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Compiled by Alieen Reid

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Greenhouse roses for cutflower production

Roses can be one of the more profitable flower crops to grow, but also one of the most difficult. Intensive, on-going management is necessary to obtain quality flowers.

The number of rose growers in Western Australia has declined. Many older growers have retired and are not being replaced by newer growers. Increasing competition from imports means that operations need to be highly efficient and it is increasingly difficult for small enterprises to survive. The high capital cost of installing and operating heating for winter production, in combination with cheaper imports from areas with warm winter climates and low labour costs means making money during winter is especially difficult. Most WA production is now either under soil-less or hydroponic systems using a range of methods.

This Bulletin deals with production of roses in soil.

Varieties

Rose varieties are constantly changing. Contact suppliers for information.

Plant material

Large orders for specific material need to be placed nearly a year ahead to be certain of supply. Most rose bushes are ordered from interstate suppliers.

Australian Roses

85 Ferndale Road
SILVAN VICTORIA 3795
Tel: (03) 9737 9226
Fax: (03) 9737 9277
www.australianroses.com.au

Grandiflora
565 Dandenong-Hastings Road
CRANBOURNE VICTORIA 3977
Tel: (03) 9782 2777
Fax: (03) 9782 2576
www.grandiflora.com.au

Flora International
1322-1340 Camden Valley Way
LEPPINGTON NEW SOUTH WALES 2179
Tel: (02) 9606 6222
Fax: (02) 9606 6841
www.florainternational.com.au

Growers need to be aware that bare-rooted roses can be a source of nematode infestation

Rootstocks

Many rootstocks are in use in Western Australia. *R*. x *fortuneana*, *R*. *multiflora* and *R*. 'Dr Huey' have been traditionally used but in more recent years, others such as *R*. *indica major, R. chinensis* var *Manetti* and *R*. *canina* have become more popular.

There is also a trend, especially overseas and particularly in hydroponics, towards growing plants on their own roots. In many instances the yield is as high or higher than using traditional rootstocks.

Climate control

Heating

Growers debate the economic feasibility of heating over winter. For good winter production, heating is essential. However there may be a trade-off. Some growers feel that bushes allowed to rest in winter, produce

better in spring and summer and have a longer lifespan. It is feasible to plan a rotation whereby some bushes are rested while others are heated and forced to produce over winter when more production may be needed. In the end, the value of heating comes down to economics. It is possible to argue against the need for high spring and summer production since this is when prices are lowest and high temperatures are detrimental to flower quality. However, Australia, being southern hemisphere has both Christmas and Valentine's Day, two major flower marketing days, in the middle of summer.

The optimum night temperature for roses is about 14 to 18°C depending on the individual cultivar. Given that most plantings are a mixture of several cultivars a minimum temperature of 16°C is probably a reasonable compromise. In Israel a night temperature regime of two hours at 18°C alternated with two hours at 12°C has been found to increase production by as much as 30-40 per cent in some varieties.

Bullheads are caused by low temperatures which result in abnormal flower development.

Cooling

Western Australian summers have high temperatures accompanied by very low humidity, causing problems with flower quality. When temperatures are high, the time for flower development is shorter and flower size decreases. The associated low humidity is conducive to mite infestations. One way to tackle both of these problems together is to use fogging to lower temperatures and raise humidity. Fogging requires an additional irrigation system, usually above the plants which is operated when temperatures exceed a given level. It is easy to reduce temperatures by 10°C using this method. The associated increase in humidity is not sufficient to cause disease and is unattractive to mites. There are several types of fogging systems available. Consult your DAFWA adviser for up to date information. One advantage of installing an overhead fogging system is that, depending on the nozzles used, it may also be used to apply pesticides.

Soil and pH

A well drained soil ranging from sand to gravelly loam with a pH of 6.5 to 7.0 is suitable, although roses prefer between 5.5 and 6.2. If soil pH is low, a dressing of ground limestone may be necessary. Depending on soil type, 100 g/m^2 should change the pH by about one unit.

Over time pH will drift downwards and can be difficult to correct. One way to manage pH drift is to use calcium nitrate as a major source of nitrogen. Many growers baulk at the cost, especially as it is only 15.5 per cent nitrogen, but the benefits of maintaining pH in the ideal range far outweigh the cost. There are now also some liquid preparations available that are applied via the irrigation, and reduce soil pH quite effectively, for example TIPA Gold®.

