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Organic apples a production guide

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a production guide

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Introduction

The belief among some conventional apple growers that it is not possible to reliably produce profitable yields of good quality apples under an organic system in Western Australia is being reconsidered. There are now very good examples of successful commercial organic apple orchards in many parts of the world, including WA. The organic production systems developed by these dedicated growers are showing that yields and quality are comparable to conventional systems.

Modern organic systems are largely the result of many years of on farm trial, error and improvement – typically undertaken without the routine support and scientific research effort afforded conventional growers. However, in recent years the emergence of new equipment, substances and techniques suitable for organic systems suggests the future development and refinement of organic systems will accelerate as will the provision of professional supporting services. For new entrants into organic production, this means the path to success may be less arduous. However, establishing an organic system typically requires a fundamental change in approach – toward a biological basis for production management. Motivation and commitment to this biological approach is seen as an essential requirement if the development of a reliably profitable and robust sustainable organic system is the business objective.

Establishing a well-functioning organic system takes time. The wide range of biological processes involved must be initiated, nurtured and maintained at optimal levels in an integrated fashion to achieve the desired results. This integrated biological management must replace the routine reliance on conventional substances including synthetic chemical fertilisers, herbicides, pesticides and growth regulators.

Producers already using Integrated Pest Management (IPM) and other integrated approaches will find the transition to organic production less dramatic than those with heavy chemical dependency.

A well established organic orchard.

Market outlook for organic apples

World trade in organic agriculture products is estimated to be valued at US$31 billion in 2005 and growing at 10-30 per cent per year. Major markets are the affluent nations of North America, Europe and Japan. Domestic and export markets are expanding for organic products across all agriculture sectors and apples are an important product in the fresh produce category.

The main organic apple producing nations are USA, Europe (Italy, Germany, France, Switzerland and Austria), New Zealand, Canada, Chile and Argentina. Total area is estimated at around 13,000 ha. The main supply competition for Australia is from New Zealand and South American producers. All are expanding their organic apple area primarily aimed at counter seasonal fresh market niches in North America and Europe.

In Australia, organic apples are grown in Western Australia, South Australia, Tasmania, Victoria, New South Wales and Queensland, with over 60 growers certified for organic apple production. Many are small mixed orchards, however some large orchards are now involved including the 130 ha Parramatta Creek orchard in Tasmania.

Western Australia has at least 21 producers certified for organic apples, including three full time professionals. Total production is approaching 300 tonnes per year, comprising mostly of Lady Williams, Cripps Pink and Fuji varieties.

Domestic demand expectations

The present growth in domestic WA organic sales has been achieved at relatively high price premiums and without any coordinated marketing strategy. As yet, little promotion and advertising of organic apples has taken place, indicating that demand continues to be driven by ‘consumer pull’ rather than ‘retail push’. This suggests a well designed and implemented market development plan combined with a carefully planned pricing strategy would stimulate significantly greater consumer demand than current levels.

Indications from organic wholesalers suggest the market for organic fresh produce including apples has doubled in the past two years. This growth is largely driven by the emergence of mainstream retail traders into the organic sector.

A number of leading specialist fresh produce retailers (greengrocer/growers markets) are active in building and promoting their organic range. Wholesale traders report that these shops have become more active in the organic market as they use organics to create a point of difference from their competitors.

The two major supermarkets have national policies to stock a range of organic products and are embarking on the development of ‘own brand’ organic lines. However, where supply volumes, continuity, quality and price are perceived as erratic, significant investment in promoting organic products remains unlikely. Select wholesalers in most States have been engaged by the major supermarkets to investigate the supply of organic produce and consolidate volumes to suit their needs.

The emergence of supermarket interest in organic products, combined with improved supply continuity may lead to some mainstream promotional activity related to organic products. A number of independent supermarkets are actively developing their organic range and developing organic sections within categories. Some of these stores are now beginning to promote and advertise their range of organic products. It is envisaged this increase in promotional effort will increase demand for organic products among more mainstream consumers.

Organic fruit – high quality is essential for expanding markets.

Export prospects

In 2003-4 Western Australia exported 35 per cent of its conventional apples and 50 per cent of its conventional plums making it Australia's main exporter. WA apples are popular in the UK, Malaysia and Singapore and were also exported to India, Brunei and Hong Kong.

Potential exists to offer organic apples on the back of existing conventional apple export trade. Destinations that have strong organic market growth such as the UK, USA and Europe have potential. However, these prospects are subject to competitive pressures from New Zealand, Chile, Argentina and South African organic apple supply. The extent and profitability of these markets requires further investigation and confirmation. However, at present WA has insufficient supply capacity of organic apples to seriously consider exploring these export market opportunities.

Processed and value-adding developments

Juice – demand for organic apple juice on both domestic and export markets, particularly Japan and UK have yet to be realised. One bottling business in Perth has been seeking supply of organic juice for many years. Supply volumes of organic juicing apples have been insufficient to justify separate crushing by conventional juicing facilities.

Cider – new opportunities are under development for regionally produced and branded organic apple cider. Reliable supply volumes of organic juicing fruit are necessary for economic feasibility of operations.

Apple cider vinegar – this product is believed to provide a range of heath benefits. Japanese buyers are seeking supply of organic apple cider vinegar for the Japanese health market.

Food ingredient – a new regional food processing facility – specifically for organic products – now provides new opportunities to supply organic apple puree as an ingredient in new products development.

Recent investment in organic flour milling and associated integration into bakery products also suggests potential for new bakery products using organic apples.

Dried apples – opportunity exists for import replacement of dried apple products.

General principles for organic apple production

This section outlines the general principles that underlie organic apple production systems. Aspects of organic standards specific to apple production are highlighted.

A whole system approach

Many orchards are mixed plantings that may include apples, pears, stone fruit, citrus or other fruits and possibly some seasonal vegetable crops. Production of apples must be considered as only one component of an integrated whole farm system. The inclusion of other fruit crops from unrelated botanical families, as well as soil regenerating pasture or green manure phases and the use of other plants species can have implications for management of pest, disease or weed control. The whole system should be designed and managed to optimise benefits and minimise problems across all crops arising from treatments to any one crop. The layout of cropped areas may change towards more mixed cropping as a way of breaking up large areas of a single crop, thereby increasing biodiversity and assisting pest or disease management.

Enterprises aim to become closed systems

Organic farms aim to operate as closed systems, using renewable resources wherever possible, maximise recycling, minimise waste, with reduced reliance on outside (off-farm) inputs as far as practical. Management strategies based on an understanding of biological cycles and other interactions are the main tools that replace reliance on synthetic chemical and non-renewable inputs. Organic farms can be managerially more complex, but should be less dependent on the use of external inputs.

Plant health stems from soil health

The underlying principle of organic crop production is that: 'healthy plants grow from healthy soil'. Well balanced, biologically enhanced soil – measured by adequate organic matter, humus level, crumb structure and feeder root development – forms the basis of organic production. Plants are nourished through a soil ecosystem built over time, and not primarily through fast-acting, soluble fertilisers added to the soil.

Synthetic fertilisers, chemical pesticides and herbicides are not permitted and can be detrimental to biologically active healthy soil.

Conservation and recycling of nutrients is a major feature of any organic farming system. Organic and mineral fertilisers should be used as a supplement to recycling, not as a replacement.

Land degradation problems such as organic matter depletion, soil structure decline, compaction, erosion, and nutrient leaching must be avoided. In general terms, well managed soils with adequate organic matter, biological activity and humus formation tend to be more resilient against most forms of land degradation.

Biological processes are important

Organic systems are primarily biological systems, both above and below the soil. Pest, disease, and weed control must, in the first instance, encourage and maintain natural biological processes so as to balance disease and pest problems. Enhancement and manipulation of these biological processes form the basis of organic management. Other control measures can include:

- choice of crop species and varieties;
- orchard layout and tree structure and canopy management;
- orchard hygiene;
- orchard floor species mix;
- mulching and mowing regimes;
- biological control and maintenance of beneficial predator habitats;
- mechanical controls such as traps, barriers, light, sound and pheromones.

Where available, the grower should use organically grown nursery plants, not treated with synthetic chemicals.

Part certification of a property can aid conversion

Growers may initially convert part of a property to organic methods while continuing to use conventional methods on the remainder. Typically, this involves selecting a location with low risk of spray drift or contamination from adjacent land. Buffer zones may be required to ensure adequate separation from conventional cropping.

Where the same variety is grown both as organic and conventional, the grower must demonstrate that very tight management protocols for product separation and record keeping are in place to allow complete verification of volumes and trace-back through the operation.

Sufficient area must be allocated to develop a proper functioning organic system. Some organic certifiers may also require a development plan that aims to convert the whole property to an organic system within a defined period. Moving into and out of organic certification is generally unacceptable.

