Profitable FARMING

MAKING MORE MONEY FROM YOUR FARM

JOHN MASON

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Preface

The main thrust of this book is to urge its readers to adapt to the change that is inevitable, and to offer them alternatives that might help them to do so.

As many of my previous books have had wide readership overseas, I have tried to provide imperial conversions to metric measurements as much as possible. With money values changing as quickly as they do, dollar conversions would be unrealistic.

I am sure that overseas readers will realise that Australian conditions do not necessarily apply to their part of the world (nor, indeed, do they apply equally in every part of this continent, with its wide range of soil conditions and climate zones).

It cannot be stressed too much that, whatever the project, your chances of success will be enhanced by recourse to local knowledge and advice, and this includes a good understanding of the laws, both local and federal, that apply to your enterprise.

I wish you the very best of luck.

John Mason
1999

CHAPTER 1

Adapting to Change

The world is changing faster than ever with the introduction of new technologies, and there are implications for every industry, including farming. If you are to be successful in farming today and into the future, you must learn to adapt to these changes. The way to succeed today will be different from the way success was achieved in the past, just as the way to succeed in the future will be different from the way you might make headway today. And while it is still important to learn from 'the way we've always done things', it is even more important to face up to new challenges and to embrace new opportunities.

Growing good produce was once sufficient for most farmers to make a profitable living — but not any more. Catchphrases such as 'value adding' and 'multiskilling' are common now, but what exactly do they mean? And what about just being good at one thing, or the concept of creating a core business? All of these things are important to the success or failure of business today. Some businesses, not all, that have gone down the track of specialising to some degree have failed, simply because they did put all their eggs in one basket rather than hedging their bets with other enterprises.

The farm business, just like any other, must learn to take calculated risks. But risk-taking should always be based on sound knowledge, thorough planning and painstaking preparation.

To look at what business opportunities are available, we must first look at where rural industries have been and where they are going.

WHAT HAS CHANGED

In the past, a farmer's market was frequently local, with most competition coming from the local area or state, or perhaps within the country. Markets are now international; competition can come from anywhere in the world, including places where labour costs are very low. But just as competition has increased, so have opportunities. It is no longer unrealistic to look at overseas opportunities as well as still catering for local markets.

People in developed countries are eating foods and using other produce which they previously did not use. Even foods that seem so commonplace now, such as Asian vegetables and herbs, were not readily available on the market 20 years ago. These changes are occurring not only at our own back door, but overseas as well.

Keeping abreast of what is occurring, both financially and socially, in overseas markets is important to the successful farming operation. If your

country appears to be 'flavour of the month' to the people in another country, what opportunities for your products or services could be found there? Expanding economies and increasingly higher standards of living in other countries are creating new markets all the time. The market possibilities in a particular country may be short-lived, but who's to say that yet another country will not be interested in what you produce in later years? Making a high profit for a short period is also a good way to finance other, longer-term ventures.

Many people are well aware of the opportunities in overseas markets, but find unfathomable the prospect of getting contacts, organising the logistics, etc. Remember that not everything has to be done by you alone. Options include creating a co-operative with similar producers, supplying a larger producer who already has the overseas markets, or working through an agent who specialises in creating and catering to markets overseas. Government agencies may also provide excellent advice and even financial assistance to help you establish overseas markets.

Scale of production, as well as market opportunities, has also changed. It is cheaper to produce large quantities on large farms. Because the markets set the price on commodities, rather than the producers themselves, it is often unrealistic, or unprofitable, to enter such a market on a small scale. But that does not rule out being in a similar market. By creating a difference in your product, such as organic or high quality, you may in fact be able to enter a market that is more profitable.

For instance, wheat is produced on a large scale, so it is not cost-effective to grow wheat on a small scale. But alternative markets may include organically grown wheat. While production costs for organic wheat would be higher, so is the market price and, potentially, the demand.

While large-scale production is most economical in terms of return, the long-term effects on land, water use, etc. can be costly. Rather than strive for the highest return in the short term, a good farming enterprise must always be looking to the future. While fallow land may be unproductive, the money lost in short-term production may benefit the farm in the longer term. As less and less land is available to provide farm produce for more and more people, it becomes increasingly important that the land be kept productive. Land care issues should always form part of the long-term management of a property. Just as a good factory must be maintained to ensure long-term productivity, so should the land and other natural resources of the farm, such as water, be well husbanded.

Production methods have also become more sophisticated. Through the use of technology, mechanisation, biochemical products, biotechnology and a myriad of other techniques, production has changed a great deal. It is more than the average person could hope to keep up with, especially one who is already working hard to maintain a business. Seek advice, use the service of experts. Don't let high technology be daunting, but don't expect to know everything about it. Learning just enough to see how it could fit

into your business, and experimenting with new ways, can lead to changes that will benefit the farm overall.

There are also a lot of niche industries available to service providers specialising in an area of technology or machinery. For instance, it is not cost-effective for most small grape producers to own the harvesting equipment necessary for picking grapes, yet machine harvesting may be cheaper than hand picking. The person who has invested in the harvesting machine will often have a solid market in running the harvester for other small producers. The same is done in all areas of agriculture, including hay baling, wheat and cotton harvesting.

Aside from the increasing challenges of production, we operate in a different financial climate than we did in the past. There are more types of credit available; interest rates seem to go up and down with alarming regularity and finding the right type of credit, and a source that will provide it, is difficult. But you can take advantage of these differences if you are prepared to look at all the options. Many private investors are always looking at ways of making money, and while most farmers would prefer to be a sole proprietor, there are methods of having it both ways. This could be achieved by the autonomy of your own business and the support of an investor, be it banks, private parties or other sources. As with all other aspects of farming, though, you need to be prepared to do your homework, to ensure that you are legally covered and that the arrangement suits your needs. While everyone hates to pay the high price of legal and accounting advice, it is generally much better to part with the money and obtain good, sound advice, than to lose the business because of some type of 'fine print' or a lack of understanding on your part.

Today's farmer is expected to meet these higher and ever-changing demands of production, marketing and finance while operating on tighter margins. One of the greatest difficulties for many farmers is finding time to spend on budgeting and planning for the business. It is understandably difficult to justify looking over the books when there are fences to mend, animals to tend to and endless chores to complete. But as profit margins decrease, so the need increases to know exactly what your financial position is at all times, and what can be done about it. Keeping an eye on the markets, planning for both poor and productive years, and knowing what you intend to do for 1, 5, 10 and 20 years are all very important and very time-consuming aspects of successful farming.

SECRETS OF SUCCESS

There is no real secret to success. It is a combination of factors including hard work, tenacity, ongoing education, adapting to change and, yes, a certain amount of luck. But mostly, success in any field is about being aware and taking advantage of your own skills, resources and knowledge. Many highly successful people will tell you they were 'just in the right place at the right time'. Being in the right place though, is often due to

knowing what is happening and being there to take advantage when it does happen. The following are some pointers to successful farming:

- **Always be prepared to change**

Routine, and doing things the way they've always been done, is comfortable. You know the procedure and, in most instances, the outcome. But many farms fail because their owners are unaware that everything else is changing around them. This is not to say that old-fashioned ways are not good ways. In fact, many people are willing to pay extra for what they feel is extra service or extra quality. But that does not mean that change is not necessary.

A good example would be in providing farm-fresh eggs. A small egg producer may have always managed chickens free range. Some people are willing to pay a premium to obtain free-range eggs, and the cost of producing free-range eggs is higher for the producer. What may have to change is the way the eggs are marketed. It is no longer good enough to sell the eggs as 'farm fresh'. The emphasis must be changed from that to 'free range'. So, the change here is small, but very effective.

Other changes may be more substantial, such as changing the overall production output of the farm. In the case of a farm raising wool sheep — is that the most effective use of all the land? Could the wool clip be subsidised by growing a crop on part of the land? This would lessen the size of the wool flock, but may be more productive overall.

- **Know your strengths and weaknesses, both personally and professionally**

There is always an emphasis on knowledge in business. Know your market, know what is going on in the economy at large, know what your product and core business is, know your strengths and weaknesses. It can be quite overwhelming. But being able to identify where you excel and where you don't is important to managing all of these other aspects of your business.

Identify what your strengths are, both personally and professionally. Then look at your weaknesses, so that you can identify where you need to find support. The most successful people don't expect to know everything. What they do know is how to admit where they need help and where they can get it. Expert advice need not always be costly. Producers' organisations are a great source of information. They often provide forums for discussion, both formally and informally, as well as current information relevant to your particular market. They also often serve as a lobby group, acting on your behalf on government issues.

