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# Organic fruit production

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## Introduction

Consumers and producers of organic products understand organic agriculture as the production of food and fibre without the use of synthetic chemicals. However, there is more to organic farming than just doing away with artificial inputs.

### Minimum reliance on artificial inputs

Organic farming aims to minimise inputs to create an agricultural system that is as near as possible to a self-perpetuating or closed system of production. However, some nutrients are removed when the crop is harvested, so some inputs in the form of composts and green manure crops are added to replace these nutrients. Other natural substances may also be added to stimulate biological activity in the soil.

### High level of management

Organic farmers rely on natural methods of pest and disease control, and crop nutrition. A high level of understanding is needed of the life cycles and interactions of crops, livestock, weeds, pests and diseases. Problems that may arise need to be pre-empted (rather than reacted to).

This requires a high level of management, achieved through a variety of techniques:

• creating environments that encourage beneficial species to keep pest populations in check

• selecting crop varieties that discourage or are resistant to pests and diseases

• using management tools such as crop rotations and companion planting to inhibit or repel pests and diseases.

Some naturally occurring chemicals such as derris and pyrethrum are permitted in organic farming systems, but their use is not encouraged and often only permitted as a last resort.

### Feed the soil, not the plant

Organic farmers aim to feed the soil, not the plant, to create a soil that is balanced in nutrients, has good structure, high biological activity and high levels of organic matter. Organic growers believe that a plant grown under these conditions is healthier and therefore less susceptible to attack by pests and diseases.

## Planning the organic orchard

There are several factors that you need to consider when setting up an organic fruit orchard.

### Site selection

To grow organic fruit successfully, you need to maximise the local environmental factors in your favour. One way of doing this is to decide which particular crop you want to grow, then select the most appropriate site. For example, if stone fruit is your choice, the orchard may be located inland to avoid many pest and disease problems associated with coastal production, and isolated from similar crops to minimise the risk of pests and diseases.

The other approach is to decide on your location, then determine which crops can be successfully grown there using organic techniques.

It is important to test the soil at your chosen site for pesticide and heavy metal contamination. Excessive levels of either will exclude your product from being certified and sold as organic. This is also critical when converting established orchards. A soil test will also provide important information about fertility and nutrient levels.

Other site considerations include:

• proximity to materials that can be utilised as a fertiliser or in compost making (such as animal manures and straw)

• availability of transport and markets

• availability of certified processing facilities.

### Organic certification

Certification means having your farm and farming methods inspected to confirm that they meet the certifier's standards for organic farming. The certifier's standards cover all the requirements of the National Standard for Organic and Bio-dynamic Produce. Since January 1993, exports of organic produce have been required to meet this standard.

It is essential to develop an understanding of the certification process and the requirements of certifying organisations, well before your first case or tray of fruit is marketed.

Produce may either be certified A Grade for a fully converted organic farm or 'in conversion' to organic production. Initially, the orchard will be classified 'in conversion' until your farming system satisfies the standards of organic production.

Currently, there are no legal requirements to become certified. There are nevertheless, severe penalties for selling non-organic produce as organic. The Australia New Zealand Food Authority is reviewing domestic requirements which, if approved, would make the labelling and certification of domestically produced organic food compulsory.

### Property management planning

A property management plan will help you decide the most appropriate layout and management strategies for your enterprise, given the physical and natural constraints of the site, your resources and personal goals.

As an organic farmer you also need to consider:

• creating windbreaks and retaining existing vegetation to encourage predators within the orchard

• incorporating buffer strips along the boundaries of your property to minimise the risk of pesticide spray drift from neighbouring farms

• developing a financial plan, including a marketing strategy, value-adding options and planning for the possibility of income reduction during conversion to organic production.

### Variety selection

Selection of material for planting is determined by a number of factors. These include:

- growing conditions
- pest and disease resistance
- fruit quality parameters (such as size, firmness and keeping ability)
- maturity dates
- market requirements.