Minimum qualifying period

The transition from a conventional system to a balanced, biologically active organic system is a gradual process. For organic apple production the land must be managed in accordance with organic standards for a minimum of three years. However, growers can obtain certification as 'in conversion' to organic after completion of one year (pre-certification) of compliance with organic standards. Markets for 'in conversion' status fruit may require careful assessment as premiums can be lower than for full 'organic' certification. Product in the first year of conversion (pre-certification) can not be sold labelled as organic.

Avoid contamination and spray drift

Potential sources of contamination, from spray drift, water sources or other means, can require careful consideration. Buffer zones are likely to be required between organic crops and conventional crops. Neighbours must be informed of contamination risk and cooperation sought. Soil tests may be required to check for chemical residues in soil from previous land use.

Old orchard sites can potentially have residual soil contamination from past use of synthetic chemical use such as DDT or Dieldrin. Generally soil chemical residues should be less than 10 per cent of the maximum residue limit (MRL). In cases where soil residue is above this level, special orchard management and tissue testing conditions can apply.

Genetic engineering is banned

The use of genetically engineered (GE) organisms and their products are prohibited in any form or at any stage during organic production, processing or handling. Crops and land must be free of GE contamination.

Co-existence with, and protection of the environment

Maintaining biological diversity on and around the farm is an important feature of organic systems. Avoiding monocultures by encouraging biological diversity tends to allow ecological balance or equilibrium to establish, resulting in a more stable system with less dramatic biological fluctuations – both on the farm and in the surrounding natural environment.

Areas of remnant vegetation should be protected. Shelterbelts and areas of remnant vegetation can be important habitats for natural predators of insect pests, which when kept naturally in check will reduce harm to crops and reduce the need for control measures.

Organic farms should also ensure that pollution and other forms of degradation resulting from agricultural practices are avoided. The use of non-renewable resources should also be minimised to help extend future availability of these finite resources.

Irrigation management

Irrigation methods must be adequately managed, scheduled and monitored to reduce problems with watertable, leaching of nutrients and salinity inducement. Irrigation management must minimise disturbance to the environment and natural ecosystems, including wetlands, river flow regimes and wildlife habitat.

Post-harvest, storage and processed products

To prevent contamination of apples on farm, organic product must be kept in a dedicated storage area separate from conventional product. Post-harvest treatments and packaging materials must comply with organic standards.

Where growers intend to value add or process apples, compliance with organic processing standards is required if the final product is to be labelled as certified 'organic'.

Making the change to organic

Setting up an organic system of apple production will take time. Organic standards require a minimum of three years, and this reflects the significant changes that must take place for an organic system to begin to function properly. This period will require serious commitment to understanding the different approach involved, especially in relation to the way plants are fed and how to manipulate biological processes – both above and below the ground.

Developing a system of organic apple production that suits your situation may not be simple. Expect some crop failures, be prepared to make mistakes and don't expect an organic crop to perform the same as a conventional crop. Sometimes a crop you are familiar with will perform quite differently under an organic system, for example different growth patterns or the impact of pest or disease burden.

Many growers start with a small area that is unlikely to have a significant impact on profit. By starting with a small trial area dedicated to organic methods, growers can gain experience, knowledge and confidence about what works and where problems may occur.

Growers who already use integrated pest and integrated weed management techniques may find the transition to organic less dramatic than otherwise.

Working in conjunction with a few other growers can speed up the learning period by providing more scope for testing ideas and finding better solutions.

The transition toward an organic system can lead to some problems in the first few years. Some growers report that tree vigour may look a bit poor, but as the system establishes, tree health recovers and improves to better than previous conventional condition and good yields return. Also in the first few years some pest or disease problems can get worse while others improve. However, over time those transitional problems diminish as changes in the biological dynamics progress toward a different equilibrium.

Existing orchard condition

The existing condition of an orchard can have a significant bearing on the likelihood of successful conversion to an organic system. Listed below are some important considerations:

- **Tree health –** The existing condition of trees needs to be healthy. Successful conversion to organic management can be difficult to achieve with old and diseased trees.
- **Weed status –** Existing serious problems with invasive perennial weeds, especially kikuyu and to a lesser extent couch grass, can present a major difficulty and cost to control under organic systems. The usual course of action is to minimise these weeds before establishing an organic system. On-going vigilance is needed to ensure timely control of subsequent outbreaks.
- **Rootstock and varieties –** It has yet to be determined which varieties are more amenable to organic systems in WA. As yet no specific varieties have been developed for organic production. Obviously, varieties that are less prone to problematic pests or diseases are desirable, however market preferences and other agronomic traits must also be considered. In Washington State, USA, grower reports suggest Gala and Golden Delicious are relatively amenable, but Fuji can be problematic. British Columbia organic growers are evaluating new variety Ambrosia that shows particular promise for organic production.

  Rootstocks that impart resistance to woolly aphid such as the MM series are important, whereas dwarfing root stocks are typically susceptible to woolly aphid.
- **Orchard layout, tree structure /trellising system –** The best layout and pruning system may vary to suit regional conditions. High density plantings may be more susceptible to fungal disease. However, this may be off-set with careful layout and pruning to facilitate good air flow. Pruning to central leader structure with new wood replacement management may suit higher density planting.

Selecting a site

Selecting a location isolated from potential sources of pest, disease or weed introductions is obviously desirable but not always possible. Sites that are away from conventional production areas can avoid problems of spray drift and chemical contamination. On windy sites, windbreaks may be required, not only to control spray drift problems but also to protect crops from wind effect and damage. Buffer zones between conventional and organic areas can be used to protect against contamination.

Selecting better quality soils is likely to be helpful and require fewer inputs than poorer soils. Loamy soils are likely to require relatively less nutrient inputs and less frequent watering than sandy soil types. In addition, the clay content in loamy soils can accommodate organic matter, the development of good soil biological activity and humus formation suitable for organic production. Chemical or heavy metal residue in soil must not exceed limits set by organic standards.

Water requirements for apple production in WA can be significant. Consideration should be given to possible sources of unacceptable contamination or excessive nutrients in irrigation water.

Organic apple production strategies and methods

To meet organic certification requirements, conversion from a conventional system to an organic system is likely to involve changes to existing management practices and adoption of some new strategies and techniques. Changes to management go beyond simply not using synthetic chemicals and fertilisers.

This section outlines some of the strategies and methods used by organic apple growers that should be considered when planning conversion of an existing conventional production system. Please note that details provided are general outlines only. Specific techniques and strategies adopted by individual organic growers will vary according to their circumstances, location of the property and type of enterprise.

Good organic managers rely on close observation, anticipation and prevention to develop a robust organic system for each situation.

Overall management strategies need to reflect the following key organic farming principles:

- soil health largely determines plant health;
- organic systems are biological systems;
- organic farms should operate as closed systems as far as possible; and
- a holistic approach ensures good integration.

Many of the best management practices developed for conventional apple production are likely to also be applicable for organic systems. Efficient irrigation management, windbreaks, erosion control, and aspects of integrated pest management or integrated weed management may be adapted to suit an organic production system. In addition, quality control management systems, preferably incorporating a Hazard Analysis and Critical Control Point (HACCP) system, are desirable.

As with other forms of organic farming, organic apple production requires a whole farm approach. Increased reliance on management rather than substances demands careful planning.

A well designed whole farm plan should devote special attention to the conversion phase – the first three years of transition from conventional to organic management – when premium markets for ‘in conversion’ product may be uncertain and while practical experience is being developed. Such a farm plan can enable an organic system to be easily integrated with all farm activities. Financial risk can be managed and adoption of each new operational component can improve management and enterprise effectiveness.

Details of the progressive changes intended will help develop a smooth conversion towards a profitable, productive and sustainable organic system.

The major changes are likely to relate to the following aspects of a conventional production system:

- Orchard floor management
- Irrigation layout
- Soil fertility and nutrient management
- Weed management
- Fruit Thinning
- Pest and Disease management
- Post-harvest treatments

Orchard floor management – **orchard floor plants can provide many functional benefits**

The basis of organic orchard floor management is to grow grass to build mulch. Typically a range of preferred species are established that contribute various system functions including:

- generate biomass/organic matter (roots and tops) that feeds soil biological activity as the foundation for sustaining soil conditions, nutrient availability and organic matter cycling;
- build soil structure and improve resilience to soil compaction and erosion;
- protect the soil from extremes of water stress, heat and cold;
- attract and harbour beneficial predators and biodiversity to minimise pest pressure;
- provide competition to suppress problem weeds;
- facilitate rapid decomposition of diseased tissue;
- improve resilience to traffic;
- attract bees and other pollinators.