Support can also be found through outside professional services. This can be in the form of book-keeping, accounting and legal advice, or through government advisory services. For instance, the Bureau of Meteorology has a wealth of information on weather patterns, temperatures, rainfall, etc. Many farm management decisions must be based on the weather. If you are

People are always interested in new flavours — the smart farmer will capitalise on this phenomenon by looking for something new to grow, like this range of exotic tropical fruits.

not good at keeping weather records or have not had the opportunity, the Bureau of Meteorology can enhance your knowledge.

Half the battle of addressing and providing for your strengths and weaknesses is knowing the 'lingo'. All people in business have their own language, be they plant growers, bankers, chemical suppliers or equipment dealers. By having an awareness of the language, you are halfway to having the knowledge. If you feel that lack of understanding is a weakness, first try learning the language. You will find in many cases that you know a lot more than your thought you did.

- **Plan ahead and always have contingency plans**

There is one thing that is sure about farming — unexpected things will happen. You need to plan for contingencies such as drought, fire, crop failure, animal diseases, etc. What arrangements, if any, do you have to cope with such problems? Could you plant fodder trees as windbreaks, branches of which could be used as emergency stock food? Do you have other sources of income (e.g. off-farm investments, another job) that could support you through lean times on the farm? Have you invested profits from good years in new equipment, new dams, paying off loans ahead of schedule, etc? During a good season, do you buy up large quantities of grass/lucerne, hay, various grains, molasses, etc., when prices are low? Do you alternate sources of feed for your stock in times of drought, such as road verges, timber plantations, public land, etc? Do you have a contingency plan for dispersal of stock when drought is forecast or when dry spells are lengthened.

Modern farming must keep abreast of new technology if it is to remain viable into the future. Using micropropagation, these disease-free banana plants are being grown in a laboratory more quickly and in larger quantities than was possible in the past.

It is financially sound to take a slightly lower price at the beginning of an imminent drought than having to resort to shooting starving stock or watching them starve to death or die in bogs — neither of which are good husbandry practices.

- **It is not what you have (money, facilities, assets etc.); it is how you use it**

You might, for example, produce a wheat crop year in, year out, because that is what you, and your father before you, have always done. Does this provide the most effective return for your time, money, equipment and material inputs? In many cases farmers get little or no return from all their efforts and inputs — they would have been better off not growing a crop at all, instead utilising their resources to do something else, or saving them for better conditions, and the land may be better off in the long term after a year of rest. Usually it is better to expend more time and effort in those areas where you get the best returns, or look at alternative enterprises with potentially higher returns.

- **Always be different — try to think laterally**

Just because everyone else and previous generations in your area have all grown the same crops or raised the same animals, doesn't mean you have to do the same things. Many of our farming enterprises and production systems are based on those the early settlers brought with them from Europe. They may have been suitable for European conditions, but Australia is a lot different, particularly with our generally low fertility soils, and lower

Brussels sprouts were widely grown in the Scoresby area of Melbourne 20 years ago; but as the suburbs expanded, the land in this area was sold for housing. Farmers who were tuned into this trend saw an opportunity and began to grow sprouts in new areas. It is critical to think 10 or 20 years ahead.

average rainfall over much of the country. Why not look at other countries with similar climates? What crops are they growing successfully? What production methods are they using? What crops or animals are they experimenting with? What about crops or methods being used successfully elsewhere in this country? Are there crops or animal products that Australia imports, that could be readily grown here? Could you experiment on a small scale, without having to initially spend a lot of time and resources?

- **Look at ways to add value to your product**

Each step in processing a product can significantly increase its value. For example, milling wheat to produce flour will see an increase in value. Converting that flour into products such as pasta or bread will see another increase in value, as will further processing those products into a meal (e.g. sandwiches, pasta dishes). Could you readily process your products in some way 'on farm' to get a significant increase in value? This may not require a significant investment in processing equipment, or the returns from purchasing or building such equipment may make such investments well worthwhile in only a few years. Further examples of value adding are discussed in Chapter 4, 'Alternative Enterprises'.

- **Know what your business is**

Be sure you know what you are doing, or aim to do. Don't try and be all things to all people. You will generally get better results concentrating your resources (time, money, equipment, etc.) on one, or perhaps two or

three enterprises, than on many enterprises, otherwise you will find yourself running from one to another and not doing justice to any of them. You might find yourself literally a jack-of-all-trades and master of none. Customers will generally prefer to deal with someone who is an expert in their particular field or enterprise.

- **Give people a reason to prefer to deal with you**

In order to ensure that customers choose you to provide the service or product, it needs to be sufficiently different from, or of better quality than, that of your competitors. Your product may be better marketed (e.g. attractively packaged), or you may provide a better service (e.g. follow-ups, transport, advice, etc.) to give you an edge over the competition.

- **Be prepared to take risks**

The old saying that 'you can't make an omelette without breaking eggs' holds true when considering a new enterprise. If new enterprises were easy, or didn't take a lot of time, effort and research, then lots of people would try them. Be prepared to take risks, but make sure they are calculated risks. Ensure that you have done as much research as possible into any proposed enterprises, and that you are as aware as possible of things that could go wrong. Learn from other people's mistakes in the same or similar industries.

If possible, have fall-back plans. Could you use equipment, materials, etc. you have purchased for other things, rather than wasting them if the enterprise you are trying is not successful? It is generally a good idea to experiment at first. Try things in a small way, and see if you strike any problems; if so, can they be easily overcome? This may be a step-by-step process, rather than jumping in feet first, spending a lot of time and money, only to find it doesn't work.

When you feel confident with what you are doing, only then consider expanding.

CHAPTER 2

Spending Less

When a farm comes under financial pressure, there are two possible ways to overcome the problem: a) spend less money; b) make more money. Often the solution involves a combination of both. This chapter will show you ways of spending less money. It aims to provide ideas rather than masses of specific details.

One of the best ways to reduce spending is to yourself create as much as possible of what you need yourself ... in other words, to become more self-sufficient. This may involve extra work and, in some instances, it may require you to modify and change your needs or lifestyle. For instance, you might stop eating certain foods that you consumed previously, and eat other foods that are easier to grow/process on your property. Nothing comes free. You will need to compare the benefits and savings derived from this exercise with the costs involved. It will cost you time (and perhaps money) to produce alternative foods. If that cost ends up saving you money however, it is worthwhile.

SELF-SUFFICIENCY

Modern society is extremely complex. It relies completely upon a massive network of interrelationships between individuals and groups where each part supports another part. To live in such a world usually involves finding a niche for yourself; you make your contribution to the whole machine and it, in return, supports you. This system does have its advantages:

- It allows for efficiencies of scale. When something is made in large quantities, it can be produced more efficiently and sold more cheaply.
- It allows for specialised development of skills (i.e. if a person is able to concentrate on one job they can become more proficient at that undertaking).
- It buffers the effect of a mishap (i.e. if someone has an accident, the system supports that person until they recover — whether through an insurance scheme or government welfare, the expense of the accident is shared by many).

Modern society also has its disadvantages:

- It is impersonal — it is concerned only with the material needs of a person. The impersonal way in which goods and services are provided can increase the likelihood of emotional problems.

- It does not tolerate anything that does not fit the system. People who deviate from what is considered the norm are 'labelled' and mainly rejected by society as being odd or difficult.
- Everyone is so dependent on everyone else that they are frequently affected by things beyond their control, e.g. industrial disputes.
- If the system collapses, everything collapses. People do not have a broad enough range of skills to survive if thrown into unusual situations such as war, economic collapse, massive power plant breakdown or natural catastrophes.

The concept of self-sufficiency is all too often bandied around without people properly understanding what it means. Consider the following statements:

- To be self-sufficient is to produce the things that you need to survive without the assistance of outside people.
- You can produce some of your needs and be partly self-sufficient, or produce all of your needs and be completely self-sufficient.
- An individual person can be self-sufficient, a small group (e.g. a family) can be self-sufficient, or a large group can be self-sufficient (you might think in terms of a whole society, city or nation).
- To become self-sufficient usually involves making certain compromises or concessions in your lifestyle. You might have to wear different types of clothing, adapt to a different level of mobility, reduce or no longer use modern consumer goods, or change your diet. The degree to which you can achieve self-sufficiency is usually related to the degree to which you are willing to make compromises.
- Large areas of land are not necessary to become self-sufficient. Depending on what you produce and how you produce it, you can become relatively self-sufficient in terms of food production on even a standard suburban house block.
- Bartering or swapping goods and/or services is a way of living often adopted by the person interested in self-sufficient living. This is not strictly self-sufficiency but, like self-sufficiency, the barter system offers an escape from a dependence on the monetary system. Many communities have set up barter groups which work on a points system for goods or services supplied, which are then traded throughout the group.