Select varieties for the available markets, not vice versa. Contact wholesalers and retailers of organic produce to determine the lines in which demand exceeds current supply. Your certification organisation may have received requests for particular produce, so make enquiries with them too.

Select varieties that are adaptable. It is an advantage to have additional markets available for second grade produce. For example, a peach has potential to value-add into products such as preserves, pastes or dried fruit; while an orange can be considered for juice, marmalades or the oil in the rind.

Physiological features may give some varieties an advantage that allows them to resist pest and disease attack. Hairs or bristles on fruit may deter certain insect pests. For example, some peach varieties are less attractive to certain pests due to their hairy skin. Some fruit varieties have deep cavities where the stalk attaches to the fruit providing perfect hiding places for pests, or environments for disease development.

Some 'old' cultivars exhibit desirable features which discourage pest attack and are worth investigating. Some varieties may have been bred for resistance to certain diseases. However, those produced by genetic engineering or treated with ionising radiation, are not permitted under organic standards.

When selecting varieties for your area ask your district horticulturist and other growers about the performance and problems experienced with local varieties. Forewarned is forearmed.

### Ground preparation and planting

Before planting it is important to build up soil organic matter and nutrient load and to control problem weeds (particularly perennials). Weed control is easier to achieve before orchard establishment, particularly as herbicides are not permitted.

Green manure crops, containing both legume and non-legume components, can be turned into the soil before planting, to add nitrogen and to build up soil organic matter. For example, an oats/vetch crop may add up to 100 kg/ha of nitrogen to the soil.

Use soil and leaf tests to check for other soil nutrient deficiencies or structural problems before planting. Several organic amendments are permitted under the standards, but their use must be recorded.

Consider inter-row cropping between rows of fruit trees or vines, particularly while they are young. Crops could consist of herbs, flowers, vegetables, grasses or legumes (for hay, mulch or compost production). The benefits are obvious – increased

bio-diversity and income before the main crop comes into production and during conversion to organic production.

Establish a permanent mixed sod containing herbs, legumes and grasses as the orchard planting nears maturity. Take care that the inter-row crop is not a host to pests of the main crop and that it doesn't compete with the main crop for nutrients and water.

Establish a windbreak before planting. A well designed windbreak shelters young plants, increases bio-diversity, provides habitat for wildlife, reduces levels of dust, and encourages predators and bees. Planting timber or woodlot species can diversify and supplement on-farm income.

To be most beneficial, windbreaks should be at least five rows wide with medium to low shrubs located on the side of the prevailing winds. Wind speed can be halved by placing shelter belts 250 m apart. Avoid locating woodlots or shelter belts along the bottom of slopes as frost pockets may develop.

The design of the orchard can help in pest and disease management. For example, mixing species within a block can disorientate insect pests. You can achieve this effect by planting in a semi-random layout, being careful not to make harvesting difficult. Species that ripen at the same time as the main crop, but which are more attractive to pests such as birds, can be located elsewhere to lure pests away.

Newly planted trees and vines need to be well watered-in, provided with permanent irrigation, mulched, and protected from pests (such as insects, rabbits and kangaroos).

## Orchard management

Organic systems aim to recreate natural systems. Natural systems support several competing species, so that no single species has a consistent advantage. This is contrary to the main objective of modern agricultural systems where the enterprise must maintain a permanent advantage, to be viable.

Several management tools are available to help organic farmers to achieve this.

### Pest and disease management

Integrated pest and disease management (IPDM) is an approach to pest and disease management that utilises a range of techniques intended to reduce economic damage.

There are several techniques you can use to manage pests and diseases.

*Cultural controls*

Reduce the impact of pests by manipulating cultural practices. Some of the strategies employed include the following.