Establishing floor cover species may include barley in the first year (new orchard), then a mix of grass and legume pasture species are sown – for example red clover, rye grass, fescue and cocksfoot. Other cover crops

Organic orchard floor cover.

may also offer functional benefit or be more suited to local conditions. Careful management to ensure good establishment and persistence of sown cover plants is important, especially the legume component. However, excessive legume dominance can lead to excess of nitrogen which can affect fruit quality and lead to storage problems.

The selection of legume species can be important. For example, one orchard in South Australia reported red clover was considered to be better than white clover which proved to be too vigorous, produced excess N and made the ground slippery for machines. In the USA, Kura clover (*Trifolium ambiguum*) is being trialled for the following functional benefits: foster soil fauna that will eat leaf litter (scab control), provide source of N used in part by the trees (minimising purchased N inputs and nitrate leaching), favoured nectar source for bees, effective for soil conservation (erosion prevention) and non chemical means of weed control. In New Zealand, investigation of orchard floor cover species has included various herbs species that are powerful attractants for beneficial insects. Of particular interest are those plants belonging to the family Umbelliferaceae such as parsley.

The aim of building mulch can be achieved by simply bringing in straw. However, growers caution that straw has often been responsible for bringing in too many problems – especially weed problems.

Costs associated with orchard floor cover management can relate to equipment and labour time for mowing, as well as additional irrigation costs to grow cover plants over more of the orchard floor.

Irrigation layout **– micro sprinklers on raised irrigation laterals**

With the aim of growing grass to produce mulch, a number of growers use micro-sprinklers or fan jet sprinklers in place of drippers. This allows a greater area to be irrigated and so the benefits of the cover plants extend over a larger proportion of the orchard floor.

To facilitate periodic mowing under trees and around tree trucks, irrigation lines are typically raised off the ground. A common method used is to install a wire down the tree row above the ground. The irrigation line is then suspended from this wire. This allows mowing machinery to move under the irrigation line and around tree trunks without damaging the irrigation line. Sprinklers can be installed on flexible droppers that hang from the irrigation line above.

Another method used is to pin the sprinkler riser to the trunk of the tree with a stainless steel fastener. With this method access for equipment between the trees is retained.

Raised irrigation lines with micro sprinkler droppers.

In some circumstances, overhead irrigation is being installed to enable cover plants to be grown over the entire orchard floor throughout the year. A good water supply would be essential, and the main cost is water as it takes a lot to keep a good cover growing throughout the summer.

Soil fertility and nutrient management **– no synthetic fertilisers**

Managing nutrients is important because fast acting synthetic chemical fertilisers are not permitted. Many conventional growers wrongly believe organic systems use no fertilisers. In fact a wide (and increasing) range of nutrient inputs are permitted, making it possible to correct any soil imbalance and provide specific supplements as required.

The main difference from conventional systems is that inputs are used in keeping with a biological approach to managing soil fertility. This means that growing plant cover over the orchard floor, and mowing to create mulch that will fuel soil biological activity, becomes the engine that generates soil fertility and plant available nutrients. The application of supplementary fertiliser inputs only becomes necessary where an imbalance or deficiency can be demonstrated. The amount of supplementary inputs needed typically diminishes over time as the system of biological cycling develops. Growers with well established and managed organic orchards report that relatively small quantities of input nutrients are required each year to sustain tree health and yields that are comparable to conventional systems. They try to use good science to target fertility and assist the natural recycling process rather than use large quantities of product.

In conjunction with taking a biological approach to managing soil fertility, a number of growers use the 'Albrecht' method of balancing soil chemistry. Dr William Albrecht was an American soil scientist who established a set of ideal ratios for the main soil cations (Ca, Mg, K and Na). One feature of this method is the importance given to the Ca to Mg ratio as a key driver of soil health and therefore plant health and performance.

In general, nutrient supplements can be applied to remedy identified soil deficiency – rather than applying as a routine event. Occasional foliar nutrients are permitted. Soil tests are important to verify the need to apply the deficient nutrient. The general approach toward correcting any deficiency is via the soil, rather than applying directly to the plant (leaves). Of course in early years of conversion some foliar nutrients may be required while soil imbalance is corrected. The grower needs to demonstrate that measures are being taken to correct the soil rather than simply relying on direct feed to the plant – so the approach is to 'feed the soil and let the soil feed the plant'. Care must be taken to use materials that will not be detrimental to soil biology – in fact they should be beneficial to soil biological processes – as soil biological health is the foundation of organic soil management.

Compost is seen as a valuable input to be used in conjunction with an integrated soil fertility management program. However, availability, quality, purpose and cost are important considerations depending on location.

A number of acceptable organic input nutrients cost more than conventional product. Although the nutrient quantities applied may be less than in a conventional system, overall fertiliser costs can be similar. However, organic growers tend not to 'chase' fertilisers, noting that mulching the grass to assist the natural recycling process is better value.

The main nutrients and acceptable organic products are outlined as follows:

- **Nitrogen** – legume plants and mulch, pelletised poultry manure, blood meal, blood and bone, fish emulsion. Compost can provide useful amounts of available N.
- **Phosphorus** – phosphate rock, guano, various pre-digested phosphate rock, compost, blood and bone. Compost can provide useful available phosphorus.
- **Potassium** – as potassium sulphate, langbeinite, seaweed. Compost can provide significant available potassium.
- **Calcium** – as agricultural lime (limestone), dolomite, lime sand, micronised lime.
- **Magnesium** – as dolomite or magnesite. Magnesium sulphate (Epsom salts or kieserite) is also acceptable.
- **Sulphur** – often via the use of gypsum, potassium sulphate or other sulphate nutrients. Elemental sulphur can be used on a restricted basis.
- **Trace elements** – As a general rule naturally occurring sulphate forms are acceptable, as are oxide forms – though oxides are less available in the short term. Products made from nitrates or chlorides not permitted. Products must not be chemically treated to promote water solubility. Acceptable examples are; Zinc sulphate, Iron sulphate, Copper sulphate, Manganese sulphate, Borates or Boric acid. A number of other products can also provide useful quantities of trace elements, such as compost, seaweed and fish emulsion. Natural chelates, e.g. ligno sulphonates and citric acid, maleic acid, amino acid and other di or tri acids are permitted. Synthetic chelates, e.g. EDTA and HEDTA are not permitted.

Plant availability of a number of the nutrient sources listed above can differ from highly soluble conventional product. The lead time required from first applying the input until useful quantities are plant available must be carefully considered – especially in the first few transitional years. Over time residual pools of nutrients held in soil biomass can compensate for this time lag.

The impact of growing orchard floor cover and producing mulch must also be considered in calculating a nutrient management program. In some instances too much clover legume growth can lead to excessive nitrogen levels in the soil that can have a detrimental affect on fruit quality and storage.

Weed management **– without herbicides**

Attempting organic conversion on a site with serious weed problems will be difficult and expensive. Pre-treatment weed control is considered essential for perennial grass weeds, especially kikuyu and couch. Once established, the deep rooted stolon habit of these robust plants make them hard to control, and their competitive impact on tree performance can be significant under an organic system.

Moderate/high vigour root stock may potentially tolerate couch grass if nutrient inputs are adjusted to suit, but kikuyu is too aggressive and depleting and needs to be removed before planting.

Starting with a site that is relatively free from serious problem weeds is an important pre-requisite before committing to an organic production system. Vigilant monitoring and timely control of problem weed outbreaks will be important to ensure serious infestations do not get established.

Mowing and mulching

A well established plant cover, of preferred species, over the orchard floor provides the basis for out-competing and controlling weeds. Managing the orchard floor cover requires periodic mowing and mulching, and these events can be designed and timed to optimise the impact on target weeds.

A common machine used is a tractor mounted mower with spring loaded retractable outrigger that moves around trees trunks. The height and timing of cutting can influence the growth and flowering of different orchard floor species and hence their ability to attract beneficial insects. Leaving occasional strips un-mowed at certain times can assist in maintaining biodiversity.

Different mowing options should be considered for early and late in the season. One grower reported using a modified hay cutter twice early in the year to keep cut grass long and lain flat. Finely chopped up grass tends to decompose quickly, so tall grass is cut with a hay cutting action in the spring which gives a slower breakdown and helps conserve water, and builds biological activity and humus formation. Later in the year a mower with outrigger is used.

For new tree plantings, the use of heavy straw mulch down rows during the first few establishment years is common practice. The use of barley as an initial cover crop followed by sowing selected orchard floor species can give a solid cover that allows mowing and mulching down the young tree lines. A brush cutter can also be used around young trees and other areas where necessary.

The strategic use of chooks (in mobile housing), positioned to impact on problem weed hot spots, has been used with success. – especially on kikuyu and couch grass. Sheep can also be used for weed control at strategic times of the year. It can be important to balance soil minerals to prevent sheep from eating the bark.

