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Department of Agriculture and Food
Government of Western Australia



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GROWING OLIVES IN WESTERN AUSTRALIA



Figure 1

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and

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August 2007

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General

There are about 9 million hectares of olives in the world, with the largest areas in Spain, Italy, Greece and Tunisia. Olives are grown between the latitudes of 30° and 45° from the equator. In Australia, the main producing areas are between latitudes 31° and 38°S. Production in Western Australia ranges from Chapman Valley, Northampton (29.5°S), to Albany (34.5°S). Olive production has increased markedly in Australia in the past ten years with a large increase in managed investment scheme olive groves. The Moore River region of the Shire of Gingin accounts for over 70 per cent of olive trees and production in Western Australia. Large groves are also established at Frankland and West Beverley. Smaller groves have been planted in areas such as Geraldton, Margaret River, Peel, Warren and York.

About 90 per cent of olives in the world are grown for oil production and 10 per cent are grown for table olives. Imports into Australia are about 33,000 t of olive oil per year and 14,000 t of table fruit. The main sources of imports are Spain and Italy. A large proportion of imported oil is refined oils sold as light or extra light olive oil. Production in Western Australia in 2006 was about 1,400 t of oil from 8,000 t of olives and 80 t of table olives. Table varieties require more labour than olives grown for oil. There are now nearly 2 million olive trees in Western Australia and 10 million trees in Australia, comprising 38,000 ha, mostly in Victoria, NSW, and South Australia. The industry in Western Australia is dominated by six large groves, each with 100,000 to 260,000 trees. Most growers in Western Australia have 500 to 5,000 trees. A production of 8,000 t of oil is expected from Western Australia by 2012.

Interest in organic olive production is increasing and one company is establishing organic groves at Preston Valley, Beverley and Gingin.

History

The cultivated olive (*Olea europaea*) was introduced to Australia around 1805. At first, there was little commercial interest due to the predominantly English population using the ample supplies of animal fats. However, following World War II, the large number of immigrants from Mediterranean countries resulted in an increased interest in olives and olive oil and demand rose dramatically.

The area of olive plantings began to expand from 1946, especially in South Australia and Victoria. Expansion continued until 1958-59 when over 3,000 ha of olive groves were grown in Australia. Plantings in Western Australia peaked at 29,000 trees in 1968. However, poor management techniques and the tree's natural tendency to bear every second year limited the profitability of olive growing in Australia.

When Government protection of the industry was reduced and finally removed in the late 1960s, the larger growers in Victoria switched from oil production to pickling olives. This proved an unfortunate decision as competition from cheap Mediterranean imports and high labour costs made olive production unprofitable for most growers. Despite efforts to improve management and yields, and increased mechanisation, even the largest holdings had difficulty in achieving economic returns.

Interest in olives was renewed in the late 1990s with research and industry initiatives now underway. The Australian consumer is becoming increasingly aware of the health benefits of olive oil. This contains mono-unsaturated fats and anti-oxidants, which are believed to link

the Mediterranean diet with one of the lowest cardio-vascular disease rates in the world. The per capita domestic consumption of oil in Australia is low compared with European countries. However, the demand for olive products in Australia is continually increasing.

Climate

The olive grows best, with less disease, in regions with a Mediterranean type climate, which have cool winters with a warm dry summer and autumn. Rain in autumn lowers the oil yield. The optimum temperatures for growth are 15 to 34°C. The most unfavourable temperatures are above 40°C and below 5°C. However, young and established trees will withstand the light winter frosts experienced in Western Australia.

For good flower initiation and production, an average monthly minimum winter temperature of less than 10°C is required. However, this chilling requirement varies between varieties. The average minimum temperatures for the coldest month recorded at the nearest weather sites in each of the following districts is as follows: Albany (8.3°C), Beverley (5.1°C), Badgingarra (6.9°C), Frankland River (6.3°C), Geraldton airport (8.9°C), Moora (6.8°C) and York (3.4°C). Olives are not grown commercially in the Carnarvon area, where the minimum temperature of the coldest month is 10.5°C.

Areas with early or late frosts should be avoided. Early frosts cause the maturing fruit to shrivel and late frosts can damage the flowers and shoots in spring.