Chlorosis is almost always a sign of high pH and the symptoms can develop very quickly. On the other hand, the symptoms of low pH take a long time to develop. Early symptoms are a dark greyish green appearance to the foliage.

In soil, pH analyses are not reliable. Readings taken using standard methodology do not reflect the pH at the root surface. True readings can be taken by using a vacuum pump to extract water from the root zone through a ceramic nozzle such as those used in tensiometers.

To modify pH, a range of acids may be used. Sulphuric acid is common but has several drawbacks. It may cause precipitation of calcium and does not supply any major nutrients. It has been linked in anecdotal evidence to growth problems. Nitric or phosphoric acids are preferable. Recent work has also highlighted some benefits of using citric acid, particularly in hydroponics. Citric acid will form chelates with micronutrients and help keep them in solution.

Adding organic amendments such as composts, animal manures or peat is highly recommended, especially on sandy soil. Sewage sludge should be used with caution as it may contain toxic levels of some micronutrients.

Apply base fertiliser dressings of superphosphate and mixed trace elements to the soil at rates of 100 and 5 g/m^2 respectively.

Apply a nematicide and rotary-hoe the soil to a depth of 20 cm.

Plant spacing

A density of 10 bushes/m^2 of bed is usual. Many growers use 0.9 m wide beds with two rows of bushes. The spacing within rows is 20 cm, with 40 cm between rows. However, this will depend on individual greenhouse designs and irrigation design constraints.

Trellising

Little trellising support is needed for roses, but orderly straight edges to beds must be maintained. For this purpose, wire can be stretched under tension along the edges of the beds. Star pickets 3 m apart along the beds can be used to support three or four wires 20 cm apart. The star pickets should be 20 cm from the base of the outer row of plants.

Planting

The best planting month for bare-rooted rose bushes is July. Rose bushes grown in containers are grown locally and can be planted all year round.

Allow the bare roots of dormant plants to soak up water just before planting. The planting position of the grafted union of each plant should point in the same direction along the length of the beds.

Make sure that the roots are spread out evenly and downward. Adjust the planting depth so that the grafted union is just above soil level. For rapid plant establishment, water to excess for the first few weeks. Without a good root system, plants will never perform at their best and the best time for root establishment is before the competing pressures of flower production start.

Building the canopy

Building the plant canopy or bush structure depends on:

- healthy roots; and
- vigorous bottom breaks.

There is a very strong correlation between root growth and shoot growth. In the early development of young plants, good root development is essential. Good roots support strong shoots and vice versa. Within 24 hours of cutting a plant hard back, a corresponding proportion of roots will die also. The plant requires a considerable amount of time and energy to regenerate those damaged roots. For this reason, hard cutbacks are not recommended. The final number and quality of the flowers is dependent on the correct functioning of the roots. If the roots are healthy, the whole plant will be healthy.

Stimulation of bottom breaks on new plants

A long life span and high production require strongly developed bottom breaks which are structural shoots arising from the base of the plant (see Figure 1).

After planting, remove terminal buds on all growth, including strong stems and deshoot these as soon as possible. Deshoot and disbud all other growth. The side shoots should be removed as early as possible (7 to 10 days from terminal bud removal).

This procedure is repeated until a plant of the desired size is built. Usually two pinches on vigorous canes, three on weaker ones, will suffice. Weak stems can also be bent down, leaving the foliage intact. This is called arching and will force breaks from lower down on the stem. ‘Bottom breaks’ are fast growing and should exceed 8 mm in diameter. They should be pruned back to 25 to 50 cm above ground level. Subsequent growth after these pruning operations will produce the first flower stems to be harvested.

Do not commence flower production until a strong plant framework has been established. Full production should be achieved within six to eight months of planting.

Stimulation of bottom breaks on old plants

There are two main techniques to stimulate bottom breaks on old plants.

Remove terminal buds and new shoots as they appear (deshooting). This forces all the plant’s food reserves downwards and new shoots will be produced from the base of the plant (Figure 1). This should not be done in summer

as the risk of sunburn is too high. To encourage bottom breaks in plants which are not too old, bend down any long weak stems with plenty of foliage and allow them to lie in the aisle. Strong growth will come from below the bend.