Fruit thinning

Fruit thinning sprays used by conventional growers are not permitted under organic systems.

For organic systems fruit thinning costs are typically higher than for conventional systems. The increased costs relates to additional labour time required to thin crops that have not already been partially thinned by other means. Hand thinning is an expensive and labour intensive process – in some instances the cost can be higher than picking costs.

However, reliance on hand thinning was reported by one grower as an important aspect of quality control. The selection and spacing of fruit to be retained was seen as important to ensure a high proportion of top quality fruit. Inadequate thinning tends to bend branches, exposing the fruit to sunburn in hotter regions.

Crops that have not been partially thinned with chemicals prior to hand thinning require more time and effort to thin. Hand thinning heavy crops may cause disquiet among workers or when using contract fruit thinning teams. However the non-use of synthetic chemicals may appeal to some workers.

Fruit thinning needs to be done early before physiological impact, thus minimising biennial bearing problems. Chemical thinning can reduce the time for follow-up hand thinning by between 50 to 90 per cent depending on timing and effectiveness of the chemical (affected by weather and plant development status). Where labour is limiting, hand thinning can take longer and this may accentuate biennial bearing compared to chemical thinning. Conventional chemicals can thin at onset of flower before fruit has set, whereas reliance on hand thinning may mean some fruit has set and thinning may still be incomplete during crop filling.

There are a number of organic acceptable substances that have been reported to give some thinning effect. Application of lime sulphur in cool weather during or just after bloom can cause blossom and fruit thinning. One report suggests rates of around 1 litre per 95 litres can be applied at up to 10 per cent bloom without leaf burn.

Other options reported to assist fruit thinning are the use of biodynamic 501 silica spray. In the USA, research on thinning is investigating ways to interrupt the reproductive process so only hardiest fruit are left on tree.

Research in Switzerland has demonstrated that vinasse (a by-product of molasses) and mechanical thinning with a rope thinner have good potential. Alternatively, corn oil – a commercial product from New Zealand – has given encouraging results.

Pest and disease – prevention, resistance and IPM

Apple production in WA has the enviable position of having freedom from several serious pests that affect most other apple growing regions of the world. However, for many conventional growers the first question often asked is how do you manage pests and diseases?

Successful organic production requires an integrated approach to managing pests and diseases. An important part of this approach involves a number of underlying preventative strategies that can contribute to minimise the likelihood and severity of problems.

Conventional growers that have adopted Integrated Pest Management (IPM) techniques into their orchard management practices will find the transition to an organic system less dramatic than those without IPM knowledge and experience.

All of the principles of IPM can be applied to an organic system with the main variation being that some of the substances used for specific pest or disease control may need to be changed. Building biodiversity into an organic system by way of establishing and managing the orchard floor to attract and harbour beneficial predators can increase the effectiveness of IPM techniques.

A range of preventative measures are important to minimise susceptibility to pest and disease pressures. Some key preventative measures are as follows:

- **Location /regional occurrence** – Understanding the prevalence, timing and severity of specific pests or diseases for a given location is very important and can have a significant impact on production costs and reliability of production. An organic management plan can be developed to minimise identified risks. For example the relatively warmer drier climate of the Perth Hills suggests fungal problems may be less severe than in cooler wetter regions. So in the South West region issues of orchard layout, varieties, planting density, tree structure and pruning should be designed with emphasis on avoiding conditions that favour fungal attack.
- **Surrounding land use** – Neglected orchards or poorly managed surrounding properties can be a constant source for new outbreaks of pest or disease (or weeds). Sometimes unhelpful neighbours can make these sources of pests or disease a major problem.
- **Cooperation** – With conventional growers is very useful. A local monitoring group for weather and other risk factors can mean less unnecessary sprays. This is important to reduce resistance issues and leaf burn.
- **Rootstock and variety** – Selection of plant material with resistance characteristic should be used wherever possible. For example the use of MM rootstock that has resistance to woolly aphid. The use of M series inter-stock to control tree growth.
- **Tree health and age** – Successful conversion to organic management can be difficult to achieve with old and diseased trees.
- **Healthy trees** – Emphasis on maintaining healthy trees that are naturally able to cope with minor pest or disease problems. The foundation for healthy trees stems from healthy soil. This is achieved via biologically active soil with adequate organic matter and nutrient cycling to balance the chemical, biological and physical condition of the soil. A wide (and increasing) range of inputs are permitted, making it possible to correct any soil imbalance and provide specific supplements as required.
- **Biodiversity** – Orchard floor management that involves a mix of plant species and timely mowing to encourage and maintain beneficial predators. Windbreaks and shelterbelts can also be designed to encourage biodiversity.
- **Hygiene** – Vigilant and thorough orchard hygiene is very important. Removal of infected wood, fruit and other plant tissue can reduce the severity of subsequent problems.
- **Rapid decomposition** – Infected leaf litter as a source of future inoculant can be reduced by rapid decomposition assisted with mulch from the orchard floor.

An increasing range of substances are permitted for controlling pests and disease in organic production. Some substances require close attention to timing and frequency of application in order to optimise effectiveness. Target specific substances should be used in preference to broad spectrum substances, and special attention must be given to any potential impact on beneficial predators.

The main pests and diseases of apples with examples of remedies or products used by organic producers are outlined as follows in Table 1 and Table 2.

Table 1. Pest management options

For general information see Bulletin 4585 *Common pests of summer fruit in Western Australia*.

Pest	Organic management options
Weevils (garden weevil, apple weevil)	Can be a severe pest especially in young trees. Adult weevils feed at night and shelter during the day in litter at the base of the tree. See Farmnote No. 60/2003 *Garden weevil in vineyards*. Also see Garden Weevil Watch **www.agric.wa.gov.au**.
	• **Collars** installed around the tree trunk to prevent weevils entering the canopy. Growers have used a number of different types: - Tac-gel® collars have been used on established trees. They require annual maintenance, can burn the trunk on hot days and young trees can be particularly sensitive. - Dirco® wool collars can be used on young trees in the establishment years when the problem can be severe – could possibly soak or spray pyrethrum or neem oil on collars once or twice per year.
	• **Poultry** have been used to good effect in a number of situations. Strategic use of chooks from late spring to early autumn can control weevil/beetles hot spots – they also add manure and can be positioned to impact on problem weeds especially kikuyu and couch grass. Geese and guinea fowl in orchards have also been used to minimise weevil problems.
	• **Neem oil** sprayed at the base of the trunk has been reported to provide mixed results.
Mites (two spotted mite)	Rarely a problem in a well managed organic system. Problems are often reported to disappear when chemical sprays are stopped due to the ability of predator mites to re-establish.
	• **Predator protection** – avoid spays that kill or deter predator mites. Encourage and maintain good population of predator mites.
	• **Water stressed trees** can be more susceptible.
	• **Dormant oil sprays** used for aphid control also control mites.
Apple dimple bug	Main cause of misshapen fruit. Monitoring is important, especially early in the crop to establish threshold levels (2 bugs/100 fruit cluster) before treatment required. See Factsheet 42/2000 *Apple dimpling bug*.
	• **Monitor pest levels** against economic thresholds. See Orchard Alert **www.agric.wa.gov.au**. Tagasaste (tree lucerne) is reported to attract dimple bug and could be useful as a monitoring attractant for early warning indicator or trap crop.
	• **Pyrethrum** is effective, but its broad spectrum action could impact on non-target beneficials. Careful timing to minimise damage to non-target species.
	• **Neem** was reported as not that effective in reducing populations, however did seem to reduce damage to acceptable level – perhaps had anti-feeding action.
	• **Blue dog bane** (*Plectranthus ornatus* syn. *Coleus caninus*) is a pungent aromatic herb with pest repellent action.
	• **Kaolin**, **e.g. Surround®** spray early to deter pest damage – excessive use may affect mite predators.
	• **Ants** are known to deter dimple bug.
Light brown apple moth	Chews and skeletonises leaves. Damages the surface of ripening fruit. Most severe where clusters of fruit provide shelter.
	• **Pheromone twist ties**.
	• **Bt (*Bacillus thuringiensis*)** timing is important as only effective on young larvae.