Strong easterly winds in spring and summer can drop flowers and fruits.

Although the olive is a hardy tree and possesses drought resistant qualities, the tree will not crop regularly or produce good yields without sufficient water. To achieve regular cropping, winter and spring rainfall or irrigation must provide adequate soil moisture for blossoming and fruit setting. In Western Australia, irrigation is required in the warmer months to increase fruit size and oil yield.

Soils

The olive can be grown on a wide range of soils, but it favours well drained, slightly alkaline loams with a pH of 6.0 to 8.0 (by the water system of measurement). Good growth is achieved on sandy or gravelly loams. Heavy soils can be deep-ripped in the planting area to 60 cm deep before planting. If mechanical harvesters are to be used, a slope of less than 4 per cent is necessary. If the soils contain a high level of clay, they may be subject to waterlogging during heavy rains, in which case drainage can be improved by planting on small mounds.

For a commercial crop, it is advisable to seek professional advice on site selection, as the investment is long term. The assessment provides advice on soil structure, soil amendments, type of irrigation, suitability for the crop and management requirements.

Propagation

Most varieties are propagated from cuttings of one year old wood struck in potting mixture, using misting, bottom heat and dipping in IBA hormone for two to five seconds. Propagation from cuttings is less labour intensive than grafting so tree costs are lower, but some varieties such as Kalamata must be grafted. Trees can be purchased from local or Eastern States

nurseries. Purchasers should demand trees with good health to ensure good growth and freedom from pests and diseases, as Western Australia does not have some of the pests and diseases occurring in other states.

Planting

To allow easy planting, cultivate along the ripped tree rows before planting. Having marked out the tree sites on the prepared ground, spread about 1 kg of superphosphate copper zinc over a 1.5 by 1.5 m area at each tree position and cultivate to incorporate. A good quality compost at 10 L per hole can be applied and worked into the planting hole of young trees, especially trees which are being grown organically.

Acidic soils (below pH of 5.5 by the water system of measurement) can be amended with applications of lime around each planting site, or along the tree line, and mixed in.

Plant the trees the same depth as the mark on the trunk shows it was planted in the nursery. Remove any seriously damaged portion of roots, but disturb the roots as little as possible. Pots can be dipped in a bucket of water before planting to remove any air around the roots.

Work the soil around the tree roots. Do not totally fill the hole, and leave a depression for watering. Fill this with water and tamp in the soil. A little more soil may be needed if there is considerable subsidence.

It is usually advisable to stake the young trees, such that the tree can move with the wind to some degree. Support the trees with a 1.2 m stake and tie the plant with a cloth tie that does not cut the trunk or branches close to it.

Mulching around the young trees with a coarse compost is beneficial, especially on sandy soils and for the first two years after planting .

Figure 2 shows a field planting 18 months old.



Figure 2.

The best time to plant is in the cooler months, especially April and May, and September. Do not shade the trees.

The best orientation is to plant the rows north, south.

The stem can be painted with a water based or plastic paint to protect from sun-burn.

A cover crop such as lupins or subterranean clover can be grown between the rows during winter.

Plastic sleeves can be used on young trees against sun damage, rabbits and for better use of contact herbicides. However, sleeves can damage the trees during high temperatures in summer.

Trellises are sometimes used to support the trees particularly in large groves aiming for mechanised harvesting and removed about four years after planting.

In home gardens, old trees up to 40 years old can be transplanted successfully.

Where trees are not mechanically harvested the number of trees per hectare is usually 250 to 300. In this case, trees are normally spaced 6 to 8 m apart between the rows and 5 m apart within the rows. Trees that are too shaded will produce lower yields. The tree spacing is also determined by water availability and proposed method of harvesting.

Mechanically harvested trees need a closer spacing (5 to 7 m rows, with trees 3 to 5 m apart in the rows) and there may be 400 to 500 trees per hectare. However, adequate room for harvester movement must be left between and at the end of the rows. These trees need good pruning to increase light and to maintain the correct shape for mechanical harvesting. If harvesters are not used, leave room for firebreaks (contact the local Shire).