To be self-sufficient requires a blend of three things:

- practical knowledge and skills;
- management or organisational skills;
- a readiness to compromise. You may need to compromise to achieve a balance between the things you would like to have and the things you are able to provide for yourself. A self-sufficient lifestyle might make

you less dependent on society, but this might only be possible at the expense of giving up some of society's luxuries.

To become self-sufficient, you must be selective in the goods and services you choose to supply for yourself. It involves doing those things which yield greatest benefit in relation to the time, money and materials you need to spend on producing the goods or service (e.g. if you spend $20 on fertiliser and seed in order to grow $10 worth of vegetables, you would have been better not growing the vegetables at all ... you could have bought them instead, and still had $10 in pocket to spend on another more worthwhile project).

The way you physically organise your property and living space (both inside and out) as well as the way you organise your time, are vital factors in improving your level of self-sufficiency.

The Basic Essentials

The first items to which one must look at for self-sufficiency are food, clothing and shelter. Once these are either satisfied or a plan is organised as to how to meet your requirements, further areas of self-sufficiency can be explored.

FOOD

Food is the single most important consideration if you are trying to become self-sufficient. It should be possible for any family to become relatively self-sufficient for food on as little as a quarter of an acre (0.1 ha) of land. You cannot do this by simply growing anything you might be able to eat; it is essential that you plan the food you produce, to ensure a steady supply of a variety of foods needed to maintain good health.

Vegetables and fruit

In most climates it is relatively easy for the farmer to maintain some cropping, although events such as drought, floods, fires, etc. can play havoc with crops, as can marauding animals.

A constant supply of a variety of fresh vegetables is important for health. Many fruits and some vegetables store well, and these make important food reserves.

Meat

Stocking animals which can be slaughtered on farm and eaten reduces costs and improves self-sufficiency. To ensure good health through variety, a range of animals is recommended such as cattle, pigs and poultry. Animal by-products such as milk and eggs are also important for self-sufficiency.

CLOTHING

Consider farm animals capable of yielding useable fleece, e.g. sheep, goats, alpacas, etc. Another by-product, the hide, is essential for leather production.

Fibre from plant sources such as cotton, flax and silk will provide the

farmer with a more diverse range of materials to work with. Hemp, although at present illegal in Australia, produces a popular, well-wearing cloth.

It may be difficult to become self-sufficient in terms of clothing based on these products, but they may become valuable as barter commodities.

SHELTER

Most farmers already have their dwelling, so at this point we will presume that this basic item is catered for.

HEALTH

It is almost impossible to become self-sufficient in the area of health care, but measures may be taken to minimise your dependence on the medical profession.

There are two things you can do to reduce your dependence:

1. Maintain a healthy lifestyle

If you are fit and healthy you are more likely to be able to resist infection when you come in contact with it. Sleep is essential to good health. People have different requirements, however most need at least seven hours.

2. Learn first aid

Everyone should have a grasp of basic first aid. If you know the basics, you will then know when to seek professional help. The Red Cross and St John's Ambulance Society regularly hold courses in first aid.

The practice of *preventative medicine*, which incorporates an overall healthy lifestyle, may reduce the need for medical consultations. However, it is important to recognise that there are many situations where the advice of a medical expert is warranted.

A wide variety of *alternative medicine* practices have seen a resurgence of practitioners in recent times. Many have a scientific foundation, others do not. You should approach alternative medicine with caution and make up your own mind after thorough investigation of all the available facts.

ENERGY

Not many people would like to go back to the days before electricity was supplied to every home. The thought of living a contemporary lifestyle without flicking a switch can be daunting. However, there are ways in which the energy needs of the modern family can be met by those who are looking towards self-sufficiency. Sun, wind and water — when the latter is available — can be harnessed to provide us with our daily energy needs while reducing long-term costs. (See 'Energy Use and Conservation' later in this chapter.)

Basic non-essentials

These are items for which people can either use substitutes or, in some cases, can live without.

For the self-sufficient person, it is the items used within the house that are the first to be replaced with more natural or basic alternatives. Soaps,

cleaning solutions, shampoos, etc. can be made at home with a few basic ingredients. Once the process of making these products is understood, expensive named brands will no longer need to be purchased.

For the farm, it is wise to consider items that might be purchased and try to determine how to make alternatives or do without.

Growing Food

Although farmers are in the business of producing crops/goods for others, they often overlook the fact that they can save money by using a relatively small portion of their land to produce crops for their own consumption. To achieve this the farmer does not have to plough up half of the best paddock. By using the 'no-dig' method the most marginal piece of land can transform into a productive garden. To be self-sufficient in most of your daily food-requirements takes up less land than most people imagine. Even a small suburban backyard can produce enough to sustain an average-sized family.

A productive vegetable garden needn't take up a lot of time, either. By using the 'no-dig' method, a vegetable garden of generous size could be assembled in a morning's work.

THE 'NO-DIG' GARDEN

The method used in this type of garden is quite simple: layers of material are placed on top of the ground and seedlings are planted with a handful of soil. The materials needed would be found on most farms — old hay, straw, newspapers, manure and some fertiliser such as blood and bone are all that is needed. If the ground is very hard or rocky it is advisable to put down a thick layer of old hay (about 20 cm or 8 in) first and then build your layers up from there. Kitchen scraps can be incorporated into the mixed layers, alternating with manure, spoilt hay, blood and bone, etc. It is advisable to water it all as you go along and top it with wet overlapped newspapers and a layer of old straw to keep it all in place.

Holes are punched into the paper through the straw and the seedlings planted with a handful of soil. No weeding is required. This method also requires less water than a conventional garden, as the mulch is extremely water-retentive.

Most vegetables thrive in a 'No-Dig' garden. Crops that need seed to be sown directly into the soil, such as carrots and onions, could be planted in a conventional patch on their own.

Seeds are very cheap. A few packets of seeds such as cabbage, lettuce, etc. have potentially hundreds of plants in them. It is well worth the effort to grow your own seedlings as well. A lot of farm produce stores also sell seeds such as corn, peas and seed potatoes (tubers) and onion sets in bulk, translating into a further cost reduction.

BOUNTY TIME

Once your garden is established and producing vegetables, you will almost certainly find yourself with a glut. This produce could be traded with

Choko vine produces fruit for up to six months each year in mild or warm climates. Chokos are ideal for chutneys, or can be eaten as a boiled vegetable or in stews.

neighbours or relatives for other goods or services, or sold off the farm. Local shops could also be interested in good quality organically grown fruit and vegetables — if you haven't used chemicals in their production, this produce will attract premium prices.

Of course, to be relatively self-sufficient, you should preserve a lot of the produce you can't consume immediately for use later. Fruits such as strawberries, blackberries, etc. can be turned into jams and jellies for later use or for sale. Corn freezes well, as do beans and peas. Potatoes can be stored in the ground for as long as possible; just lift up the mulch and take what you need on a daily basis. Towards the end of winter, remove the top mulch and store the remaining potatoes in a cool, dry place. Tomatoes can be turned into sauce, paste, or bottled for use over the winter months.

Eat what is in season.

Preserving and Processing Your Food

BOTTLING

Preserves include jams, pickles, bottled fruit and vegetables, chutneys and sauces. Preserves will normally keep for a minimum of 12 months at room temperature in a reasonably dark pantry. There are many excellent books

on the subject of home preserves which give details of methods involved in bottling a wide variety of fruits and vegetables, and such a book could pay for itself many times over in the first season of bottling.

Do not use metal saucepans or sieves when cooking pickles, chutneys or sauces, as contact with metal can reduce the keeping quality of these products. Use pyrex or enamel saucepans instead.

Sterilising jars or bottles

Containers must be sterilised before use to prevent contamination by bacteria and other micro-organisms. Wash them thoroughly in hot, soapy water, then place them in a large saucepan or boiler of cold water and bring to the boil for five minutes. Remove with tongs and invert onto a clean tea towel to drain.