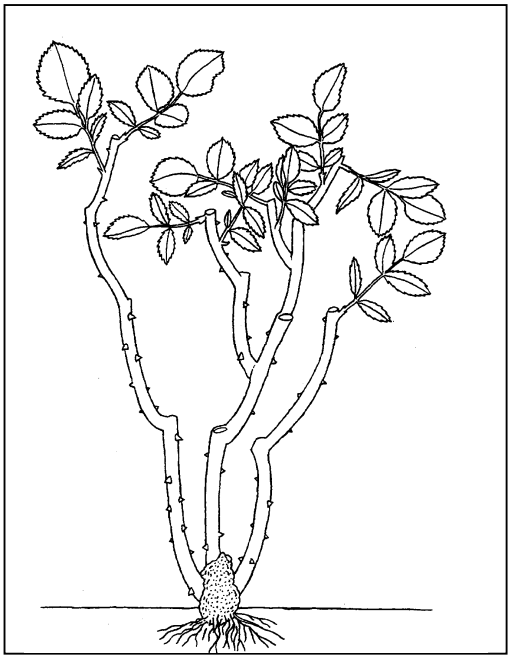

Figure 1. Bottom breaks are fast growing structural shoots which grow from the base of the plant.

Cut the plants back very hard and expose them to cold weather or refrigeration. This forces food reserves downwards in the same manner as deshooting.

Regeneration may also be stimulated by drying the plants out for a period of time and then giving them a lot of water. This approach can be used in warm weather.

Disbudding

Most large flowering greenhouse varieties produce few lateral auxiliary buds. Lateral buds which do develop must be pinched out regularly to obtain high quality production from single apical buds. Two or three disbuddings per week may be needed during peak production. Remove the lateral buds as soon as they can be pinched out without causing damage to the stem or apical bud.

Weed control

Few chemicals are registered for use on roses. Surflan® or Simazine® may be used for pre-emergent control. Simazine® should not be used on bushes younger than 12 months. Fusilade® and Sertin® will control grasses. Linuron® has a Minor Use Registration on roses grown for edible flowers. Take care when using herbicides around roses that are not as vigorous, for example, miniatures and those that do not have woody stems near ground level. Since roses are a perennial crop many growers prefer to avoid the use of herbicides and use mulches instead. These have the added benefit of moderating soil temperature and moisture and also supplying some additional humidity. Jarrah wood chips are widely used.

Fertiliser

Greenhouse roses have a high demand for nitrogen and potassium. A liquid feeding program should aim to maintain the leaf tissue levels of nutrients outlined in Table 1.

Table 1. Optimum leaf tissue levels in greenhouse roses

Nutrient	Leaf tissue level
Nitrogen	3.0-5.0%
Phosphorus	0.2-0.3%
Potassium	1.8-3.0%
Sulphur	0.2-0.5%
Calcium	1.0-1.5%
Magnesium	0.25-0.35%
Sodium	0.02-0.04%
Chloride	15-50 ppm
Zinc	15-50 ppm
Manganese	30-250 ppm
Iron	50-150 ppm
Boron	30-60 ppm
Copper	5-15 ppm

For sampling purposes, take the first and second, five leaflet leaves from stems with a bud ranging in size from a pea to first colour.

Recent research at Medina Research Station has shown that applications of 0.1 g nitrogen and 0.085 g potassium per bush per week should achieve these levels. The suggested rate of magnesium is 0.008 g per bush per week and for copper 1.6 g/m^2/year.

Table 2 gives a suitable fertiliser regime for a planting density of 10 bushes per square metre

Table 2. Recommended fertiliser rate for planting density of 10 bushes per square metre

Fertiliser	Rate of application
Agran®	1.5 g/m^2/week
Calcium nitrate	1.2 g/m^2/week
Potassium nitrate	2.2 g/m^2/week
Magnesium sulphate	0.8 g/m^2/week
Mixed trace elements e.g. Librel BMX® or Hitrace®	0.2 g/m^2/week

The amount of calcium nitrate may be altered to help change soil pH. As a rule of thumb, for every 1 kg of Agran® taken out, replace with 2 kg of calcium nitrate. Remember that the calcium nitrate will need to be injected separately as it will react with the sulphates in the mix.