Where trees are used as windbreaks, the spacing between trees can be reduced to 3 m, but this can reduce individual tree yields.

Varieties

Different olive varieties are grown for oil and table use (pickling). Some varieties can be used for both purposes. The requirements for oil production are consistent yield and high oil content, level of free fatty acids and good oil flavour. Fruit size is relatively unimportant. Varieties such as Arbequina, Barnea, Coratina, Corregiola, Frantoio, Koroneiki, Leccino and Picual are commonly planted in modern commercial olive groves in Australia.

The industry is continually assessing which variety produces olive oil that meets market requirements in terms of taste and other quality aspects. Climate and soils as well as management, particularly irrigation, have an effect on quality and yield. The National Olive Assessment Report (RIRDC publication 05/155) provides useful information on varieties.

For marketing and management reasons (increased pollination and varietal diversification), some growers prefer to include a number of varieties in new plantings. New varieties are regularly introduced, especially by companies with overseas experience.

A good table olive variety needs firm good textured flesh and a high flesh to pit ratio (> 6:1). Consistent yields and good fruit size are considered important but some small olives with small pits sell well as pickled olives.

Varieties such as Barouni, Kalamata, Manzanillo, Picholine, UC13A6 and Volos are known for their excellent textures and flavours when processed as table olives.

Oil varieties

Arbequina

One of the main varieties planted in Spain. Low vigour and medium to dense canopy, suited to intensive plantings. This variety produces high yields of high quality oil. Small fruit size ripens early to mid-season.

Barnea

Originated in Israel, vigorous tree with erect canopy, suited to mechanical harvesting. This variety has a medium to high oil content, suitable for blending. Medium sized fruit can also be pickled, ripens mid-season. Pollinators are Picual, Manzanillo and Picholine.

Frantoio (also known as Corregiolo or Paragon)

This variety is originally from Tuscany and is now extensively planted over the Mediterranean basin and other parts of the world. The tree is of medium vigour with slender fruit branches and ripens mid/late-season. The fruit are small to medium in size at harvest and vary from green to pale yellow, pinkish and purple. The variety is self pollinating and highly productive, even in adverse conditions. It yields best in colder, southern regions. The oil quality is excellent and it yields about 23 to 28 per cent.

Mission

Most Mission trees in Western Australia are from a local selection from the olive grove at the New Norcia Monastery, Western Australia. This variety is similar to Frantoio. The fruit are small and have an extended harvesting period, which can be beneficial. Only a small proportion of the fruit become fully black, the colouration varying from light green to pinkish yellow through to purple.

The tree produces well in coastal as well as inland areas, is self pollinating and well suited for use as a windbreak. The oil content is high (23 to 25 per cent) and has good quality.

Pendolino (Nevadillo)

A high quality oil variety with an oil content of 22 per cent. An excellent pollinator, with a low to medium vigour and a pronounced weeping habit. The fruit are small and purplish black at maturity.

Picual

This is a Spanish variety, which is widely planted in large Australian groves and is producing well in areas north of Perth. It has medium vigour with dense canopy and ripens early in the season. Trees produce high yields of good quality oil with high stability, which makes it suitable for blending with oils of low stability.

Oil and table varieties

Kalamata

A Greek cultivar, which is one of the best black pickling varieties and highly regarded by Australian consumers. It is also used for oil production, produces medium yields and the oil has a distinctive flavour.

A late ripening olive, the fruit is medium to large with a pointed end. Trees produce heavier crops when cross pollinated with Pendolino. Frantoio and Koroneiki are also suggested to be good pollinators.

Leccino

Originally from Tuscany, this is a popular variety for new plantings in Australia. It is medium in vigour and has consistent productivity. The fruit are reasonably small, but if the crop is light or well thinned it can produce quality black olives. This variety matures early and is easy to harvest. It requires cross pollination, with varieties such as Frantoio, Coratina and Pendolino. It has a medium to high oil content with characteristic, good quality oil.

Manzanillo

This is the main variety grown in Spain. The tree is a low vigour variety with a spreading medium density canopy. It matures its fruit early and is one of the highest yielding varieties. It is used mostly for green pickling, but can also be black pickled and pitted and stuffed with capsicums. Figure 3 shows Manzanillo fruits at three stages of maturity. The fruits are large and because of the relatively small stone, the proportion of flesh can be as high as 90 per cent. It is partially self pollinating. It has medium oil content, but extraction is difficult when the fruit has excess moisture.