Just before filling, place the containers in the oven (140°C, 285°F) to warm, and fill while the jar is still hot.

It is not necessary to sterilise jars used in vacuum preserving, as they are sterilised during the process. Simply wash these jars in hot, soapy water, rinse and drain.

FREEZING

Fruit or vegetables should be frozen on the day they are picked to ensure the least loss of flavour and colour. Most frozen fruits or vegetables will retain their nutrients and flavour, but some will lose their consistency when thawed. Tomatoes, for example, become mushy, but they can still be used in cooking. Once thawed, vegetables should not be refrozen.

Vegetables particularly suited to freezing include peas, beans, soybeans, corn and asparagus. The general procedure for freezing vegetables is as follows:

1. Pack food in airtight containers such as plastic freezer bags or plastic containers.
2. Before sealing the container, remove as much air as possible.
3. Write the date of processing on the container. Most frozen vegetables can be kept up to eight months in a standard home freezer.
4. When you put the container into the refrigerator, place it as close as possible to where the refrigerant circulates. This is the coldest part and is where freezing will be fastest. Leave a small air gap between containers when first freezing. This increases the rate of freezing. You might turn the freezer up to high when first freezing, then turn it back later. Avoid too frequent opening of the freezer door when a new batch of vegetables has been installed.

Blanching

Some books (particularly older ones) will suggest that vegetables should be blanched before freezing. Blanching is a process of cooking or part-cooking, and a certain amount of contention surrounds it. Some people believe it reduces the pungency of certain strongly flavoured vegetables

(e.g. cabbage or onions), others believe it is necessary for the freezing process, while the disbelievers will argue that in most cases it is unnecessary.

How to blanch

1. Put prepared vegetables into 1 to 2 litres (2–4 pints) of boiling water, or steam them, for several minutes.
2. Plunge the vegetables into iced water to rapidly cool. These extremes of temperature are said to kill harmful bacteria and keep the vegetables fresh.
3. Allow to dry thoroughly before placing in freezer bags.

Table 2.1. Vegetables suitable for freezing

Vegetable	Method of freezing
Asparagus	Normally blanched 2–4 minutes, packed alternating stems and tips to minimise air gaps.
Common beans	Frozen whole or sliced; may be blanched 3 minutes.
Broad beans	Shelled, washed and often blanched. Small size blanched 2 minutes, large 4 minutes. Drained and cooled before freezing.
Beetroot	Boiled 30–50 mins, peeled, packed and frozen.
Broccoli	Soak 30 minutes in salt solution to remove any insects, then blanch 3 minutes, cool, drain and pack as airtight as possible (this can be difficult).
Carrots	Cut into slices, boil 5 minutes, then pack and freeze.
Corn	Remove from plant, trim off leaves, place in freezer bags and freeze as quickly as possible.
Cauliflower	Treat the same as broccoli.
Mushrooms	Wash, trim and soak in a solution of 2 cups of water to 1 teaspoon of lemon juice. After 5 minutes, remove and steam for 3 minutes. Cool, pack, seal and freeze.
Okra	Use only tender green pods. Remove stems and wash. Boil for 3 minutes, cool and drain. Either freeze whole or slice first then pack for freezing.
Parsnips	Treat the same as carrots.
Peas	Shell, blanch for 1–2 minutes, cool, drain and freeze packed in freezer bags.
Tomatoes	Freeze whole and untreated to be used later to flavour stews, make sauces, etc. The storage life of tomato paste can be extended considerably by freezing.

MANAGING THE FREEZER

You should plan what you freeze. Keep a written record of what you freeze and when you freeze it, so that you can see which is the oldest food, and use

it first. When you remove something from the freezer, mark it off on your record. Plan how much of each crop you put into the freezer, so you don't end up with too much of one thing and too little of another. Consider:

- the size of your freezer;
- how much food your family needs;
- the best times to grow particular crops;
- what time of year the produce will be ready;
- what time of year there will be room in the freezer;
- the time needed to prepare and pack food for freezing.

DRYING

Drying involves reducing the water content of a food to a very low level so that fungi and bacteria cannot be supported. This can be done either by natural methods, using the sun, or by using a food drying machine, which consists of a heater element and a fan to circulate the heat.

Drying is done on trays or racks, often stacked one on top of another, but with sufficient space to allow good air circulation between layers. Dried products are best stored in airtight containers at room temperature in a dark cupboard or pantry.

Fruit or vegetables can be cooked up into a pulp and dried as a puree to form 'leathers', or sliced and dried. Vegetable soups can also be dried. Even meats can be dried. The dried puree may be reconstituted with water at a later stage. This process is commercially used for potatoes, peas and beans.

Drying can in fact be used for virtually any type of fruit or vegetable. Dried fruits such as apricots, apples, peaches, pears, etc. not only make nutritious snacks, but can be rehydrated later to make fruit desserts. Dried vegetables can be made into soup powder (for instant soup), or to add to stews, casseroles, spaghetti sauce, etc.

Harvesting and Storing

Proper harvesting and aftercare of your crop is essential if you are to reap the benefits of all the hard work that went before. By treating your harvest properly, you can keep yourself supplied with food a lot longer, and reduce your waste to virtually nil.

HARVESTING HINTS

1. With flowering crops, e.g. beans and peas, don't tear off foliage when picking.
2. It is best to use a fork to lift root crops out of the ground to minimise cutting or tearing of the vegetable.
3. For leafy crops, e.g. lettuce, cabbages, use a sharp knife to cut the vegetable from its stem.
4. Pick rhubarb or silver beet by gently pulling individual stalks from the plant. It is difficult to cut the leaves without cutting the remaining plant or leaving a piece of leaf attached (which can rot).

5. It is important to pick continuously cropping vegetables regularly, e.g. marrows, melons, pumpkins, beans, peas, cucumbers, brussels sprouts. This ensures that crops continue to develop steadily throughout the season.
6. Always pick the largest pieces first. These will be the most mature and will begin to deteriorate if left on the plant.
7. Pick all vegetables before they become over-ripe and start to deteriorate on the plant.
8. If you plan to store them, choose only unblemished pieces that are in peak condition. Tears in the skin may act as an entry point for bacteria and fungi.
9. Taste, rather than size, should influence harvesting time. For example, carrots and turnips are at their most tender when they are 10–15 cm (4–6 in) long. Peas, beans, soybeans, lima beans, corn and asparagus are known for their particularly rapid maturation and should be picked while they are still tender. Within one or two days of reaching peak maturity, these vegetables become tough and stringy if left on the plant.
10. Similarly, leafy vegetables, squash, rhubarb and most of the root crops should be picked before they become too mature. Exceptions are celery and swedes — the taste of these improves the longer they are left to grow.

STORING VEGETABLES

Most vegetables will keep at room temperature for at least a few days. Generally, storage life is extended considerably by keeping in the bottom of the refrigerator (i.e. away from the freezer section). The ideal temperature for storage is normally 0–5°C (32–41°F). For long-term storage, vegetables are normally frozen, dried or made into preserves.

ENERGY USE AND CONSERVATION

In an average home in a temperate climate, heating and cooling can account for up to three-quarters of your energy use; it will be rather less in warmer climates. As such, most people can make a great impact on energy conservation by concentrating on this aspect alone.

Significant energy costs are also incurred in the day-to-day operations of most rural enterprises, including electric fencing, cool rooms, processing equipment, heating, lighting, etc. There can be significant reductions in these costs, too, if energy conservation techniques are practised, and/or alternative sources of energy are used.