Irrigation

There are two common systems of irrigation. The first consists of low level micro-sprinklers designed to give maximum uniformity of soil surface wetting while keeping the spray off the foliage and flowers. Take care not to position nozzles behind stems as this will cause an uneven wetting pattern. Some growers choose low level micro-sprays as their method of irrigation because they have the added benefit of increasing the humidity (see section on cooling). In addition, a one minute flick on can be used to increase the humidity on hot days.

The second system is trickle irrigation. A line of black polythene pipe is laid for each row of plants. Either in-line or button drippers are suitable. One dripper per plant is used.

Israeli research suggests that for optimum production the soil should be maintained close to field capacity. In sandy soils, this means regular monitoring since little plant available water is held by the soil. Frequent applications of water are needed to ensure that the soil moisture does not fall too far below field capacity. Care is needed, however, to ensure the plants do not get excessive heavy applications. Any excess will rapidly drain beyond the plant's root zone, wasting water and power, leaching fertilisers and contributing to groundwater and environmental pollution.

On heavy soils, similar attention to irrigation scheduling is needed, but the problems of low soil moisture storage are far less. On other soils, scheduling can be based on soil moisture or evaporation measurements.

If tensiometers are used, apply water when the tensiometer reading is between 10 and 15 kPa on sandy soils and 15 to 20 kPa on heavy soils. Consider the positioning and maintenance of tensiometers carefully. On sandy soils, schedule irrigations to minimise leaching.

During winter in heated greenhouses rose bushes transpire at night so there is potential for water stress at sunrise when the stomata open. It is recommended that irrigation be given before sunrise to compensate for this.

Pests

Chemicals and other management techniques for controlling pests and diseases are constantly changing. Consult your adviser for the latest information.

Mites

Mites are the most troublesome pest of roses. They are a particular problem in hot, dry weather. Symptoms are bronzing or a sandy appearance and dehydration of foliage followed by leaf drop. Webbing may be noticeable on the underside of leaves.

Growers have the option of using chemicals alone or a combination of predatory mites (*Phytoseiulus persimilis*) and chemicals. Predators are available from:

Manchil IPM Services
PO Box 431
WANNEROO WA 6946

Mob: 0403 727 252
Web: www.manchilipmservices.com.au
Contact: Lachlan Chilman

Bugs for Bugs
Bowen Street
MUNDUBBERA QLD 4626

Ph: (07) 4165 4663
Fax: (07) 4165 4626
Email: sales@bugforbugs.com.au
Web: www.bugsforbugs.com.au

Manchil also offers insect and disease monitoring.

When using predators, there will always be a low level of mite infestation and care will be needed when using chemicals, as not all are compatible with predators, for example, synthetic pyrethroids such as Ambush®. For further information on predators, contact the above companies or your adviser.

Sulphur vaporisers may help control mites and are safe to use with predators. Chemicals such as Pyranica®, Mavrik®, Talstar®, Biomectin® and Apollo® are effective miticides but not all are safe to use with predators. Mite resistance to chemicals is a widespread and persistent problem. To gain the maximum life from chemicals, rotate miticides on a regular basis.

For effective mite control it is essential to get good coverage on the underside of leaves. High volume spraying is generally more effective than fogging. Be sure to use a wetter. See also the section on cooling.

Aphids

Aphids may be found clustered on young shoots and buds. Control with Confidor® or Talstar®.

Thrips

Infestation causes flower and leaf distortion. Frequently, the symptoms are not seen for some time after the initial attack. Control with chemicals such as Confidor® or Talstar®. Regent®, Biomectin® and Success® are registered for the control of western flower thrips only, on roses.

White fly

Rogor® is the only registered chemical for white fly, which is not usually a problem, but when present can build up rapidly to epidemic proportions. Talstar® has a Minor Use Permit only on roses grown for edible flowers. Confidor® has a Minor Use Permit for use only on silverleaf whitefly which is present in Western Australia.