Figure 3.

Table varieties

Sevillano (Queen of Spain)

This is best pickled green. It produces large fruit, but is not a high yielder. It is the only variety known to be damaged by larvae of Mediterranean fruit fly. It is subject to 'soft nose'.

South Australian Verdale (Figure 4)

The tree produces medium yields of large olives and is usually pickled green. It has good flavour and texture, but the seed is large.



Figure 4.

UC13A6 (Californian Queen)

This variety originated in the USA and ripens early to mid-season, with medium yields. It produces very large olives which can be pickled green or black.

Fertilising

Olive trees are not big feeders, but will respond well to a balanced fertiliser program.

Apply superphosphate at 250g in the planting hole before planting and mix with 10L compost.

Suggested fertiliser dressings are given in Table 1, but this is not based on trials information. They will vary with the area, soil type, cropping load and varieties. Rates may also need to be adjusted based on plant appearance and leaf analysis.

Table 1. Fertiliser dressings for trees planted in September in Year 1

Year	Time	Fertiliser	Amount
1	October, November and December	Mixed NPK fertiliser	100 g per tree per month
1	January, February and March and April	Mixed NPK fertiliser	150g per tree per month
2	August	Mixed NPK fertiliser	250g per tree
2	October, December, February	Urea and potassium nitrate	60g per tree of each fertiliser applied by fertigation every two months
2	April	Mixed NPK fertiliser	300 g per tree
3	August	Mixed NPK fertiliser	350 g per tree
3	October, December, February.	Urea and potassium nitrate	80g per tree of each fertiliser applied by fertigation every two months
	April	Mixed NPK fertiliser	500g per tree
4	August, October, December and February.	Urea and potassium nitrate	100g per tree of each fertiliser applied by fertigation every two months
4	April	Mixed NPK fertiliser	1 kg per tree
5 onwards	August, October, December and February.	Urea and potassium nitrate	150g per tree of each fertiliser applied by fertigation every two months
	April	Mixed NPK fertiliser	1.25 kg per tree

Mixed NPK or Nitrophoska fertilisers contain most of the 12 essential nutrients such as nitrogen 12 to 15 per cent, phosphorus 2 to 5 per cent, potassium 14 to 17 per cent, magnesium 1 per cent, calcium 3.5 per cent, sulphur and the trace elements boron, copper, iron, manganese, molybdenum and zinc. They are not readily soluble and can be applied by a tractor and spreader. Urea and potassium nitrate are soluble fertilisers and can be applied by fertilising through the irrigation system (fertigation).

If necessary, on sandy soils, well rotted animal manure, at 30 m³/treated hectare can also be applied in August to the tree rows (half the whole area) to supply organic matter and nutrients. Do not allow manure near the stem. Restrictions on poultry manure apply in some shires on the Swan Coastal Plain and poultry manure can only be applied from June to August. Conditioned poultry manure and other animal manures can be used at any time in the year.

All fertilisers should be applied to the soil, which is more efficient than spraying soluble fertilisers onto the leaves.

Analysis of the leaves (third leaf from tip) will provide a guide on the levels of some nutrients (not boron or calcium) and indicate whether levels are deficient, optimum or toxic. Adequate

levels of nitrogen and potassium in the leaves are 1.5 to 2.0 per cent and 0.8 to 1.5 per cent respectively. Sodium and chloride levels higher than 0.2 per cent and 0.5 per cent respectively indicate toxic levels in the soil and/or water supplies.

Nitrogen is the most important nutrient, but do not over-fertilise, as this encourages vegetative growth and suppresses flowering and fruit set. Nitrogen deficiency is seen as yellow leaves and small fruit. Potassium deficiency is less common and is seen as a tipburn on the leaves.

Magnesium deficiency can be seen as yellow areas between the green veins. If this appears, apply magnesium sulphate at 50 to 100 kg/ha by fertigation.