Table 1. Pest management options **(cont'd)**

Pest	Organic management options
Heiliothos	Caterpillars feed on flowers, shoots and newly set fruit causing fruit drop and holes in fruit.
	• **Bt (Bacillus thuringiensis)**.
	• **Parasitic wasps (Tricogramma) and flies (tachinids)**.
	• **Spinosad**, e.g. Success®.
	• **Pyrethrum** as last resort but this can lead to a mite problem.
Mediterranean fruit fly (Medfly)	Larvae damage fruit and can destroy entire crop.
	• **Spinosad**, e.g. Naturalure®.
	• **Neem oil** plus pyrethrum, e.g. Azadol® has been reported to provide control. (Note: Neem is not registered for use as a pesticide.)
	Baits can be effective in situations of low Medfly pressure. Suggested baits are: - For males – Dryacide® with Pheromone for male. - For female – wet yeast bait = brewers yeast 2 g, sugar 150 g, water 500 mL.
Scale	Generally only a minor problem.
	• **White oil**.
Woolly aphids	• **Rootstock selection** – use woolly aphid resistant selections. The M (Malling) series with numbers over 100 are resistant to woolly aphids, e.g. MM111, MM106.
	• **Promote predator populations:** avoid sprays that disrupt biological control. Predated on by the tiny parasitic wasp *Aphelinus mali.*
	• **Winter oil** – may require only one initial application but may not be necessary again.
Aphids	Damage to buds may reduce fruit set. Aphids will also attack new fruit and leaves causing them to fall.
	• **Winter oil**.
	• **Potassium soaps**.
	• **Control ants** (trunk collars and boric acid). Ants protect aphids from predators and move aphids about.
	• **Promote predator populations:** avoid sprays that disrupt biological control. Predated on by ladybird, lacewing and hoverfly larvae.
Looper caterpillar	Traps and monitoring can be important.
	• ***Bacillus thuringiensis***.
	• **Spinosad**, e.g. Success®.
	• **Pyrethrum** – as last resort but this can lead to mite problem.
Mammal and bird pests	Birds, especially parrots have been reported as the biggest problem. Rabbits can be a problem on new plantings and kangaroos can be a problem in some locations.
	Birds – ringneck parrots and black cockatoos. See Farmnote 125/2000 *Parrots and cockatoos in orchards*.
	• **Netting**, but expense and return on investment needs to be considered.
	• **Scaring devices:** - gas gun (two bang reported to work on cockatoo not parrots); - flying hawk, etc.
	• **Peppering** has been tried by a number of growers with inconclusive results. (Peppering is a biodynamic technique based on spreading the ash of burnt pest species.)
	• **Shooting** only under registered permit.
	Kangaroos and rabbits
	• Purpose built fencing.

Table 2. Disease management options

Disease	Organic management options
Powdery mildew	Hot dry conditions (in Perth Hills) usually means less problems compared to the cooler wetter South West region. Reported to be more of an ongoing problem with Lady William and Cripps Red.
	• **Adjust pruning/tree structure** to improve airflow, reduce humidity and improve spay coverage.
	• **Removing infected shoots** during dormant pruning and new shoots and blossoms as they become infected.
	Applications of lime sulphur, micronised sulphur or summer oil at pink bud and petal fall stages usually controls this disease. However, during high risk conditions and for susceptible varieties additional sprays may be required.
	• **Liquid lime sulphur** (1 litre lime sulphur to 35 litres of water) applied at a rate of 112 L/ha. It can be phytotoxic and burn leaves and blossom if applied in hot weather. It is highly caustic and must be handled with care. Also is potentially harmful to predator mites causing spider mite outbreaks later in the season. In cool weather lime sulphur at rates of 1 litre per 95 litres can be applied at up to 10% bloom without leaf burn. Application during or just after bloom have caused blossom and fruit thinning.
	• **Micronised sulphur** (80% sulphur) applied at 11-17 kg/ha effectively prevents apple scab infection and also controls powdery mildew on some varieties. Can be applied from green tip through fruit set and fruit development without phytotoxic effect or fruit russeting. The residual for protection is about 1 week. Therefore under susceptible conditions should be applied weekly.
	• **Summer oil** – but timing important to avoid burning.
	Oil and sulphur spays should not be applied together or within two to three weeks of each other due to the potential for leaf burn and fruit russeting. Sulphur is a mild irritant and gradually acidifies the soil. Sulphur and oil are incompatible and should be applied at least two to three weeks apart, otherwise phytotoxic effect on leaves can occur.
	• **Milk or whey** based spays are reported to be effective preventative treatments on grapes.
	• **Seaweed** based sprays may improve resilience and reduce susceptibility.
	• **Predators *Ampelomyces quisqualis*** (a parasitic fungus of powdery mildew) has been reported to control some types of powdery mildew in glasshouse crops and has been reported in some vineyards in Australia. Fungus eating mites, such as the Tydeid mite, and beetles have been reported to reduce powdery mildew colonies on vines. See Bulletin 4575 *Powdery mildew in wine grapes in Western Australia*.
Sooty blotch and fly speck	The fungi that cause sooty blotch and flyspeck grow superficially on the surface of the fruit, losses are primarily through reduced visual quality.
	• **Potassium bicarbonate/ oil mixture**.
	• **Methionine-riboflavin** mixture.
	Either of the above are reported to reduce sooty mould and flyspeck as well as or better than sulphur.
	• **Sulphur**.
Alternaria	Small, slightly sunken, light to medium brown spots appear on the lenticels of the fruit, often after rain. Potential emerging problem, look for signs especially on old neglected orchards. Some growers have had severe problems and lost crop.
	Mowing with a flail mower helps to break the leaves up and destroys the over-wintering spores. Removing diseased leaves from the orchard floor and destroying them is an effective management tool.
	• **Potassium bicarbonate**, e.g. EcoCarb®.

Post-harvest treatments

All post-harvest operations must comply with organic standards. Producers often convert only a portion of their orchard to organic initially (known as 'parallel production'), so both conventional and organic product will move through the same pack-house facility. The primary objective is to avoid contamination with prohibited chemicals and to ensure separation of organic product from any conventional product.

The post-harvest procedure normally adopted is to run organic fruit first after the equipment has had a clean-down. This allows the organic product to be dealt with and packed away in a separate area prior to commencing with the conventional fruit and so avoids the risk of contamination from conventional fruit and related treatments.

Hazard Analysis Critical Control Points (HACCP) based quality assurance systems are ideal for establishing protocols and audit systems that meet organic requirements. Operations with existing HACCP based QA systems typically find that only minor changes are required to comply with organic standards.

The main post-harvest changes for conventional operations may involve some the following:

Table 3. Post-harvest management

Issue	Organic management options
Equipment wash down and surface sterilants	Substances and procedures used for cleaning equipment prior to handling organic fruit must comply with organic standards. The use of some substances may need to be followed by detergent cleaning and clean water rinsing procedures.
	• Steam, acetic acid, carbonic acid, hydrogen peroxide, ozone, soap and water.
Waxes	• **Carnauba** (restricted for export produce where use is mandatory).
Controlled atmosphere storage (CA)	The use of controlled atmosphere storage is permitted. However, organic product cannot be stored in the same CA room with conventional product. The use of DPA pre-treatments is prohibited as may be other storage chemicals.
	• **Bitter pit** – unrefined mineral calcium chloride is reported to have effects equivalent to synthetic calcium chloride compounds in the suppression of bitter pit in stored apples.

Key conversion impediments for WA growers

Producing a certified organic apple product is no guarantee for better market response and repeat sales if quality is inferior. Poor quality organic apples are unlikely to attract a consumer following, whereas delicious eating qualities and good visual appearance will stimulate consumer interest and repeat sales. So it is important to first build a reputation and brand with customers based on quality before moving into organic. Organic certification can then add value to this relationship by reassuring customers that the product is safe, healthy and produced with care for the environment.

Experience, system knowledge and confidence

There is a common misconception that organic production is not suitable for professional orchardists. However, there now are good examples of mainstream commercial orchards, managed by full time professional orchardists, who have developed organic systems that work, and have successfully converted to profitable certified organic production.

Motivation for moving toward organic methods appears to be twofold. Gowers want to use environmentally benign and sustainable production methods and they want to make a reasonable living. Taking a biological approach and moving to organic is seen as a way to satisfy both objectives.

One of the biggest problems is the lack of support services that are normally available to conventional growers. For example local agricultural suppliers will be knowledgeable about the use of many conventional inputs, but may be unfamiliar with the use of various organic inputs and the biological approach required. Similarly, the advice available from agricultural advisers, consultants and other service providers may be limited. As a consequence, many things have to be done by trial and error. So it is important to trial first, and have many of the answers before committing. However, having all the answers to make an organic system work reliably takes time. Careful application, testing and monitoring of alternative technologies can be required.

Most experienced organic producers report that the longer their organic system operates the less they have to do – the systems tend toward its own balance. Each year brings more confidence in the performance of the orchard ecosystem.

Starting with a small trial area to experiment with at first, allows time to gain experience, knowledge and confidence. This strategy can reduce the commercial risk before converting more land as market opportunities warrant.

Producers who have implemented IPM systems will find the move towards organic less dramatic than those with heavy reliance on synthetic chemical inputs.