Diseases

Several diseases can be troublesome to roses, especially with humid conditions in the greenhouse. The best means of preventing many diseases is climate control. Avoid getting water on leaves by using ‘anti-fog’ plastic coverings on houses and ground level irrigation – either drippers or microjets. Most growers underestimate the value of good ventilation to keep the air in the greenhouse moving.

Botrytis flower blight

The first symptoms on open flowers are water-soaked spots. The tissue later becomes soft and watery. If the humidity remains high, a greyish brown coating or web of mycelium and spores develops over the surface of the collapsed tissue.

Frequently, *Botrytis* is a problem after harvest. Refrigeration will retard, but not completely stop development of the disease, and when infected tissue is warmed, decay can proceed rapidly.

Botrytis or grey mould is seldom a problem in summer. To eliminate it, the surface of the leaves must be kept relatively dry. Below 85 per cent relative humidity, *Botrytis* will not be a problem. However, during winter when greenhouses are closed at night, the humidity builds up and permits development. Dehumidifiers can be used to lower the amount of water vapour in the greenhouse, but they are expensive and beyond the scope of most growers. Ventilation is probably the most practical way that growers can influence disease development in the greenhouse. Greenhouse designs should permit plenty of air movement and not have any dead spots. The dilemma is reduced production due to higher disease incidence or lower temperatures. Anti-drip plastic films prevent condensation dripping on plants, but the anti-drip chemical impregnated into the plastic gradually dissipates over a 12-18 month period reducing its benefit.

Chemicals for control of *Botrytis* should be used in rotation to prevent the development of resistant strains. Mancozeb, Thiram®, Bravo®, Scala® or Pyrus®, Rovral® and Zyban® are registered for control of *Botrytis* on roses and ornamentals. Growers should be aware that resistance exists to Rovral®. Contact your adviser for up to date control measures.

Powdery mildew

Symptoms are a white powdery growth on (usually) the upper side of leaves, stems and flower buds. New shoot growth is distorted.

Powdery mildew spores require free moisture to germinate so minimising condensation is the primary method of prevention. Electric sulphur vaporisers are highly effective when used for four to six hours during the night. One vaporiser of 100W is needed per 100 square metres of greenhouse space. Sulphur will also provide some mite control. Baycor®, Nimrod®, Rubigan®, Bavistin®, Spin® and Ecocarb® (non-toxic, based on potassium bicarbonate) are some other chemicals also registered for control of powdery mildew on roses.

Downy mildew

Leaf drop may be the first indication of infection from downy mildew. As infections become established, purplish-red to dark brown irregular markings appear on the upper side of leaves, flower stems, calyces and canes.

To control downy mildew keep humidity below 85 per cent. Minimise condensation, as downy mildew spores need free water to germinate. Copper oxychloride is registered for control. Ridomil® and Previcur® also have Minor Use Permits for roses.

Cane diseases

A number of fungi cause dieback of canes. In WA the principal pathogens are *Botryosphaeria*, *Botrytis* and *Coniothyrium.* Others such as *Pestalotia, Phomopsis* and *Alternaria* are often isolated from areas of stem dieback, but these are generally regarded as secondary pathogens. *Botrytis* frequently enters canes by infecting young leafy shoots while *Coniothyrium* usually enters via pruning cuts, eventually developing pinhead size black sclerotia on the lesions.

When cane dieback is suspected, pathological testing is advisable to determine the causal organism so the appropriate treatment may be given.

Soil-borne diseases

Crown gall is occasionally recorded on bushes and not generally considered to be a problem in WA. An unconfirmed report of *Verticillium dahliae* exists but no true verticillium (*albo-atrum*) wilt of roses has been found.

Nematodes are the biggest problem. Most growers treat the soils every six months with nematicides such as Nemacur®. Signs of infection are stunting and general decline. Frequently, plants which seem predisposed to other diseases, especially cane diseases, are in fact infected with nematodes.

Flower harvesting

During flower harvesting, pick each stem with future flower stem development in mind. The most vigorous shoots develop from the leaf axils of leaves with five leaflets. The eyes from three leaflet leaves have poor sprouting characteristics and develop weaker shoots.