Boron deficiency is sometimes a problem and is seen as yellow leaves, dieback and a deformity at the tip of the fruit. Borax at 18 kg/ha can be applied to the soil to correct boron deficiency.

Zinc deficiency is seen as leaf distortion and blotchy yellowing on the leaves. Zinc sulphate at 18 kg/ha can be applied to the soil to correct zinc deficiency.

Irrigation (see Bulletin 4462)

Most olive trees throughout the world are grown without irrigation. In most areas of Australia, supplies of good quality water can be applied to increase yields and quality. Irrigation is essential with table olives to achieve the size and firmness required by the market. In Western Australia, in addition to rainfall, a mature orchard, needs about three megalitres (3 mL or 3,000 kL/ha) of irrigation water in the south west, up to 10 mL (10,000 kL/ha) on drip irrigation in the mid-west and slightly more for sprinkler irrigation (see Table 3 in Bulletin 4462). Sprinkler irrigation is better suited on sands and drip irrigation can be used on loams. Irrigation is needed mainly from November to April.

Most growers use one drip irrigation line per row, but if the grove is in sandy soil, it is now common to add a second drip line after about four years to increase the wetting zone. Drippers range from 2 to 4 L/hour and are 40 to 70 cm apart. Filters may be needed to remove iron which can block the drippers.

With established trees, water is absorbed through the capillary roots at some distance from the trunk and, for best results; the application method must deliver the water to that zone.

To increase oil content and give easier oil extraction, reduce irrigation for the final two to three weeks before harvest. This also hardens the stems for people who use tree shakers.

The quality of table olives or olive oil will not be impacted greatly by saline water but tree yields will be reduced by high levels of salinity in irrigation water. The highest yields will be obtained with water with less than 500 ppm total soluble salts. For long term use, the maximum salinity for commercial olives is 1,375 ppm total soluble salts (250 millisiemens per metre or mS/m).

Pests

In Western Australia, the major pest problems with olives are scale insects (black scale – *Saissetia oleae* and olive scale – *Parlatoria oleae*) and apple weevil – *Otiorhynchus cribricollis*. Garden weevil (*Phlyctinus callosus*) occurs in some groves but is much less important. In some groves, African black beetle (*Heteronychus arator*) and wingless grasshopper (*Phaulacridium vittatum*) have been a problem at establishment. Rutherglen bug (*Nysius* sp.) has invaded groves during early summer affecting vigour of young trees; and olive bud mite (*Oxycenus maxwelli*) has caused minor levels of bud deformation in a very low number of groves.

Of the scale insects, black scale is the more important. Black sooty mould is a fungus that is associated with the scales and feeds on the sugary exudates produced by them. Sooty mould blocks sunlight from the leaves and should not be a problem if there is good control of scales. Spraying may be necessary to achieve control and growers should only use chemicals registered or with a current permit (see www.apvma.gov.au). If horticultural spray oils are used, they should be timed to coincide with the presence of crawlers. This can be gauged by placing scale infested stems collected in late spring in transparent containers and checking for hatching of eggs. At least two applications of oil would be required. Some growers are releasing beneficial wasps into their groves to control scales.

Apple weevil is mainly a pest in the South West. Adults can damage young trees and if uncontrolled may affect the vigour of older trees. For control, use registered insecticides only – see the web site mentioned above. Fluffy polyester bands on the trunks of trees have proven effective as a barrier to weevils getting into the tree canopy.

The olive lace bug (*Froggattia olivinia*) is about 3 mm long and damages the leaves. Symptoms are numerous light green spots on the leaves. The olive lace bug is native to the Eastern States. A number of incursions into Western Australia have been sighted in recent years.

Birds such as 28 parrots, lorikeets, ravens, black and white cockatoos can cause major losses by damaging tips of young trees and twigs and fruits on older trees.

Rabbits can ring-bark the trees and trees may need tree guards. Kangaroos can eat the leaves and must be repelled with an electric fence. Mice can eat the fruit.

Diseases

Anthracnose (*Colletotrichum gloeosporoides*) can be a problem on ripening fruit particularly in moist conditions. It causes sunken lesions on the fruit and may be controlled by strategic copper sprays. The disease is more severe with some varieties (for example Manzanillo and Leccino) and with early rains.