Regulation and certification process

Formal organic certification proceeds through a three year transition period. The first year is known as 'pre-certification' and involves compliance with organic standards and implementing an organic management plan. Years two and three are conversion years where a proper functioning organic system is established and product can be sold labelled as 'in conversion' to organic. After three years (year four) full organic status is possible and product can be sold labelled as 'organic' certified.

Obtaining and complying with organic certification does involve additional administrative time and paper work. Good records must be maintained to allow a complete trace back of any product from the cool room to the paddock. Direct costs of organic certification vary according to the certifier and involve an initial fee for establishment and inspections in the first year. Subsequent years typically attract an ongoing annual charge to cover the cost of subsequent annual reinspections.

Additional management time may also be expected, especially during the early transition years, depending on the extent of changes required to the existing production system. Close observation, attention to detail and careful timing of activities is important when running a biological system. Therefore organic production can typically be more complex than when using conventional chemicals. This additional management is greatest in the early years and while running a conventional system in parallel. However, experienced organic growers report that a well developed and managed organic system tends to stabilise over time and begins to require less input than their conventional counterparts.

All reputable markets require product labelled as organic to be certified by a third party body. In Australia the Australian Government body, Australian Quarantine

Inspection Service (AQIS), administers the 'Australian National Standards for Organic Produce'. AQIS has accredited a number of independent organisations to conduct the farming system inspections and issue organic production certification.

Not all AQIS accredited certifiers have the same status on some export markets. Some markets have a preference for specific certifiers. For example, some European Union (EU) supermarkets prefer Australian organic certifiers that are recognised by International Federation Organic Agriculture Movements (IFOAM) – an international organic body. If exporting is envisaged, it is important to ensure the organic certifier chosen is acceptable in prospective target markets.

Growers who have in place existing quality assurance (QA) systems typically find relatively few administrative changes are required to comply with the record keeping needs for organic certification. Incorporating organic certification into existing QA systems is currently being developed by some organic certifiers in order to minimise paperwork and costs for growers.

Approved materials

Organic standards restrict the range of products that may be used in an organic system. In general, products that are naturally derived are permitted whereas synthetic pesticides, herbicides and fertilisers are prohibited. Therefore many growers will have to source alternative products and management techniques when planning an organic management plan. There is an expanding range of acceptable materials available. It is important to check the status of all inputs in advance to ensure compliance with organic standards. Use of prohibited materials can lead to de-certification. Contact your organic certifier for a list of permitted materials. The Department of Agriculture and Food, Western Australia can also provide contact details of suppliers of materials likely to be permitted for use in organic systems.

Where export markets are likely to be involved, it is important to confirm with your organic certifier any special provisions, especially relating to permitted materials, as these may vary slightly from the National Organic Standards for Australia.

Availability, cost, application and effectiveness of approved materials are likely to be different to the more familiar conventional materials. While the range and availability of products is increasing, there is also an increase in exaggerated and unsubstantiated claims for some products. Caution is required to avoid costly mistakes. Checking with other experienced organic growers can be useful to confirm the value of a product.

Reliable production system and management risk

For most producers it usually takes a number of years to gain experience and knowledge in the different management approach necessary to operate a biologically based organic production system. Starting with a relatively small area to trial different management techniques and the use of organic sprays and fertilisers can minimise the commercial risk of moving toward organic certification.

Key production issues for WA growers and possible solutions are outlined in previous sections. Producers are advised to trial different approaches on small areas over a number of years to confirm solutions to each problem prior to committing large areas over to organic methods.

Issues that could benefit from further research and development relate to fruit thinning, dimple bug, weevils, post-harvest CA treatment and the streamlining/ incorporation of Organic Certification into Quality Assurance or Environmental Management schemes.

Engaging the services of an experienced organic orchardist to assist in the establishment of an organic system, may be a cost effective way to accelerate the understanding of an organic approach and avoid costly mistakes during the early transitional years.

Organic standards, regulations and certification

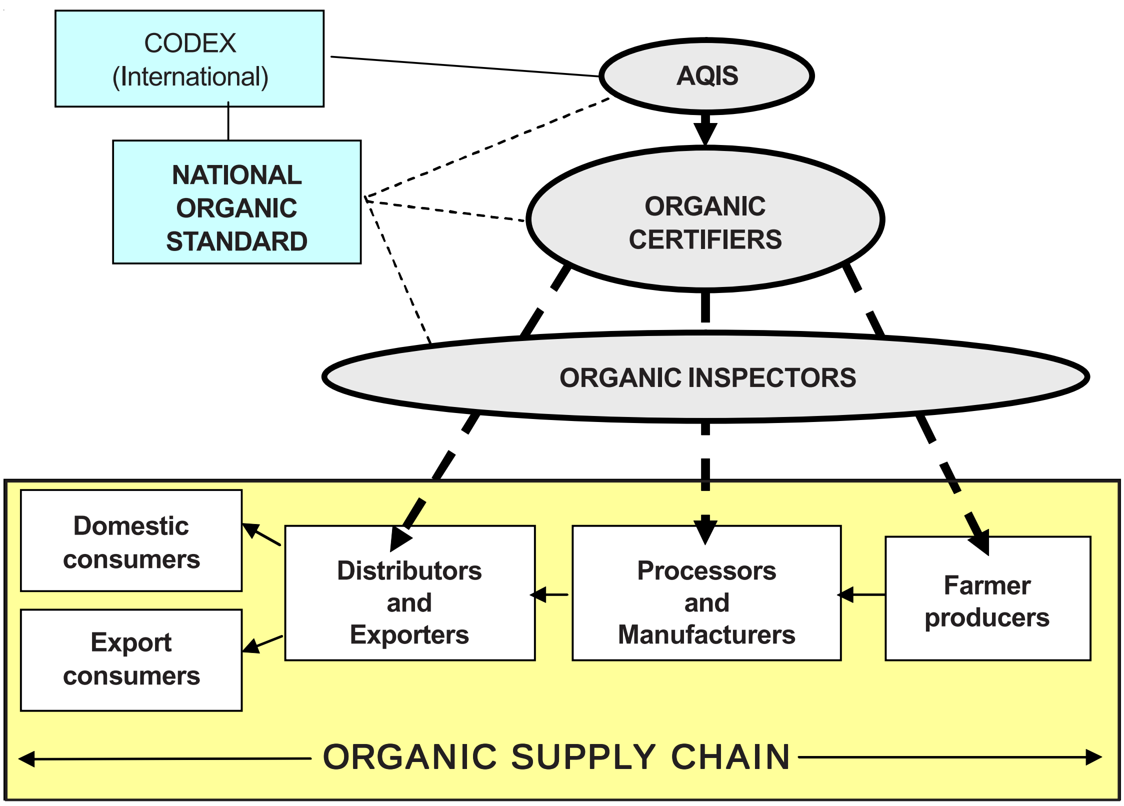
A grower who proposes to establish serious commercial production of organic apples should seek organic certification to verify that the product is truly organically grown in accordance with reputable organic standards.

This section describes in general terms the requirements and procedure for gaining organic or biodynamic certification within Australia.

Background – organic and biodynamic regulations in Australia

Internationally it is accepted that the veracity of claims on the labels of organic products must be underpinned by product and producer certification. The reputation and recognition of the organic certification system is often of great importance to importing countries.

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 independent AQIS accredited certification organisations, who conduct whole farming system inspections and ensure a comprehensive record keeping system is in place that allows trace back and verification of inputs used, management practices, yield and sales. Organic standards can also apply to processing and distribution, as shown in Figure 1, to ensure integrity of the certified organic product throughout the supply chain.



(Taken from: Comparison of the Australian National Standard for Organic and Biodynamic Produce with Key International Organic Standards and Regulatory Texts. By Mr Rod May and Dr Andrew Monk. Rural Industries Research and Development Corporation.)

On the Australian domestic market no mandatory requirements currently exist regarding the labelling of products as organically grown – although new regulatory arrangements are proposed. However, there is a trend across all markets for objective proof to support claims relating to product attributes. Most reputable retail outlets require independent organic certification by one of the AQIS accredited certifier organisations for product labelled as organically grown.

Organic Production Standards aim to:

- protect consumers against deception and fraud in the market place and from unsubstantiated product claims;
- protect producers of organic produce against misrepresentation of other agricultural produce as being organic;
- harmonise national provisions for the production, certification, identification and labelling of organically and bio-dynamically grown produce;
- ensure all stages of production, processing and marketing are subject to inspection and meet minimum requirements; and
- provide a guide to farmers contemplating conversion to organic farming.

Copies of the national standards are available through the certifying organisations, Australian Government Bookshops and the AQIS website (**www.aqis.gov.au**).

Contact details of the AQIS accredited organic certifiers are listed in Appendix 1.