Being Self-sufficient With Energy

Individuals who are concerned about self-sufficiency on a farm can approach their own energy problems in both the home and work areas in two different ways:

1. BE MORE EFFICIENT

- Reduce energy use. Don't heat more rooms than you are using. Closing off central heating ducts to unused rooms can significantly reduce energy used for heating.
- Insulate the home and selected work areas. This will significantly reduce both heating costs in cooler seasons, and cooling costs in summer.
- Walk or ride a bike around the farm more often, instead of driving a car or using the tractor as a farm transport vehicle. This not only uses less energy, but helps keep you a lot healthier.
- Turn off unnecessary lights. Connect sensors to exterior lights so that they turn on when people are present, and turn off when no one is there. Use energy-efficient light bulbs instead of common incandescent bulbs.
- Plan your use of vehicles and other machines to reduce the number of times you use them.
- Reduce energy loss by using better designed and more energy-efficient tools and equipment.
- Add an extra or thicker blanket or doona to your bed, or wear warmer clothing when you are cold, rather than turning on heating.
- Seal up cracks or gaps in your house and work areas (e.g. around doors, poorly sealed windows) that increase the passage of hot air into the house in summer, and out of it in winter.
- Minimise opening of external doors (this allows heat in during summer and cold air in during winter). This practice alone can significantly reduce energy costs.
- Use good quality blinds or curtains and carpet to help insulate against summer heat and winter cold.
- Use the most fuel-efficient wood heaters/stoves available to minimise fuel use and reduce negative effects on the environment such as pollution and global warming (open fires are neither energy-efficient nor environmentally friendly).
- Keep heating and cooling units clean and well serviced.
- Don't use exhaust fans any longer than necessary, as they suck hot and cold air from a room.
- Plant trees for fuel efficiency (shade trees insulate in summer against heat and against cold in winter). Windbreaks can deflect prevailing winds, as well as protect stock.
- Colours in the house and work place affect temperature absorption both in real terms and psychologically. Cool colours (e.g. blue) make you feel cooler; warm colours (e.g. red) make you feel hotter. Dark colours absorb heat, light colours reflect more heat. In warm climates, simply painting a shed or building with a light colour can keep that building significantly cooler, by reflecting a lot of sunlight rather than absorbing it as heat.
- Carpet helps insulate.
- Arrange furniture and work equipment so that it doesn't restrict flow of warmth or coolness from heaters or air conditioners.

2. WHERE POSSIBLE, USE RENEWABLE ENERGY SOURCES

- Install a solar hot water service instead of an electric one.
- Use wood for heating and cooking.
- Use wind-powered pumps for pumping bore water.
- Use water-powered pumps or turbines to move water or generate electricity.

Energy Conservation Techniques

WATER CONSERVATION

Consider the following methods:

- **Toilets**. The average toilet flush is 9 litres (2˝ gallons) of water per flush. The half-flush option uses 4.5 litres/flush (1˝ gallons), ultra-low-flush toilets use less than 2 litres/flush (4 pints). Reduced water use means smaller septic tanks and reduced costs for water treatments.
- **Showers**. Reduced water flow fittings may use only one-third to one-fifth of conventional showers. An added bonus is that less energy is needed to heat water, as less water is actually used.
- **Washing machines.** Front-loaded washing machines tend to use less water than top loaders.
- **Recycling.** In some districts, recycling water is permitted provided it meets certain health restrictions. For example, washing water may be reused for the toilet or urinal.

EFFICIENT APPLIANCES

Energy rating of appliances is now available in all countries. The star rating system means that the more stars an appliance has, the more energy-efficient it is. So look for the stars when buying an appliance!

Lighting-efficient globes use roughly one-fifth the electricity of a standard incandescent bulb; they give the same amount of light and last a lot longer. These globes are efficient when used in areas where the globe must be on for extended periods, as continual switching on and off greatly reduces the life of the globe.

Skylights can provide a good daytime light source, but they can be poor in terms of insulation.

WASTE HEAT RECOVERY

Recovering heat loss (e.g. heat given off during processing raw produce, pig farm wastes, etc.) can be an important money-saving practice. Heat can be recovered and used for heating water, greenhouses, rooms, or for drying. The economic viability of waste heat recovery is very dependent on the particular circumstances and should be costed for each job.

STAND-ALONE POWER SYSTEMS

Isolated locations can be powered by renewable energy supplies linked to battery arrays. Photovoltaic cells, wind turbines or micro-hydroelectric power can be used to supply electricity which is stored in the battery array

until required. Electricity can be used directly from the batteries if low voltage, direct current wiring and appliances are used. Alternatively, an inverter can be used which converts the battery supply to 110 or 240 volts alternating current.

Photovoltaic cells convert sunlight to electricity. In present terms, if used alone (without diesel generator back-up) the payback period is less than five years, but there is some loss of reliability.

Wind turbines depend heavily on wind speed for success. A doubling of wind speed produces an eight-fold increase in electricity. Locations with average annual wind speeds of 20 km/h (12 mph) or more are considered suitable for wind turbines.

Micro-hydro. A running stream nearby is important to the success of this system. The stream must have a good fall in height so that there is a good 'head' of water to run the turbine. It is advisable to keep a steady load on the turbine, so when electricity is not needed the power should be redirected to heating water, etc.

Biomass combustion. Wood-burning appliances have been used for centuries, but recent developments have produced energy-efficient designs.

Solar food driers. A solar food drier captures heat from the sun to dry fruit, vegetables and some meats. Its construction needs to protect the food from rain or excessive humidity in order to prevent it spoiling. In humid areas, the design may need to provide for forced air flow through the system, particularly a larger facility. (You may be able to design a wind- or water wheel-powered fan.)

Table 2.2. A comparison of renewable energy sources

	Wind	Solar power	Hydro power
Installation cost	medium	lower	higher
Site specific	medium	low	higher
Running costs	medium	low	low
Noise	yes	no	very little
Reliability	medium	high	high
Capital cost	medium	high	lower

Source: *Tourism Switched On: Sustainable Energy Technologies for the Australian Tourism Industry* (1996), a guide prepared by Tourism Council Australia, World Travel and Tourism Environment Research Centre and the Office of National Tourism.

MORE ON WIND POWER

One of the advantages of wind power is that the wind may still blow even if the sun is covered by clouds. Developing a two-energy source system by using both solar energy and wind power is an excellent method of achieving alternative energy self-sustainability; however initial costs may be daunting.

Ensuring that the wind has sufficient strength for the turbines is essential. Just because a site looks windy, it may not produce the necessary wind velocity to produce sufficient energy. Turbulent wind can negate the benefits

of a rotating propeller, and turbulence can be developed from nearby trees, buildings, etc. It is therefore important to ensure that the proposed turbine site is above any 'external' influence.

To establish whether there is an even air flow in the area under consideration, place a ribbon on the end of a long pole and position this in the wind stream. If the ribbon flows strongly and evenly, then this is a good indication of a suitable site.

Air speed is best measured by an anemometer. Air speed increases with height because there is no ground surface friction. At a height of 26 metres (80 feet) the wind speed reportedly is about 50 per cent more than at ground level; this can equate to an increase of about 300 per cent in power at this height.

To charge a 12-volt battery, the wind generator must produce more than 12 volts to be of any effect. It is worth noting that the voltage output of an alternator is directly proportional to its speed or RPM.

Some facts on wind generation

- Power generated from wind is an indirect form of solar energy.
- Wind generators can run day and night depending on the presence of winds.
- Electricity generated by wind can be stored in batteries, or used directly to power devices such as water pumps.
- Wind turbines for power generation have low environmental costs.
- The southern coastline of Australia and New Zealand is in the 'Roaring Forties', one of the best wind regimes for power generation in the world.
- Wind generators occupy only a small space for the tower, leaving the rest of the land available for agriculture and other uses.
- Depending on its location, a wind generator will produce the energy used in its manufacture in 1–4 years.

Using Firewood

WOOD AS A FUEL

Weight for weight, all types of firewood, when bone dry, have about the same calorific value (i.e. they give off the same amount of heat). Softwoods may have slightly higher calorific value (17.9 megajoule per kg [7700 BTU/lb]) compared to hardwoods (17.2 megajoule per kg (7400 BTU/lb)) due to the presence of oils and resins, and, on average, a higher lignin content. Properties of selected firewood species commonly found in Victoria are listed in Table 2.3.

Firewood is ideally burnt at an air-dry moisture content (approximately 12–18 per cent). Because of its moisture content of up to 50 per cent, green wood has about 40 per cent of the heating value of dry wood. It is also much harder to ignite.

The temperature at which a fire burns is related to how quickly it burns, and this will vary from timber to timber. Because wood is a poor conductor,

River red gums *(Eucalyptus camaldulensis)* occur naturally around watercourses and on flood plains throughout much of Australia. This species of gum tree provides excellent timber for firewood, fencing or building.

it is difficult to ignite unless its surface-to-volume ratio is large. This is why kindling, paper firestarters, etc. are required. In the combustion of wood, 70 per cent of the heat energy comes from the burning of the gases released from the wood, while the remainder comes from the combustion of charcoal.

Wood that forms glowing coals radiates more heat into the room than quickly burning wood, which usually gives off heat as hot gases that quickly move up the chimney, and hence are lost. Dense timbers such as grey box give the best coals, making them better than lighter wood for open fires. The density of grey box is up to 2.25 times greater than pine, which means that about double the amount of pine would be required to produce the same amount of heat.