Peacock spot (*Spilosea oleaginea*) is a fungal disease that shows as faint round lesions on the leaves. It was detected in Western Australia in 2006 on imported trees, but may not survive our dry conditions. It can cause leaf fall and poor fruit set, but it is a disease only of moderate importance in the Eastern States, mainly in humid areas. Any suspicious symptoms should be reported to the Department of Agriculture and Food in South Perth.

Olive knot (*Pseudomonas savastanos*) is a bacterial disease that produces knots (lumps) up to 2.5 cm in diameter on the branches and can severely impact on yields. It has been detected in the Eastern States and any suspicious symptoms should be reported to the Department of Agriculture and Food.

Soft nose is often mistaken for Anthracnose, but is a nutritional disorder. It causes blistering and crinkling at the bottom and side of the fruit, one month before harvest. It is believed to be caused by climatic fluctuations, high nitrogen and is worse with some varieties such as Sevillano. An early summer calcium spray is recommended.

Weeds

Mowing or spraying to manage weeds is preferred to cultivation in older plantings to avoid root damage. Planting or a cover crop mixture of legumes and grasses is advisable to manage weeds and improve soil structure.

The usual management practice is to apply glyphosate (e.g. Roundup®) or glufosinate-ammonium (i.e. Basta®) beneath the tree canopy and keep a slashed grass/broad-leaved weeds or sown medic pasture area between the trees. These are both registered contact, non residual, herbicides that will kill most existing weeds. Spray drift from both herbicides should be avoided on the plants. Glufosinate is safer to spray around young olive trees.

Sheep eat the leaves and fruit and can ringbark trees. They should not be allowed into the grove, unless the trees are protected by an electric fence.

Organic production

Organic products are a rapidly expanding sector of the food industry in many affluent countries including Australia. Olives are well suited to organic production methods due to their relatively low pest and disease risk, and low to moderate nitrogen requirement.

Modern organic farming is a whole farm management system where natural biology and balanced soils are developed to give sustainable yields without synthetic fertilisers and chemicals. Successful organic farmers design whole farm *integrated management* strategies to optimise the interaction between different farm activities. Close observation and understanding of biological processes, together with good management, substitute for synthetic chemical and fertiliser inputs.

Balanced biologically active soils, with enhanced organic matter content and humus formation, are the basis of organic farming. Maintaining good soil structure allows crop roots to exploit large volumes of soil for moisture, air and nutrients. Soil biological processes release nutrients for plant uptake without the use of highly soluble fertilisers. Establishing a good plant cover comprising a mix of grasses and legumes over the grove floor, helps cycle organic matter and maintain soil fertility. Synthetic conventional fertiliser inputs like urea, superphosphate and muriate of potash are prohibited. Permitted alternatives include compost, pelletised poultry manure, reactive phosphate rock, potassium sulphate and many other input nutrients. Trace elements used are typically the sulphate forms, such as zinc sulphate and manganese sulphate. Borax is an important trace element for olives and is also permitted.

Integrated weed control without the use of herbicides gives good results with timely management. Techniques for olive groves can include soil improvement, cover cropping, timely mowing, controlled grazing, green manuring, and mechanical cultivation.

Pest and disease management also relies on an integrated approach to minimise vulnerability to pest or disease problems. Healthy balanced plant growth tends to be more resilient to attack. A wide range of permitted substances are now available that can be used to supplement preventative management.

Processing methods and substances must also meet the requirements of organic standards.

Most reputable markets require product labelled as organic to be certified organic by an accredited third party.

Australia has a well-regulated system for organic and biodynamic production and processing that has gained a good international reputation. The 'National Standards for Organic and Biodynamic Produce' administered by AQIS, form the minimum mandatory requirements for export of products labelled as 'organic' or 'biodynamic'. These standards are implemented by six independent AQIS accredited certification organizations. They conduct farming system inspections and ensure a comprehensive record keeping system is in place to allow trace back and verification of inputs used, management practices, yield and sales.

For more details contact Steven McCoy, Development Officer, Organic Food and Farming, Department of Agriculture and Food, ph (08) 9368 3960 or smccoy@agric.wa.gov.au.