General requirements for organic certification

The 'National Standards for Organic and Biodynamic Produce' (Organic Industry Export Consultative Committee – OIECC) provide a general definition of organic farming as follows:

Definition

> Organic farming means produced in '... soils of enhanced biological activity, determined by the humus level, crumb structure and feeder root development, such that plants are fed through the soil ecosystem and not principally through soluble fertilisers added to the soil. Plants grown in organic systems take up nutrients that are released slowly from humus colloids, at a rate governed by sunlight and warmth. In this system the metabolism of the plant and its ability to assimilate nutrients is not over stressed by excessive uptake of soluble salts in the soil water (e.g. nitrates).
>
> Organic farming systems rely to the maximum extent feasible upon crop rotations, crop residues, animal manures, legumes, green manures, mechanical cultivation, approved mineral bearing rocks and aspects of biological pest management to maintain soil productivity and tilth, to supply plant nutrients and to control disease, insects, weeds and other pests.'

(Taken from: National Standards for Organic and Biodynamic Produce. Australian Quarantine Inspection Service. Canberra, 2005.)

Aims

The principal objectives of the certified organic operator include:

- the production of food of high nutritional value;
- the enhancement of biological cycles in farming systems;
- maintaining or improving fertility of soils;
- working as far a practicable within a closed system by minimising the use of non-renewable resources;
- the avoidance of pollution resulting from agricultural practices and processing; and
- the coexistence with, and the protection of, the environment.

Features

One essential feature of organic agriculture is the emphasis on biologically healthy, nutritionally balanced soil as the basis for healthy resilient (against pest and disease) plants.

Production avoids the use of synthetic fertilisers, pesticides, growth regulators and other chemical substances detrimental to nature. Genetically modified organisms are prohibited.

In practice, organic certification takes into consideration the whole farming system and typically requires a farm management plan, farm map and record keeping system. The grower must demonstrate and verify that a system is in place and operating in compliance with organic standards. This typically includes a sustainable crop rotation, and strategies to maintain soil fertility, control weeds, pests and disease, as well as water management and buffer zones.

High levels of chemical residues in soil from previous land use can disqualify land from organic certification, as can excessive contamination in plant or animal tissues. Buffer zones and windbreaks can be required to protect certified areas from contamination by adjacent properties. Organic growers should seek cooperation from neighbours who use chemicals on adjacent properties.

Where growers intend to value-add or process raw product, compliance with organic processing standards is required in order to retain organic certification over the final processed product.

Certification of all production, processing, handling, transport, storage, and sale of organic products is contingent on accurate up-to-date records of the enterprise concerned – to allow scrutiny of the products and processes. Records required typically relate to:

- rotations, soil cultivations and other treatments;
- inputs - type, source, application and timing;
- outputs - production and sales details.

Conversion period

Provision can exist for part certification (sometimes known as parallel production) where part of a property is converted to an organic system while the remainder is farmed using existing conventional methods. Development plans for converting the entire farm to an organic system within a defined period may be required by some certifiers.

The usual progress towards full organic certification is as follows:

Year 0-1 = 'pre-certification' (no certification status);
Year 1-2 = 'in conversion' to organic certified;
Year 2-3 = 'in conversion' to organic certified;
After 3 years = full 'organic' certified.

During the first year of compliance no organic certification is granted. In the second year of compliance, certification as organic 'in conversion' may be granted. A system certified as organic 'in conversion' typically should progress to full 'organic' after a minimum of three years verified compliance with standards.

Penalties may be imposed for failure to comply with organic standards or breach of rules of certification. This may involve cancellation of certification or reversion to an earlier stage in progress towards full organic certification.

How to gain organic certification

Once you have decided that organic or biodynamic production has potential for your enterprise, follow these steps to become a fully certified producer:

- choose an organic or biodynamic certification organisation;
- read the organic standards;
- write an organic management plan;
- begin farm conversion;
- apply for certification;
- have the farm inspected;
- inspection report submitted; and
- receive organic certification contract.

Choose an organic or biodynamic certification organisation

Contact several organic or biodynamic certification organisations (see Appendix 1) about becoming a certified producer and choose one based on the verbal and written information gathered, on your enterprise needs and goals, fees involved and market requirements. To find out if there is a preferred or highly recommended certifier, set of standards and requirements (as these can differ – especially between organic and biodynamic), it may be helpful to contact existing certified producers, organic manufacturers and/or specialist organic retailers or major retailers selling organic products.

Read the organic standards

Read the organic farming or processing standards, which your farm must comply with. Producers must demonstrate a good understanding of organic farming principles and knowledge of practices and inputs permitted as well as those prohibited according to the certifier's organic standards. If there is little or no extension help offered before implementing and establishing changes to your production system, find out if there are any workshops or field days being run, or experienced organic producers willing to show you around their enterprise. Qualified farm consultants may also be available. Have soil samples taken and analysed prior to, during and following conversion to aid farm planning and soil management.

Write an organic management plan

Most organic certifiers require a formal organic management plan that outlines the details of how you intend to operate an organic system. Typical topics covered in an organic management plan include:

- documents, records and audit trail;
- part (of property) certification details;
- land degradation issues;
- soil management;
- water management;
- pest, disease and weed management;
- biodiversity;
- contamination hazards and buffer zones.

The organic management plan is often revised and refined over time. It can be the key document that describes the farming system and is used by some certifiers as a statutory declaration of compliance with the organic standards.

Begin farm conversion

Changes to the existing production system must be made – either all at once to convert the entire property, or in planned stages. In the first year (pre-certification) initial changes to satisfy the standards are made. Over the following years the producer must demonstrate that an appropriate system is in place and that it successfully operates in compliance with the organic standards.

Apply for certification

When changes to the farming system have begun, application for organic certification can be submitted. Upon receipt of an application, the organic certifier will issue a farm questionnaire seeking all relevant details describing the farming system. Information to be provided includes land use history, rotations, inputs used, details of farming practices and a map of the property and surrounding land use. The questionnaire forms a Statutory Declaration relating to farm practices and inputs used.

Have the farm inspected

A site inspection by an experienced organic farm inspector will follow soon after the questionnaire has been returned to the certifier. The purpose of this inspection is to verify details of the farming system as described in the questionnaire, and to ensure the producer has a good understanding of the principles and methods of organic farming. As well as discussing the farming system, the inspector will view paddocks, crops, livestock, equipment, sheds and storage areas. The producer must also provide evidence of a complete documented audit trail covering all inputs used, output produced and sales details for all organic products. Soil samples or tissue samples may also be taken for testing.

Inspection report submitted

Following the inspection, the inspector compiles a report confirming details of the farming system established. This report, together with other relevant documents, is considered by the certifier to determine the appropriate level of organic certification. Specific conditions may be imposed where certain practices or circumstances require attention.

Receive organic certification contract

The certifier offers the producer a contract stating which land and crops the certification applies to, and any conditions that must be met. Acceptance of the contract and payment of fees allows the producer to market and label relevant product as certified ‘in conversion’ or ‘organic’, and use the logo of the certifier on packaging and promotional material.

Organic certification contracts are generally subject to annual inspection of the site and a viewing of farm records. The producer is required to complete a statutory declaration confirming compliance with standards and detailing yields and sales figures on an annual basis.

Producers may be subject to random, unannounced on-site inspections as part of obligations certifiers must fulfil to satisfy AQIS accreditation. Some properties may also be subject to inspection by AQIS representatives as part of the regulation of the certifying bodies.

Further reading

Organic horticulture: strategic opportunities for Western Australia. Department of Agriculture and Food WA, Bulletin 4622.

Organic food and farming – Introduction. Department of Agriculture and Food WA, Farmnote No. 199.

Export potential for organics. Rural Industries Research and Development Corporation, Publication No. 06/061.

Organic apple production manual. University California, Pub. 3403.

Biological Husbandry Unit, Lincoln University, New Zealand. www.lincoln.ac.nz.

Department of Agriculture and Food WA website www.agric.wa.gov.au.