Density and burning properties of wood can differ even within the same species, depending, among other things, on genetics, health and age. Heartwood is usually much denser than sapwood or bark, so wood from larger trees with a higher percentage of heartwood gives a higher overall density than does smaller diameter or decayed wood.

Heat values for selected timbers commonly found in South Australia are listed in Tables 2.4 and 2.5.

DRYING AND STORING WOOD

To maximise drying, provide an airy shed and have timber cut into required thicknesses. As this is not always possible, it should be remembered that stacking timber outdoors will extend the time until it is air-dry. The ideal time to gather or purchase wood is before summer so that the summer heat can dry it while it is stored.

Table 2.3. Firewood species of Victoria and their properties

A *Eucalyptus* spp. mallee roots
B *Casuarina* spp. belah, buloke
C *Eucalyptus microcarpa* grey box
D *Eucalyptus largiflorens* black box
E *Eucalyptus sideroxylon* red ironbark
F *Eucalyptus cladocalyx* sugar gum
G *Eucalyptus melliodora* yellow box
H *Eucalyptus polyanthemos* red box
I *Eucalyptus leucoxylon* yellow gum
J *Eucalyptus goniocalyx* long-leaved box
K *Eucalyptus globulus* blue box
L *Eucalyptus camaldulensis* river red gum
M *Eucalyptus macrorhyncha* red stringybark
N *Eucalyptus sieberi* silver top
O *Eucalyptus viminalis* manna gum
P *Eucalyptus radiata* narrow-leafed peppermint
Q *Eucalyptus rubida* candlebark
R *Eucalyptus obliqua* messmate
S *Acacia* spp. wattle
T *Eucalyptus regnans* mountain ash
U *Callitris columellaris* white cypress-pine
V *Pinus radiata* radiata pine

	Rel. heat available/ unit volume	Density (air dry) kg/m3	Splitting	Ignition	Coaling	Sparks (spitting)	Availability (in bush, Victoria)
A	100	N.A	Difficult	Poor	Excellent	Few	Limited
B	100	1121	Good	Poor	Excellent	Few	Limited
C	100	1121	Difficult	Poor	Excellent	Few	Good
D	98	1105	Difficult	Poor	Excellent	Few	Limited
E	97	1090	Difficult	Poor	Excellent	Few	Good
F	95	1090	Difficult	Poor	Excellent	Few	Good
G	95	1070	Difficult	Poor	Excellent	Few	Good
H	94	1060	Difficult	Poor	Excellent	Few	Good
I	90	1010	Difficult	Poor	Excellent	Few	Good

	Rel. heat available/ unit volume	Density (air dry) kg/m3	Splitting	Ignition	Coaling	Sparks (spitting)	Availability (in bush, Victoria)
J	89	1010	Difficult	Poor	Good	Few	Good
K	83	927	Fair	Fair	Good	Few	Good
L	81	915	Difficult	Poor	Excellent	Moderate	Good
M	80	890	Good	Good	Good	Few	Good
N	77	865	Good	Good	Good	Few	Good
O	76	855	Good	Good	Good	Few	Good
P	73	820	Excellent	Good	Good	Few	Good
Q	70	785	Good	Good	Fair	Few	Good
R	69	771	Good	Good	Good	Few	Good
S	63	705	Excellent	Excellent	Fair	Moderate	Good
T	60	673	Excellent	Excellent	Fair	Moderate	Good
U	60	673	Good	Excellent	Poor	Many	Limited
V	45	512	Fair	Excellent	Poor	Many	Good

This table relates to heartwood, which is largely free of sapwood and bark. Because wood is a natural material there will be variation in its burning properties, even within a particular species. This will generally be in response to variation in wood density.

NOTE: The above table is reproduced from an unpublished research and development note written by Simon Murphy of the Centre for Forest Technology, Dept of Natural Resources and Environment, Victoria (Forests Service Research and Development Note No. 26, June 1994).

WOOD TREATED WITH PRESERVATIVES

Woods treated with preservatives should not be used for firewood. As they burn they can give off harmful products, particularly timber treated with green-coloured copper-chromic-arsenic (CCA).

NOTE: The above information is a summary of an unpublished research and development note written by Simon Murphy of the Centre for Forest Technology, Dept of Natural Resources and Environment, Victoria (Forests Service Research and Development Note No. 26, June 1994).

COLLECTING WOOD

Most local and state governments have regulations governing wood collection from land under their control. Permits or licences may be required. Contact your local council or state Department of Forestry or Department of Natural Resources (or similar body) for advice.

It is also important to be clear about any regulations/laws that may exist relating to cutting down trees on privately owned land. Even though you may own the land, or have permission from the land owner to chop down trees on a property, there may be laws in that area or state that clearance of native vegetation on private land.

SMOKE FIRES

Smoky fires are more likely to occur when using greenwood and softwoods compared to well-seasoned hardwoods. These woods are also more likely to release creosote and soot.

CREOSOTE FORMATION AND FLUE FIRES

A problem associated with solid fuel appliances is the formation of creosote in the flue. This may be in the form of wet, tarry material or hard bituminous material, which can completely block the flue. These creosote deposits may also catch fire, creating a serious safety hazard.

Such fires are often indicated by a rise in temperature in the flue itself, and the sound of crackling or roaring noises in the flue. The air controls on the appliance should be immediately shut down. In airtight appliances this should starve the fire of oxygen; in poorly sealed appliances, it should be sufficient to reduce the intensity of the fire. Do not attempt to remove fuel from the stove as opening the stove will allow more air in to feed the fire. The appliance should be carefully watched, and if the problem continues or worsens, help should be requested from your local fire brigade.

To prevent or reduce the likelihood of such fires occurring, regular flue cleaning is essential. Ideally, the flue should be brushed at least twice a year, when the flue is cold. Special brushes for this task can be obtained from suppliers of solid fuel appliances.

(Source: The information above, including Tables 2.4 and 2.5, is summarised from South Australian Dept of Woods and Forests Fact Sheet 19: Firewood Facts).

Table 2.4. Heat value and ash content for common timbers in Australia

	Heat Value ML/Kg (oven dry)	Ash Content % wt. (oven dry)
Hardwoods		
Blackbutt *(Eucalyptus pilularis)*	19.07	0.08
Red gum *(Eucalyptus camaldulensis)*	20.24	0.07
Spotted gum *(Eucalyptus maculata)*	19.30	0.98
Jarrah *(Eucalyptus marginata)*	20.54	0.05
Stringybark *(Eucalyptus obliqua)*	19.23	0.06
Manna gum *(Eucalyptus viminalis)*	19.56	0.71
Alpine ash *(Eucalyptus delagatensis)*	19.70	–
Swamp gum *(Eucalyptus ovata)*	18.90	–
Mountain ash *(Eucalyptus regnans)*	19.60	–
Shining gum *(Eucalyptus nitida)*	19.30	–
Tea-tree *(Leptospermum* sp.)	20.10	–
Beech *(Nothofagus cunninghamii)*	19.60	–
Blackwood *(Acacia melanoxylon)*	19.70	–
Southern sassafras (Atherosperma moschatum)	19.50	–
Softwoods		
Radiata pine *(Pinus radiata)*	20.47	0.28
Black cypress *(Callitris endlicheri)*	21.40	–
White cypress *(Callitris columellaris)*	22.56	1.00
Celery-top pine *(Phyllocladus asplenifolius)*	20.70	–

Many of the traditionally used species of firewood are now in short supply, so other species are being looked to as a firewood source. Modern combustion heaters and stoves that can have the rate of burning adjusted allow the use of lighter timbers, such as radiata pine, to be used satisfactorily.

Table 2.5. Heat values for various species of firewood

Species	Heat Value MJ/Kg Oven Dry	Air Dry	Green
White cypress *(Callitris columellaris)*	22.6	19.8	16.5
Black cypress *(C. endlicheri)*	21.4	18.6	15.6
Radiatapine *(Pinus radiata)*	20.5	17.9	7.0
Rose Sheoak *(Casuarina torulosa)*	20.5	17.9	13.3
Red bloodwood *(Eucalyptus gummifera)*	20.2	17.7	13.7
Red gum *(E. camaldulensis)*	20.2	17.7	11.6
White stringybark *(E. globoidea)*	20.0	17.5	10.5
River sheoak *(Casuarina cunninghamiana)*	19.8	17.2	10.5
Grey box *(E. moluccana)*	19.5	17.2	13.3
Tallow wood *(E. microcorys)*	19.5	17.2	12.1
Spotted gum *(E. maculata)*	19.3	17.0	11.2
Red box *(E. polyanthemos)*	19.3	17.0	11.2
Blackbutt *(E. pilularis)*	19.1	16.8	10.7

ENVIRONMENTAL ASPECTS OF USING WOOD AS A FUEL

While firewood can be considered a renewable energy source, there are some negative environmental effects related to its use which need to be weighed against the positive aspects of its renewability.