Pruning

In general, olive trees should be pruned and shaped to maintain as much cropping as possible, consistent with ease of access to the trees' structure for picking and spraying. Figure 5 shows hand pruning from a cherry picker.



Figure 5.

It is essential to train olive trees that are to be mechanically harvested. Where tree shakers are used a single trunk to a height of at least 1 m to 1.2 m should be selected. A single leader is then selected and the trees are pruned to a tall and narrow monocone shape. Mechanical pruning can be used to trim trees in alternate years, but these trees may become excessively bushy and may need further hand pruning.

Table varieties need a vase shape with three to five fairly rigid branches and no central leader.

Pruning in winter or spring is essential prior to an 'on year' to thin the fruit and reduce biennial bearing. It will also increase fruit size in table varieties.

Topping of the trees in winter at 4 to 5 m may be needed periodically to reduce tree size.

Each year, remove water shoots at the base of the tree, dead wood, lower branches and excessive internal growth but this has to be balanced with availability and cost of labour. Table varieties need to be pruned to allow some light into the centre of the tree. Cutter bars can be used to skirt lower hanging shoots to allow for easier mechanical and hand harvesting and better weed control with sprays.

If necessary, due to fire or ring-barking from livestock, trees can be re-juvenated by cutting the stem below the damaged area and close to the ground.

Pollination

Flowers can be self and cross pollinated by wind from other varieties. With all commercial varieties, it is important to intersperse pollinating varieties regularly through the grove such as every fifth row. Hot windy conditions at flowering and lack of soil moisture can reduce fruit set. About 1 to 2% fruit set is usual for olives. The fruit bears on one year wood.

Harvesting

Trees commence to bear commercial quantities of fruit after 3 to 5 years. They are ready for harvesting from March to July, with a peak from May to June. Harvesting is a major cost in growing olives.

Small plantations of olives for oil are mainly harvested with pneumatic rakes onto nets or mats. A two stroke petrol vibrator that hooks onto the branches can also be used.

Olives for oil are picked when fruit has changed from green to half the mature colour (see Figure 6).



Figure 6.



Figure 7.

With large plantings, mechanical harvesting is carried out. Some varieties are more suitable for mechanical harvesting. These should remove 90 per cent of the fruit. There are two types of harvesters. Mechanical tree shakers (Figure 7) cost \$80,000 to \$280,000, shake the stems and may damage the trees if not operated correctly. The olives are collected on mats laid on the ground or with some models, caught by a folding umbrella attached to the shaker (see photo). Tree shakers can harvest 60 to 80 trees per hour and 10 tonnes of olives per

day. Machines that straddle the rows (Figure 8) are expensive (over \$400,000) and may be self-propelled. They can harvest 200 to 350 trees per hour. They have retractable fingers and the olives fall onto a platform and then move to an elevator.



Figure 8.

Table olives are harvested by hand and can be picked at any colour. Hand-picking limits the damage to the fruit, as bruising and injury can cause discolouration and possible breakdown of the pickled fruit. Once picked, the olives should be graded for size and maturity and any immature, undersized and injured fruits rejected.

If fruit are allowed to hang on the tree for too long, this will affect production for the following year.

Yields

A mature tree of 10 to 15 years can yield up to 200 kg of fruit, but yields of 40 to 50 kg (10 t/ha) would be considered good in a commercial grove depending on spacing. Biennial bearing is a characteristic of olive trees featuring small crops ('off year') followed by a heavy crop ('on year'). This pattern is influenced by variety, environment and management. Producers aim to reduce the impact by judicious pruning (in the 'on year'), nutrition and irrigation. Late harvesting, or leaving crop on trees for too long can reduce yields in the following year.

It can take up to 12 years to obtain a positive economic return.

Processing

If the olives for oil are mechanically harvested, they must be processed as soon as possible to limit the development of off flavours in the oil from oxidation due to storage and transport damage. Same day pressing is desirable. Each tonne of fresh fruit should produce at least 180 kg oil. Based on a specific density of 0.91, this is equivalent to 200 L oil. Olives can be processed by the traditional mat press method or the modern continuous flow method.