APPENDIX 1

Organic industry certification organisations accredited by AQIS as of May 2007

Bio-Dynamic Research Institute (BDRI)

Bio-Dynamic Research Institute
Powelltown VIC 3797

Phone: (03) 5966 7370
Fax: (03) 5966 7339
www.demeter.org.au

National Association for Sustainable Agriculture (NASAA)

National Association for Sustainable Agriculture
PO Box 768
Stirling SA 5152

Phone: (08) 8370 8455
Fax: (08) 8370 8381
E-mail: **enquiries@nasaa.com.au**
www.nasaa.com.au

Australian Certified Organic (ACO)

Australian Certified Organic
PO Box 530
Chermside QLD 4032

ACO Head Office: (07) 3350 5706
Fax: (07) 3350 5996
E-mail: **info@australianorganic.com.au**
www.australianorganic.com.au

Organic Growers of Australia (OGA)

The Organic Growers of Australia
PO Box 6171
South Lismore NSW 2480

Phone: (02) 6622 0100
Fax: (02) 6622 0900
E-mail: **oga@nrg.com.au**
www.organicgrowers.org.au

The Tasmanian Organic Producers (TOP)

The Tasmanian Organic Producers
PO Box 434
Mobray Heights TAS 7054

Phone: (03) 6383 4039
Fax: (03) 6383 4895
E-mail: **gretschmann@bigpond.com**

The Organic Food Chain (OFC)

The Organic Food Chain
PO Box 2390
Toowoomba QLD 4350

Phone: (07) 4637 2600
Fax: (07) 4696 7689
E-mail: **ofc@organicfoodchain.com.au**
www.organicfoodchain.com.au

Safe Food Queensland (SFQ)

Safe Food Queensland
PO Box 400
Spring Hill QLD 4004

Phone: 1800 300 815
E-mail: **info@safefood.qld.gov.au**

Australian Quarantine Inspection Services – AQIS

Australian Quarantine Inspection Services
GPO Box 858
Canberra ACT 2601

Freecall: 1800 020 504
Phone: (02) 6272 3933
E-mail: **organics@aqis.gov.au**
Web: **www.affa.gov.au**

For more information on the production and marketing of Australian organic produce, contact the organic industry organisations at the addresses below:

Organic Growers Association WA Inc.

Organic Growers Association WA Inc.
Box 7043 Cloisters Square
Perth WA 6850

Phone: (08) 9498 1555
E-mail: **enquiries@ogawa.org.au**
Web: **www.ogawa.org.au**

Organic Federation of Australia Inc. – OFA

Organic Federation of Australia Inc.
PO Box 369
Bellingen NSW 2454

Phone: 1300 657 435
Chairman (07) 4098 7610
E-mail: **info@ofa.org.au**
Web: **www.ofa.org.au**

APPENDIX 2

Input products for use in organic production

(Taken from: National Standards for Organic and Biodynamic Produce. Edition 3.2. Australian Quarantine Inspection Service. Canberra, 2005.)

Permitted materials for soil fertilising and conditioning

Substances	Specific conditions/restrictions
Animal manures	Application must be composted or followed by at least two green manure crops in cropping system.
Blood and bone, fish-meal, hoof and horn meal, or other waste products from livestock processing	Following application, uptake of such products by livestock does not form part of the animal's diet.
Compost	Should be produced in accordance with Australian Standard 4454-1999 or recognised equivalent system.
Minerals and trace elements from natural sources, including: - calcium (dolomite, gypsum, lime); - clay (bentonite, Kaolin, Attapulgite); - magnesium; - phosphate (rock phosphate, phosphatic guano); - potash (rock and sulphate potash); - elemental sulphur.	Must not be chemically treated to promote water solubility.
Epson salt (magnesium sulphate)	None
Microbiological, biological and botanical preparations	Products derived from genetic modification technology are prohibited.
Mined carbon-based products	Peat to be used for plant propagation only.
Naturally occurring biological organisms (e.g. worms) and their by-products	None
Plant by-products	From chemically untreated sources only.
Perlite	For potting/seedling mixes only.
Sawdust, bark and wood waste	From chemically untreated sources only.
Seaweed or algae preparations	None
Straw	From chemically untreated sources only.
Trace elements and natural chelates, e.g. ligno sulphonates and those using the natural chelating agents, e.g. citric, maleic and other di-/tri-acids	Not synthetically chelated elements.
Vermiculite	For use in potting/seedling mixes only.
Wood ash	From chemically untreated sources only.
Zeolites	None

Permitted materials for plant pest and disease control

Where wetting agents are required, caution needs to be exercised with commercial formulations as these may contain substances prohibited under this Standard. Acceptable wetting agents include some seaweed products, plant products (including oils) and natural soaps.

Plant pest control

Substances	Specific conditions/restrictions
Ayurvedic preparations	None
Baits for fruit fly	Substances as required by regulation. Baits must be fully enclosed within traps.
Boric acid	None
Biological controls	Naturally occurring cultured organisms, e.g. Bacillus thuringiensis.
Diatomaceous earth and naturally occurring chitin products	None
Essential oils, plant oils and extracts	None
Homeopathic preparations	None
Hydrogen peroxide	None
Iron (III) phosphate	None
Light mineral oils, such as paraffin	None
Lime	None
Natural acids (e.g. vinegar)	None
Natural plant extracts excluding tobacco	Obtained by infusion and made by the farmer without additional concentration.
Pheromones	None
Potassium permanganate	None
Pyrethrum	Extracted from Chrysanthemum cinerariaefolium
Quassia	Extracted from Quassia armara
Rotenone	Extracted from Derris elliptica
Ryania	Extracted from Ryania speciosa
Seaweed, seaweed meal, seaweed extracts	None
Sea salts and salty water	None
Sodium bicarbonate	None
Sterilised insect males	Need recognised by certification organisation where other controls are not available.
Stone meal	None
Vegetable oils	None

Plant disease control

Substances	Specific conditions/restrictions
Ayurvedic preparations	None
Biological controls	Naturally occurring cultured organisms only.
Copper, e.g. Bordeaux and Burgundy mixture	Hydroxide is the preferred form, Bordeaux only on dormant tissue. Annual copper application must be less than 8 kg/ha.
Essential oils, plant oils and extracts	None
Granulose virus preparations	Need recognised by certification organisation.
Homeopathic preparations	None
Light mineral oils (such as paraffin)	None
Lime	None
Lime-sulphur	None
Natural plant extracts excluding tobacco	Obtained by infusion and/or made by the farmer without additional concentration.
Potassium permanganate	None
Potassium soap (soft soap)	None
Propolis	None
Seaweed, seaweed meal, seaweed extracts	None
Sea salts and salty water	None
Skim milk or skim milk powder	None
Sodium bicarbonate	None
Sodium silicate (water-glass)	None
Sulphur	In wettable or dry form only.
Vegetable oils	None
Vinegar	None

APPENDIX 3

Alternative approaches to soil management

Management of soil fertility for biological systems has attracted a number of alternative approaches to understanding soil conditions and plant growth. The following outlines indicate several concepts for consideration.

- **Dr Rudolf Steiner** – was the initiator of the concepts that form the basis of biodynamic agriculture. Biodynamic farming is a method designed biologically to activate the life of soil and plants. Plants are fed naturally through the soil ecosystem and not primarily via soluble salts in the soil water.

  Essential features relate to the use of special preparations and other techniques that enhanced soil biological activity, humus formation and soil structural development as the basis for allowing plants to selectively assimilate nutrients as dictated by sun warmth and light. Biodynamic farms aim to be closed, self-sufficient units.
- **Dr William Albrecht** – was primarily concerned with a soil fertility approach based on nutrient balance (or ratios) as the foundation for achieving proper fertility relevant to optimal plant growth. The nutrient balance equations he developed are related to soil total exchange capacity.

  Ideal ratios or percentages of cations and anions are defined for different soil types, with the total availability of these nutrients generally increasing (except magnesium and manganese) with their percentage saturation. The optimal base saturation (cation exchange) ratios are 60 per cent Ca, 20 per cent Mg on sandy soil and 70 per cent Ca, 10 per cent Mg on heavy soil, with 3 to 5 per cent K, 10 to 15 per cent H and 2 to 4 per cent for other bases. The relative values and relationship between nutrients, especially Ca and Mg is considered of great importance.
- **Dr Carey Reams and Dr Phil Callaghan** – this work is based on the concept of defining the potential for plant growth and fertiliser performance in terms of energy release and energy exchange. The contention is that fertilisers in themselves did not stimulate plant growth. It is the energy released (electromagnetic influence or paramagnetic energy fields) from these fertilisers that enhanced production.

  A distinction is made between fertilisers (nutrients) that produce growth energy, i.e. calcium, potash, chlorine, and nitrate nitrogen, to those that produce reproductive (fruiting energy), i.e. ammonium nitrogen, sulphate sulphur, manganese and phosphate. The approach also involves a proposition that the nutrient energy potential was dependent on microbial activity, and that energy availability is determined by nutrient balance.

  The approach also argues that phosphate is the primary catalyst in photosynthesis and subsequent plant sugar production. Increasing sap sugar levels is believed to reduce susceptibility to pest and disease and that plant sap sugar level (brix) is directly related to plant pest and disease susceptibility.

Various approaches and analyses relating to soil conditions and plant growth continue to be developed and a vast array of alternative input products are available. Scientific verification of many of these contentions and products has yet to be established. As a consequence the decision to adopt particular approaches tends to rely on anecdotal information and practical experience.

Notes