The usual position to cut is just above the second five leaflet leaf (Figure 2). If stems are long and strong, cut to the third five leaflet node. This will allow three more cuts from that stem before undercutting is necessary. For example, for the first pick after Valentine's Day, this approach will give shorter stems at a time when the demand is not great and will leave foliage on the plant to generate food reserves for Mother's Day production. If plant height becomes a problem, cuts may be made either at the knuckle or even below. However, while some varieties are suited to knuckle cutting, most will produce poor quality flowers from this kind of cut. Undercutting will in most cases stimulate bottom breaks.

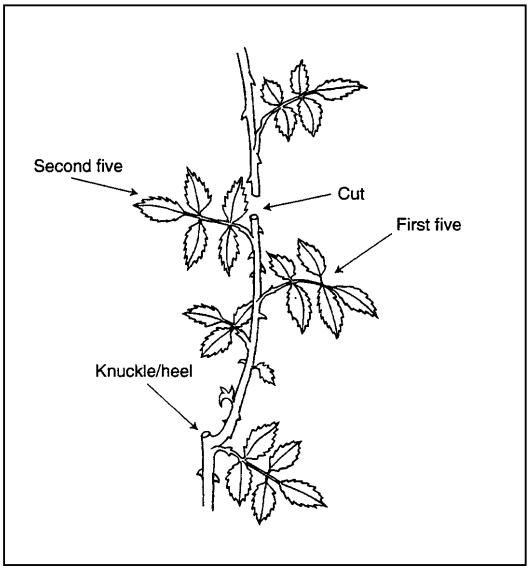

Figure 2. The usual position to cut for flower harvesting is just above the second five-leaflet leaf.

Six weeks is the average time from pinching to the time a flower is cut. This varies with the time of year and the variety, such that in summer flowers develop in about five to six

weeks while in winter eight weeks is more usual. Samantha takes seven weeks even in the middle of summer whereas some of the newer PBR varieties such as Concerto are much quicker.

Use secateurs especially designed for rose picking for fast and easy work. These have vertical ridges that grip hold of the stem as it is cut, making it possible to hold harvested blooms in one arm and cut and lift stems with the other.

The optimum stage at which to cut roses will vary with the time of the year and the cultivar. Winter-grown roses may be harvested at a more advanced stage than summer-grown roses. Roses picked too tightly will not open and will easily develop a 'bent neck' (see Figure 3).

For instance, Mercedes or Gabrielle cut at Stage A would probably not open successfully for the consumer. The optimum stage is similar to Stage B - one or two sepals have reflexed and the outer one or two petals have started to loosen. Winter-grown roses are better picked closer to Stage C which in summer would be too advanced.

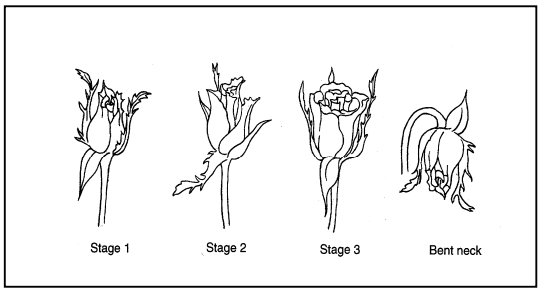

Figure 3. The optimum stage to cut roses depends on the time of year and the cultivar. Roses which are picked when too tight will develop a 'bent neck'.

If possible, cut flowers in the coolest part of the day. In winter, cut flowers as soon as any condensation has dried. In the hottest part of summer, it is necessary to cut twice a day.

Postharvest handling

Place the roses in water plus a germicide (200 ppm hydroxyquinoline sulphate or 8-HQS) as soon as possible and place in a coolroom to remove field heat. Maintain coolrooms between 1 and 4°C with over 90 per cent relative humidity. Roses may then be graded and bunched ready for sale.

Grading is on the basis of stem length; 40 to 50 cm is the usual length for domestic sales whereas 60 to 80 cm is needed for export. After grading and the removal of lower leaves, bunch roses into groups of 10 and place in polythene sleeves for sale.

For further information on the postharvest handling of roses, contact your DAFWA adviser.

Hydroponics and soil-less culture

Most WA growers now have at least some of their roses under hydroponics or soil-less systems. A well set up hydroponic system allows more control of crop nutrition and eliminates many of the problems with in-ground culture. A good system is capital intensive to set up and growers are advised to seek the advice of a consultant specialising in hydroponics.