• Rotate crops when planting a new orchard – plant botanically unrelated crops. Avoid replanting old orchard sites with the same crop as there may be pest or disease carryover (for example, *Armillaria* in stone fruit and citrus orchards, or burrowing nematodes, *Radopholus similis*, in bananas).

• Cultivate the soil to disrupt the life-cycles of soil inhabiting pests, weeds and diseases. Minimise environmental damage by cultivating at the appropriate time and at the correct soil moisture. Keep the number of cultivations to a minimum and do not cultivate steep slopes.

• Vary the harvest time. Selective harvesting periods may avoid the worst effects of pests at the crop's most vulnerable period. You may need to select cultivars which mature at a different time to the pest's peak occurrence.

• Vary crop spacing. Spacing and siting of crops may affect the relative growth rate of a plant and the behaviour of pests in searching for food or egg laying sites. Closer plantings may favour the spread of beneficial species within the orchard, but may also reduce air movement, increasing levels of disease.

• Prune crops. Thinning, topping and pruning of dead or diseased material from fruit trees reduces disease incidence and maintains productivity and vigour.

• Keep orchards clean. Remove pest breeding and hibernating sites by removing, destroying or composting old or fallen fruit. Clean paddock borders to reduce pest migrations and weed infestations. Study the insects and wildlife inhabiting paddock borders first to avoid destroying habitats of beneficial species. If fire breaks are required these areas may need to be modified.

*Manipulation of species diversity*

Manipulation of species diversity annual cropping systems is an effective method of enhancing the competitive advantage of the main crop. However, few of these techniques have been evaluated in perennial systems.

Some of the methods used in annual cropping systems include:

• strategically increasing the number of plant species that act as a barrier to the pest, or providing an alternative preferred host (for example trap cropping);

• strategically decreasing diversity to deprive pests of alternative food and refuge sites.

The method and design for varying species diversity depends on details such as the life cycle and habits of the species you wish to influence.

*Plant resistance*

Plant resistance is the ability of a plant to grow and produce despite the presence of pests. It may be naturally inherited or artificially bred into plants. Breeding for resistance aims to combine genes from related varieties with desirable characteristics into new, more resistant varieties.

Many older 'non-hybrid' varieties have natural resistance to pests and diseases. Natural resistance has been lost in many modern cultivars bred for yield increases. Several organisations specialise in producing non-hybrid planting material.

*Biological controls*

Biological controls use the natural enemies (parasites, predators and disease organisms) of pest species. These natural enemies may be introduced from external sources (mass reared and then released into the orchard), or – if they are already in the orchard – encouraged to breed naturally.

Naturally occurring predators can be encouraged by conserving and encouraging existing populations. Maintaining a mixture of desirable plants in the orchard border and in ground covers will encourage predators.

Some plants attract predators of pests. For example, members of the *Umberlliferae* family, such as carrots and parsnips, attract parasitic wasps and are used as an understorey crop in apples to help control codling moth.

*Mechanical controls*

Mechanical controls can be used to trap or kill pests, or physically prevent pests gaining access to crops. Corrugated cardboard bands tied around trunks of apple trees help to control and monitor codling moth. Bird netting or paper bags over fruit exclude flying foxes and birds.

*Physical environment*

Modification of the physical environment can also help. Light traps and sticky traps decoy night flying insects; bird scaring devices keep birds away; solar energy and black plastic can be used to control weeds (solarisation); or a crop such as canola that inhibits certain pests (biofumigation) can be used.

*Chemical controls*

Chemical controls. Several chemicals for pest and disease control are permissible under the organic and bio-dynamic standards. However, long-term reliance on these substances is not in accordance with organic farming principles, so frequent use of chemicals is discouraged.

Many of these chemicals have been selected for their short period of persistence in the environment, rather than low toxicity, so take care during application. Follow the directions on the label and be certain the chemical is registered for both the crop and its intended use.

Check with your certification organisation before using any commercial product as some may contain additives that are not acceptable under the standards.