Modern continuous flow oil presses have a range of capacity from about 25 kg per hour to 5 t per hour.

Oil processors charge about \$330/t for small lots of less than 5 t and around \$300/t for larger lots. Some processors purchase olives from growers. Processors or buyers may purchase oils from different regions and varieties to produce blends for market requirements.

Table olives can be processed by various methods and these can involve soaking in a brine solution for a few months, followed by pickling in vinegar, with added herbs. If stored correctly, pickled olives will remain in good condition for one year. Recipes are widely available.

Storage

If fruit for oil are not processed within 24 hours of harvesting, it can be stored at 4°C for one week, or at 18°C for 2 days. To be efficient, a medium size processing factory needs the fruit supplied by at least 100 ha of olives.

If necessary, table varieties can be stored before pickling at 5 to 7.5°C for 6 to 8 weeks at 90 to 95 per cent relative humidity.

Quality

Olive oil is rich on mono-unsaturated fats, mainly oleic acid. Medical studies indicate that health benefits of olive oil result from the high level of mono-unsaturated fatty acids and the content of antioxidant polyphenols. Olive oil is classified as extra virgin oil when it contains less than 0.8 per cent free fatty acid (FFA) expressed as oleic acid, as it is the dominant one. Virgin grade olive oil has less than 2 per cent FFA and ordinary grade has less than 3.3 per cent FFA. The levels of oleic acids can be higher in southern areas of the state. Levels of FFA will increase if the fruit is left on the trees for too long.

Olive oils also need to meet the requirements for the sensory (organoleptic) characteristics for each of the classifications.

Fruit and oil can be analysed for their chemical components at the Chemistry Centre of WA.

Olive oil trade

The aim in Australia is to produce extra virgin oil with a fresh fruity flavour which can be sold at both domestic and international markets at competitive prices. The oil is usually packed in containers ranging from 250 mL to 4 L while exports are in bottles, but increasingly in bulk containers. Australia has exported over 50 per cent of its production in the past few years. For an oil to be traded internationally, it requires an International Olive Oil Council (IOOC) approved chemical test to be conducted at Wagga Wagga Research Institute, NSW and an organoleptic test by an IOOC approved tasting panel. Olive oil sold locally must meet Food Standards Australia New Zealand nutritional labelling guidelines. Imported olive oil is exempt from duty, but table olives have a 10 per cent duty.

Further information

AUSTRALIAN OLIVE ASSOCIATION

PO Box 309
PENDLE HILL NSW 2145
Tel: (02) 9863 8735
Fax: (02) 9636 4971
E-mail: secretariate@australianolives.com.au
Website: www.australianolives.com.au

WEST AUSTRALIAN OLIVE COUNCIL

Executive Officer
PO Box 502
CLAREMONT WA 6910
E-mail: admin@oliveswa.com.au

REGIONAL OLIVE ASSOCIATIONS

These groups often organise local field days and meetings and are a good source of information for prospective olive growers. Details are on the Australian Olive Association Ltd website www.australianolives.com.au.

OLIVE TREE NURSERIES (not an exhaustive list)

Olea Nurseries

RMB 725 Dorset Rd
WAROONA WA 6215
Tel: (08) 9733 2100
Fax: (08) 9733 3014

Modern Olives

PO Box 324
LARA VIC 3212
Tel: (03) 5282 5988
Fax: (03) 5282 5977

Australis Plants

7 De Gruchy Court
HIGHFIELDS QLD 4352
Tel: (07) 4696 8792
Fax: (07) 4696 8712

Sunraysia Nurseries

GPO Box 45
GOLGOL NSW 2738
Tel: (03) 5024 8502
Fax: (03) 5024 8551

Lewis Nurseries

GPO Box 768
VIRGINIA SA 5120
Tel: (08) 8380 9598
Fax: (08) 8380 9774

Further reading

Irrigation of Olives in Western Australia by Neil Lantzke and Dick Taylor. DAFWA Bulletin 4462, June 2001.

Olive Lace Bug by John Botha. DAFWA Farmnote 82/2003.

Producing Table Olives, Stan Kailis and David Harris Landlinks Press.

RIRDC various research reports www.rirdc.gov.au.