On its web site (www.werple.net.au/~raou/logging.html) the Royal Australian Ornithologists Union (RAOU), now called Birds Australia, states:

> *It is well known that the largest timber industry in Australia is wood chips, which consumes about 6.4 million tonnes of wood per year. It is less widely known that firewood production is Australia's second largest timber industry, annually consuming 6.1 million tonnes of wood, more than 60 per cent of that in Victoria coming from the woodlands and box-iron bark forests.*

Harvesting timber for firewood can cause significant changes to the structure and composition of forests. Old trees, dead standing trees and fallen timber are the main targets of firewood collectors, but removal of these reduces nesting, shelter and feeding sites for many animal species. Hollow branches are commonly used for nesting or sleeping sites for birds such as parrots and animals such as possums. Fallen timber provides similar opportunities for ground-dwelling birds, snakes, lizards, and animals such as echidnas. Older, larger trees may provide food such as nectar, saps, insects, peeling bark, and rotten wood.

The invasion of a forest by timbercutters with noisy vehicles, chainsaws and talk, plus their physical presence, can seriously disrupt feeding and breeding cycles of birds and other animals. Such vehicles and cutting equipment may pose an increased fire risk during dry seasons. Trails and tracks created by timbercutters can destroy indigenous vegetation cover, open up areas to weed infestation, and create compacted or eroded areas if access to such areas is poorly managed.

The burning of large amounts of firewood releases significant amounts of carbon dioxide and other gases into the atmosphere. This contributes to global warming and the greenhouse effect.

FIREWOOD PLANTATIONS

There has been increased interest in the development of timber plantations specifically for firewood production. This is actively supported by various firewood industry associations, such as the Solid Fuel and Wood Heating Association. The benefits of timber plantations are listed at the beginning of the section on Agroforesty in Chapter 8.

CHAPTER 3

Care of Resources for Long-term Sustainability

The necessity to care for the environment has been receiving more and more attention in recent times, as we have come to understand the effects of human activities (agriculture, industry, recreation) on limited resources of the world we live in. The desertification, erosion and general degradation of once-fertile lands has prompted us to investigate why and how these processes have occurred. It has also led to increased research into how they can be stopped and/or reversed.

This chapter is concerned with briefly looking at ideas relating to conserving and managing the natural resources of a property in a manner that maintains or enhances the long-term viability of the farm business.

NATIVE VEGETATION AND FARMS

One of the principal reasons for land degradation is the practice of clearing native vegetation from the land, predominantly to provide grazing for cattle and sheep and areas for cropping. Agriculture is an important primary industry that is largely responsible for feeding world populations and therefore represents economic prosperity for many nations. But the very real threat of reduced yields, and such things as reduction in water quality, have provided the impetus for major land rehabilitation initiatives in agricultural areas.

Trees (and associated understorey plantings) are seen as an integral part of a healthy environment, and it is for that reason that tree planting operations (to rehabilitate degraded land as well as prevent further damage) are being actively encouraged by government, industry and community organisations.

Important Reasons for Using Trees

The importance of trees to land management cannot be overstated. Often in the past they have been seen as competing for valuable land space and felled indiscriminately. Over-clearing of trees can lead to salinity problems and many forms of erosion, including land slips and, as a result, impaired water quality. As we have become more familiar with their vital role in ecological processes, retention and selective planting of trees have been widely acknowledged as improving farm viability and ultimately

production. Put simply, the benefits — both financial and environmental — far outweigh the costs of establishing such plants on farms.

HOW TREES CAN HELP THE FARMER

Erosion control

Trees help control or reduce erosion in several ways:

- Their roots bind soil particles together.
- They act as windbreaks, decreasing the wind's ability to dislodge and move soil particles. This reduces wind erosion, minimises damage to crops due to windblown debris and sediment, and reduces build-up of windblown debris on fences, against buildings, etc.
- They act as a physical barrier, trapping moving soil/sand particles.
- They reduce the erosive potential of rainfall by providing a protective cover over the soil below, intercepting rainfall, which then either:
  1) evaporates back into the atmosphere without ever reaching the ground;
  2) drips slowly from the tree foliage; this increases the time available for water to infiltrate the soil, thus reducing the likelihood of erosion through surface runoff;
  3) flows down the branches and trunks of the trees, eventually reaching the ground with far less erosive power (energy) than if it fell directly onto the ground surface.

Benefits for stock

- Windbreaks/shelter belts provide real protection to stock against hot or cold winds, rain, hail and snow, and provide shade on hot days. This can significantly increase yields in stock, as stock use less energy to keep themselves cool on warm days and warm on cool days. Instead, the energy can be utilised in increased production (e.g. more meat and milk are produced).
- Lambing survival rates can be greatly increased in windbreak-protected areas.
- With careful selection of tree and associated understorey species, trees can also become a source of fodder for the animals (e.g. tagasaste, carob, saltbush).

Water management

- Vegetation cover provides a filter that helps clean water as it moves to the ground and across a property.
- Tree cover reduces evaporation through shade and shelter (i.e. reducing drying winds).
- Trees help lower water tables, reducing waterlogging of surface soils and salinity problems, which can significantly reduce yield (i.e. there is loss of productive pasture, and soil structure decline, as is happening in the Murray Irrigation Area of Australia.

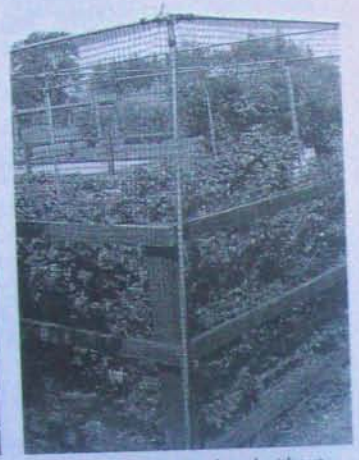
Commercial and environmental advantages

- A commercial plantation could be your own home-grown superannuation. Some eucalypts (e.g. *E. globulus*, blue gum) are being extensively planted to produce pulp for paper production. They can reach harvestable size in as little as 15–25 years. Eucalypts grown for timber may take 70–80 years or more before being ready for harvest, but a plantation of such trees represents increased value of your property, not to mention a handsome legacy for your grandchildren.
- Trees grown on your property can supply timber for fence posts and rails. This can significantly reduce the need for remnant forests to be logged.
- Firewood, for your own use or as a commercial crop. This also reduces the reliance on our remnant forests.
- Honey production is possible from tree blossoms.
- Wildlife habitat (nesting, food, shelter, etc.) is provided by trees.
- Firebreaks, if fire resistant or retardant species are selected. This could reduce the effects of fire on buildings, other structures, even pasture behind the firebreak.
- Aesthetics — trees improve the beauty of a landscape.

For more information on the benefits of incorporating trees into farming activities, see Agroforestry in Chapter 8.

A wooded pasture like this is more sustainable in the long term than one which has been totally cleared of trees. Water loss through evaporation and wind is reduced, soil fertility is healthier where there is a diversity of plant species, and stock is provided with shelter.

Carex elata, suitable for use in reed beds for waste treatment.



Organic berry fruit, produced without chemicals by growing plants totally enclosed in a cage. This may be expensive to set up, but the farmer can charge a premium price for clean organic fruit.

MANAGING LAND AND VEGETATION

Landcare Programs

Landcare programs are aimed at managing our natural resources in a sustainable way. It involves farmers, community-based groups, and even school students liaising with government on effective land management strategies. These activities include such things as:

- tree planting;
- restoration work on waterways and catchment areas;
- conservation of native flora and fauna;
- town beautification works;
- sustainable farming practices;
- control of major pest problems such as rabbits, pigs and foxes;
- control of weeds.

Landcare was initiated in response to a growing realisation that natural resources are finite — that without careful management and the introduction of sustainable environmental and land practices, our natural resources will be slowly destroyed. When applied in Australian conditions, traditional

European farming methods have contributed to numerous problems such as salinity, erosion and loss of native biodiversity.