Whatever pest management strategies you select, the more information you can obtain about the pest's life cycle and habits, the better.

**Weed management**

Weeds teach us that we have to learn to live with nature rather than dominate it.

Each weed occupies an ecological niche and has a role in that niche. For example, deep rooted species will ‘recycle’ nutrients from deep down in the soil profile, making them available to shallow rooted species. Other species may provide habitats for beneficial insects.

A well managed organic orchard should not develop a significant weed problem. A major objective in organic farming is to change the composition of the weed community so that the orchard gains maximum benefit.

Sometimes, however, one species may dominate or a noxious weed (one that, by law, must be controlled) may be present, so the weed should be managed.

Weed management around young trees and vines, is essential.

*Mulching*

Mulching helps to retain moisture, minimises weeds and improves biological activity in the soil. Inorganic and organic materials may be used for mulching. The mulch must be applied thickly enough to suppress the growth of weeds and germination of their seeds. A layer 2–3 cm deep should be adequate.

Various methods can be used to accumulate mulch under a tree or vine row. These include mowing (swing-arm mowers mulch under tree areas, and some orchard mulchers throw mowings into the under-tree area), and growing a winter-active under-tree sod which forms a mulch after it dies.

*Grazing*

Animals in the orchard can offer good weed control and provide additional benefits of extra income, added manure, insect control and the recycling of

crop wastes. Chinese or 'weeder' geese and even carefully managed sheep are some examples. However, care should be taken, particularly during droughts, when livestock may feed on trees or vines.

It is a good idea to introduce stock into the orchard when they are young to develop their 'taste' for weeds and a grazing routine. Various systems of electric fencing are available to facilitate grazing.

*Other organisms*

Insects and fungi have been commercially reared and released to control weeds such as Paterson's Curse and Bathurst burr.

*Mechanical methods*

These include:

- slashing (mowing, brush cutting)
- strategic cultivation
- forage harvesting
- brush weeding (not suitable for biennial or perennial weeds such as docks or thistles)
- thermal weeding (hot air, hot water or flame).

When using this equipment you should fit guards to protect trees and vines.

Perhaps one of the most important methods of weed control is hand weeding. Most weed problems start out as small outbreaks which are easily controlled with hand hoeing, if caught early.

## Soil management and crop nutrition

Organic farming is not just about replacing artificial fertilisers with 'organic' fertilisers and manures, it is about feeding the soil ecosystem and making full use of the resources on the farm. The overall aim is to minimise nutrient inputs and losses from within the system.

Organic farmers can build up soil fertility in the orchard by planting cover crops, and by adding crop residues, animal manures and composts, rock dusts and special preparations that stimulate soil biological and chemical activity. Some 'organic' fertilisers may also be used, particularly during conversion to organic farming.

Leaf and soil analysis is needed to determine the nutrient status of the crop and soil.

### Cover crops

Inter-row cover crops can provide additional nutrients to the crop, increase soil organic matter and improve orchard biodiversity. Several techniques can be adopted.

### Green manure crops

Green manure crops are grown specifically to be cultivated back into the soil to build up soil organic matter and nutrients. They are especially useful during orchard establishment.

The type of green manure crop and stage it is turned in determines the amount of organic matter or nutrients returned to the soil. For example, a lush, actively growing legume sward (for example vetch, faba beans or lupins) contains large amounts of nitrogen that is released to the soil upon cultivation. The same crop when allowed to mature, contributes more organic matter but less available nitrogen. If a soil is low in organic matter, then a green manure crop that increases soil organic matter is desirable (for example oats).

### Permanent sods

These are planted between the rows, and are the preferred method of inter-row management in orchards because the orchard soil ecosystem remains undisturbed. This favours the development of plant roots and soil biology; and helps to retain good soil structure.

