination. A few simple rules which can increase the picking rate are:

1. Tie or strap a small 3 litre collecting bucket around the waist
2. Pick with both hands turned upwards and gently massage the bunches to remove the individual berries. The ripe berries are easily removed. In most cases berries turn dark blue about 1–2 weeks before they are fully ripe. Do not attempt to remove all the blue fruit, just those that come away easily.
3. Whilst transferring the fruit to the bucket your eyes should be selecting the next bunch, so no time is lost looking for fruit.

Once the fruit is picked, it is then taken to a covered vehicle, weighed and its details recorded against the picker's name or number.

Harvested fruit should be removed from the field as soon as possible to avoid heat build up, loss of quality and shelf life. The fruit should be transported to the packing shed, sorted, packed and forced air cooled to around 16°C.

Freshly picked, pre-cooled fruit is packed into 150 g punnets for domestic use and 125 g punnets for export and then placed in trays of twelve punnets for marketing.

An extra 10 g is added at the packaging stage to allow for moisture loss along the supply chain. Growers may face heavy fines for underweight punnets at the retail level.

The packing area should be at no more than 18°C, which will avoid condensation occurring on the fruit, which often leads to post-harvest losses.

The fruit once packed in trays is then stored at around 5°C or transported. Coolrooms are essential to ensure maximum shelf life and quality.

Fruit that is mechanically harvested and processed for the culinary trade is packed in 12 kg cartons and stored frozen at up to minus 18°C.

Yields

Yield will vary with cultivar, age of plant, vigour, management and the growing season. In the first harvest season most cultivars will average 3–4 t/ha. In the second and subsequent years they will average 5–7 t/ha. Some of the newer varieties if well managed can yield 5–8 t/ha.

Marketing

As blueberries are a new fruit to most Australians and to many of our export markets, it is essential that only good quality, fully mature fruit is marketed. Immature berries with low sugar levels are tart in taste and could easily alienate potential new markets.

Growers have a number of marketing options for fresh blueberries.

- Direct sales to wholesalers or retail distributors
- Cooperatives where fruit is bulked by the cooperative and sold under one label to a variety of markets. The advantage lies in cost savings from increased purchasing power for members and the reduction in price competition on the free market.
- Specialty markets such as pick-your-own, tourist outlets or local restaurant trade
- Export is best carried out through a specialist selling agency such as a cooperative or large grower group. This allows them to have control of the product and become a price setter rather than receiver as with most other horticultural products. This method has proven itself for both export and domestic markets.

By professional marketing on a national scale growers can expect to maintain healthy returns for their crop. To achieve this, individual growers prefer to align themselves with larger companies that are experienced in export and domestic sales.

Growers sending plants or blueberry fruit to local or interstate markets will need to check the current entry conditions for those jurisdictions with the relevant plant quarantine authorities before attempting consignment. Currently, both plants and fruit require treatment for blueberry rust, and fruit also requires treatment for Queensland fruit fly. As quarantine requirements can change, it is important that the NSW exporter contact the relevant state or territory quarantine authority to obtain the latest information. Alternatively, they may contact their local regulatory officer or district horticulturist, who can help them source this information.

Weed control

Weed control is essential and should commence before the soil is prepared or beds formed. The use of herbicide, competitive green manure crops and a fallow period prior to planting will help to reduce the resident weed population.

The use of weedmat on mounded beds is excellent for preventing weeds. The addition of good mulch around the planting hole will further reduce weed problems.

In the first year it is best to avoid the use of herbicides as young plants have shallow roots that if exposed could lead to herbicide damage. The young tender green bark is also very susceptible to herbicide damage. Hand weeding in the first year is preferable and if done regularly before the weeds get too advanced or set seed, will give the plants a good start. Weeds will compete for nutrients, water and light, harbour pests and retard the growth of the plant. If weeds are allowed to grow too large, plant root systems may be damaged while growers are trying to remove the weeds.

Figure 3. Bird netting is essential for blueberry production.

Herbicides are available that can provide selective control of many annual and perennial weeds in established plantings.

Several herbicides are registered for blueberries in NSW and growers should contact the local district horticulturist with NSW DPI for advice on which are appropriate.

Netting

Bird control is essential for blueberries and if left unchecked will cause major economic losses, particularly in areas close to forest. Due to a lack of the bird's natural food in the forest at harvest time they will feed on the blueberry fruit until food becomes available elsewhere.

Whilst there have been many bird scaring devices on the market, the only effective and reliable method is total exclusion netting. Netting is costly; however the gain in productivity will offset the costs in a few seasons.

Growers have two options when budgeting for netting: either erect permanent netting or install removable netting.

The cost of permanent netting is approximately $28,000 per hectare or $2.80/m². This may be delayed until full production in year 3 or 4 but it is far easier to erect the structure before planting.

Growers can save some of the cost by supplying and installing their own posts and assisting with the erection of the cables and netting.

Temporary netting is a cheaper option initially due to the lower capital outlay. However, it has ongoing annual costs for maintenance, erection, removal, repairs, tractor and labour costs. The netting remains over the crop for 3–4 months each year. There is an initial cost of $12,000 per hectare for materials plus the cost of a netting machine at around $10,000 and $1,000/ha in annual labour to put it up and remove it. It normally takes 6 workers one day to put the netting up and half a day to remove it.

Disease control

Growers need to become familiar with the diseases that affect blueberries and develop a spray strategy along with cultural practices such as pruning that will ensure that plants can function to their optimum level.

The main diseases affecting blueberries are:

- *Pucciniastrum* – blueberry rust can cause early leaf drop and affect the following seasons potential crop.
- *Botrytis spp.* – twig and blossom blight
- *Phomopsis spp.* – cane dieback and death of plants

- *Guignardia* – tip dieback and stem browning
- *Botryosphaeria* – stem canker
- *Phytophthora spp.* – root rot and death of plants
- *Rhizoctonia* – death of plants
- *Pestaliopsis* – death of canes and plants
- *Crown gall* – growths just above ground level and eventual death of plants
- *Colletotrichum (Anthracnose*) – affects leaves, stems and fruit
- *Mycosphaerella* – leaf disease
- *Septoria* – leaf disease
- *Cercospora* – leaf disease
- *Alternaria* – fruit disease
- *Phyllosticta* – leaf disease.

Management of resistance to all pesticides is now an important consideration when choosing a control strategy. Growers should not rely on one chemical group for disease control and they should alternate between chemical groups where possible. Some export markets have a nil tolerance to some chemicals and therefore growers need to plan which chemical to use for these markets. Even though a chemical may be registered for blueberries in Australia it may not be acceptable to the importing country. Neglecting withholding periods on chemicals may also jeopardise export markets.

Spray equipment suitable for blueberry production should be calibrated annually to ensure good spray coverage. Nozzles should be checked and replaced if worn. Use water sensitive paper attached to the plant to check the actual coverage.

Some of these diseases do not affect all varieties – new varieties are being selected for disease resistance to reduce reliance on chemicals.

Insect control

The main pests of blueberries are: painted apple moth, light brown apple moth, *Helicoverpa spp*, looper caterpillar, leaf roller caterpillar, aphids, leaf miner, leaf eating beetles, elephant weevil, and scarabs. Queensland fruit fly can be a problem if not controlled regularly.

Anyone purchasing, handling or applying chemicals is required to complete a farm chemical user course.

For further information on disease and insects of blueberries refer to the *Handy guide for blueberry production 2006 wall chart.*

There are a number of pesticides registered for blueberries. Growers should check with their local district horticulturist at NSW DPI for advice on chemicals registered for blueberries.

Further information

Scientific papers, books, bulletins

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