Ideally, a sod consists of a range of perennial plant species. For example it may contain a mixture of:

• grasses (for example ryegrass or fescue), efficient in obtaining potassium from the soil and able to utilise excess organic nitrogen;

• legumes (for example clover or lucerne), able to add 40–140 kilograms per hectare per year of nitrogen to the soil reservoir and also 'feed' the grasses and the crop;

• herbs (for example comfrey and chicory), high in essential elements with deep roots capable of bringing up leached elements that are otherwise unavailable to the crop.

A variety of species also attract a variety of other organisms that may assist with pest and disease control in the orchard, but avoid planting or encouraging species that are known to host pests or diseases of the orchard crop.

Sods should be regularly mowed and clippings collected for use in compost, directed under trees or vines as mulch, or left to break down in the inter-row area. Keeping the sod well mown ensures the continual release of nutrients and also helps to minimise the risk of frost damage to crops.

Occasionally, the inter-row area may become compacted by machinery and the soil benefits by being aerated and loosened without being turned over. Various machines (for example Wallace Soil Aerator® and Agroplow®) are available to do this.

### Semi-permanent sods

These consist of annuals which die down or are slashed in early summer to form a mulch in the inter-row area. Suitable species include annual ryegrass, oats, lupins, vetch and field peas.

Alternatively, warm-weather crops may be planted late. These die off in cold weather, allowing a mulch to form, and result in more soil moisture in spring than if a winter-hardy cover crop had been planted.

There is less competition from semi-permanent sods for water and nutrients, and they require less frequent mowing, but they also offer less diverse orchard fauna and flora.

### Organic fertilisers and amendments

The removal of nutrients in produce and through natural processes such as leaching and volatilisation, means that organic inputs are required to maintain crop quality and production. Contact the certification organisation regarding the use of any organic inputs as it may require the input to be certified before use. The use of any input should be recorded in a diary.

*Animal manures and composts*

These may be available on-farm or from nearby livestock enterprises.

The organic standards require that manure intended for application is composted before use. When manure is composted, it is easier to spread, and losses to the environment are minimised.

The nutrient composition of animal manures varies significantly, so it is advisable to test each batch to determine application rates. Testing should also indicate the presence of toxic elements such as antibiotics and heavy metals, which are not allowed under organic standards.

It is easy to over-use organic manures. Excess nitrates can pollute waterways, damage the roots of young trees and cause fruit quality problems. For example, over-supply of nitrogen in grapes lowers fruit quality and increases canopy density, which reduces air circulation and increases the incidence of disease. Regular soil analysis is essential to help monitor soil nutrient status and to avoid problems.

Site manure or compost heaps away from water courses. Incorporation into the soil or slashing ground covers over recently spread manure can help to reduce losses and odours.

A cover placed over stockpiled manures minimises volatilisation before spreading. Nutrient losses are greater from shallow, flat heaps compared to deep stacks with steep sides.

Composts are derived from the conversion of organic ingredients into humus colloids. In organic farming, composts are frequently added to soils to improve soil fertility and increase humus content.

Composted material generally provides a more stable form of organic matter than raw wastes, which is better for the long-term maintenance of soil organic matter. In addition, composts halve the volume of organic matter, which makes spreading easier.

Compost activators, rock phosphate and rock dusts, and bio-dynamic preparations are often added to compost heaps. These are claimed to speed up composting and enhance the availability of nutrients to plant roots.

*Mineral fertilisers*

Fertilisers of mineral origin are rock-based materials and include rock phosphate, dolomite, limestone and rock dusts (from silicate rocks, including basalt and bentonite).

Rock dusts may be added directly to the soil or added to compost heaps. Whichever method of application is favoured, release of nutrients from the rock dusts is accelerated by moist conditions, high temperatures and high biological activity (for example during a green manure stage or composting).

*Other fertilisers*

Other fertilisers are often more readily available or are cheaper sources of nutrients. These include:

- waste products from fish or animal processing (for example blood and bone, and fish meal)
- seaweed or seaweed meal
- sawdust
- bark and wood waste
- basic slag (after residue testing for heavy metals)
- wood ash.

*Commercial organic fertilisers*

Commercial organic fertilisers. These are generally allowed for restricted use in organic farming systems.

To describe fertilisers, manures or other materials as 100% organic means they are derived from animal and vegetable by-products.

However, under the Fertilisers Act, 1985 (New South Wales) commercial organic fertilisers are permitted to have up to 35% artificial compounds added to boost the percentage of nitrogen, phosphorous and potassium. These blended fertilisers are not acceptable under organic standards.

When using organic fertilisers it is important to calculate the cost per hectare based on the amount of actual nutrient supplied in the product. In commercially packaged products and manures the analysis may vary significantly, so it is advisable to have each batch tested.

### Nutrient budgets

Nutrient budgets allow you to identify potential nutrient losses and gains to the orchard system.

The aim of a nutrient budget is to help estimate the balance of soil nutrients remaining after considering fertiliser applications less losses (for example, in removal of produce and prunings to the environment, such as in leaching and atmospheric volatilisation).

Rates of fertiliser or manure application should be based on the results of a soil analysis and recommendations for the crop's requirements, which can be obtained from district horticulture officer.

## Marketing

### Marketing requirements

It is illegal to sell non-organic produce as organic. It is also a legal requirement to have organic produce destined for the export market certified. Currently, locally marketed organic produce does not require certification, but this is expected to change in the near future. However, if your farm is certified, more markets are open to you because many traders prefer certified organic produce.

Organic produce must meet all relevant local, state and federal requirements, just like other produce. Organic farmers must comply with regulations on produce, such as fruit labelling. An inspection certificate may be required to accompany your consignment if it is to be sold interstate and intrastate, particularly if that State is free of fruit fly.

### Marketing strategies

The first rule of successful marketing is to produce what consumers want. Marketing is about identifying products that the consumer wants, and supplying at the right price, and in the right form. Market research provides this type of information.

At the same time you should promote your product and inform the consumer about the benefits of it. One idea is to include a colourful brochure with each box or consignment describing your production methods.

The market for organic produce varies significantly; it is easy to oversupply, particularly with fresh lines. Supply and demand for organic products depend on the number of farmers supplying that line, the number of consumers prepared to pay the price for goods and the time of year. Be prepared to market your produce on the conventional market at some stage.

Value-adding can increase the range of products that you can market and provides an outlet for blemished fruit (for example, processing into jams and juices).

Various methods of marketing organic produce are available. Your choice of marketing strategy will depend on factors such as the size and proximity of markets, closeness to other organic producers, on-farm infrastructure (for example, processing facilities), availability of transport, continuity of supply and the commitment to time that is involved.

Some selling strategies used by organic farmers include:

- local market stalls
- road-side stalls
- pick-your-own
- wholesalers or packer/distributors
- direct to retailers
- centralised markets/agents
- producer cooperatives
- home delivery/mail order
- subscription farms
- Internet subscription sales.

Most producers at some time will market their produce through organic wholesalers in large cities. Some work as agents on a standard commission, others as wholesalers who buy produce for an agreed price. Before you deal with an agent or wholesaler, find out what they will do for you and what the arrangements are for payment. Contact the State Market Authority to determine if the agent/wholesaler is properly set up with indemnities.

### Quality assurance

Marketing organic produce requires just as much attention to quality assurance as for conventional produce. Don't be tempted to market inferior products; value-add any second grade produce wherever possible.

It is good practice to keep an up-to-date record of all practices and procedures carried out in the orchard, including detailed information on each processing or packing run. This allows for problem batches to be easily traced and further problems avoided.

## Conclusion

The perennial, mono-cultural nature of an orchard can create problems of pest, disease and weed control.

However, organic fruit production can be both successful and rewarding if careful attention is paid to monitoring pest and disease life cycles, and soil fertility, and if a range of management practices are utilised.



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