Excellent information on Landcare including pamphlets, books and much more can be obtained from your local or state Landcare organisation. Other organisations, such as state Departments of Agriculture, Primary Industry, Land Management, Conservation, or local farmers' groups can provide similar or supporting information. If you cannot find anyone in your area, contact:

National Landcare Advisory Committee
GPO Box 858, Canberra, ACT, 2601.
Ph: (02) 6272 4196, Fax: (02) 6272 5618.

OTHER LAND MANAGEMENT GROUPS

National Association or Sustainable Agriculture Australia
PO Box 768 Stirling, SA, 5152
Ph: (08) 8370 8455

National Farmers Federation
N.F.F. House, 14–16 Brisbane Ave, Barton, ACT
Ph: (02) 6273 3855, Fax: (02) 6273 2331
Postal Address: PO Box E10, Queen Victoria Tce, ACT, 2600

Australian Conservation Foundation
340 Gore St, Fitzroy, Vic., 3065
Ph: (03) 9416 1455, Fax: (03) 9416 0767

Greening Australia
GPO Box 9868, Canberra, ACT, 2601
Ph: (02) 6281 8585, Fax: (02) 6281 8590
(State branches can be found listed in the telephone book white pages of each capital city.)

Sharing Equipment

Farm equipment pools involve a group of farmers in a local area sharing certain items of machinery, as a cost saving enterprise and frequently as part of a Landcare program.

There is little point in three neighbouring farmers each purchasing a $15 000 machine which they use only four weeks annually.

The advantages

1. The money saved by each farmer can be better used in farm improvements or to purchase other needed equipment.
2. Increased value for money, as the item is not superseded before it becomes worn out and needs replacing.
3. It costs less to upgrade, because costs are shared.
4. Space is saved because there is less machinery on each farm. (This is particularly significant if the equipment needs to be stored under cover.)

5. Keeping the machine in a shed is more viable because costs are shared, hence life expectancy of the machine can be extended by undercover storage.
6. More frequent use and shared maintenance effort will keep the machine running better (a machine needs to be used, otherwise moving parts will seize up).
7. Costs might be further offset by hiring the equipment to other farmers outside the equipment pool.

The disadvantages

1. More than one farmer might want to use the machine at the same time.
2. An amicable agreement on liability, care and use of the equipment might sometimes be difficult to reach.

Rehabilitation

In cases of severe land degradation the first step towards rehabilitation is identifying the problem and the underlying causes. Often there will be a number of contributing elements and these factors must be neutralised or rectified in order to obtain, as well as possible, a solution to the problem. With any problem that is encountered, there is a wide range of help and advice available directly from government and initiatives such as Landcare. In many cases, funding (e.g. grants) may be available to either individuals or groups (e.g. local Landcare groups) to carry out such rehabilitation works.

HOSTILE ENVIRONMENTS

Often rehabilitation programs are required in areas that are extremely hostile to revegetation (or have become hostile due to poor land use). Establishing trees can be especially difficult, as they are often quite fragile when young. What constitutes a harsh environment? There are numerous factors that could be considered responsible for creating these conditions:

- weather/climate (drought, flood, wind, salt-laden wind, frost, fire);
- water availability (too much or too little) and quality;
- soil (pH, chemical and physical structure, too much or too little nutrient);
- biological damage (by animals, or competition from weeds);
- physical damage (from recreational/agricultural vehicles or persons).

When trying to establish vegetation in a hostile environment, great care needs to be taken in the planning and preparation stages, as well as during the initial establishing stages.

PLANNING

There are a number of commonsense strategies that should be adopted during the planning stage that will enhance the likelihood of success in a rehabilitation project. Firstly, the site needs to be identified and defined — visual and physical reconnaissance needs to be undertaken so that

any potential problems will be anticipated and can therefore be dealt with.

Tests need to be carried out on soil type and composition, research done on weather characteristics, resident and introduced species of flora and fauna, and present and likely future land use activities. It is important to understand the state of the local environment, because it may have changed markedly and have very different factors at work since the degradation occurred. Species of vegetation that once thrived may be severely affected by the current state of local conditions (e.g. rainforest trees will not establish and grow in a large open paddock).

Remember that forests are representative of older ecosystems; they do not develop overnight, but over successive generations of favourable conditions.

It might be necessary to artificially create these favourable conditions before the proposed tree-planting takes place. Weeds may need to be controlled, as well as feral or native animals. Introduced pigs, rabbits, goats and hares can decimate tree plantings, but so too can kangaroos and livestock. Fencing or tree guards can be employed until the trees are of sufficient size to withstand foraging animals. It may be better to grow clumps of trees that can be securely fenced, and large enough to withstand grazing. However, it should be noted that during drought conditions when food is scarce, the ability of an animal to reach the succulent, tender foliage of saplings should not be underestimated. If the animal is easily able to do so, it will prove a waste of your time and money!

Rehabilitation of the land may require that certain primary species such as ground covers, annuals, perennials and shrubs be established before planting trees, or it may need to be done in conjunction with planting them. This approach is necessary with gully erosion problems. The smaller, faster growing species act to hold the soil together in much quicker time than a tree takes to develop, although trees tend to do the same job on a larger scale once they are established. It may also mean that protective measures will need to be used until ground covers or understorey plants become established.

WATER MANAGEMENT

Managing the water resources of a property is becoming increasingly important. A growing population, and a decline in the quality of available water (e.g. increased sediment due to erosion, rising nutrient levels, other chemical impurities, etc.) has meant increased demand on our water supplies. Australia is to a large extent arid to semi-arid, and has generally low fertility levels in its soils. Under these circumstances, managing water, and the nutrients it may contain, to ensure it is used effectively for both production and environmental purposes has become critical to the long-term viability of our agricultural land.

Runoff

Runoff is the term applied to the movement of water (especially rain) when flooding occurs. In the process of moving towards the line of least resistance, the water builds up speed and begins to eat away at surface soil. Runoff can be controlled with a number of strategies:

Cultivating on the contour

This refers to cultivating with the contour of the land rather than across the slope. By doing this, water is slowed down by the ploughed ridges, giving it more time to soak into the ground.

Building contour banks

Again, these should be designed to follow the land contour in order to direct the flow of water into grassed waterways, which can slow its movement down slopes and thus considerably reduce erosion. Contour banks will also direct water to catchment areas such as creeks and dams without the loss of soil.

Strip cropping

The purpose of strip cropping is to spread flowing water. This tends to restrict erosion damage as the water cannot build up in volume, and hence speed, as it is dispersing. The slower movement of water allows more time for it to infiltrate the soil, where it can be utilised by the plants growing there.

Water-saving Measures

The water requirements of your crops and pasture can be minimised in the following ways:

- Choose plant species and varieties that best suit the local climate. For example, replacement of introduced pasture, particularly in areas that are marginal, with native grasses. The overall feed value of the native grasses might be less than the introduced species they have replaced, but this decline in yield can often be more than offset by reduced need for inputs such as fertiliser, cultivation, etc. In addition, well-chosen native grasses are more likely to survive drought conditions, making re-establishment of productive pasture much quicker and a lot cheaper when conditions improve.
- Maintain a well-structured, fertile soil appropriate to the plants selected.
- Irrigate in the cool of the day.
- Use an irrigation system that minimises wastage — for example, micro-irrigation systems (e.g. trickle systems or soaker pipes on long-term crops such as fruit trees and grapes, where possible).
- Use slow, thorough watering. A thorough, deep watering once or twice a week will be more effective than light waterings every day or two.
- Avoid irrigating, where possible, on windy days.
- Reduce excess evaporation. This can be achieved by keeping bare soil

covered, where possible. As well as reducing weed growth, mulches reduce evaporation, as do windbreaks.

HOUSEHOLD WATER

It is possible to use excess water from the house to water farm gardens, in particular water from showers, baths and washing machines. This can be very important in ensuring your garden survives at times of drought. It can be really heartbreaking to see not only your stocks and crops suffer, but also a garden that you may have spent many years developing. In addition, such water could also be used to keep alive propagation or planting stock required for re-establishing crops once a drought has finished. As a last resort, such water might also be used to keep valuable animals (breeding stock) alive.

Use of household water will involve some plumbing to reduce the drudgery of bucketing water out onto the garden or into watering troughs. The simplest method is to undo your drain pipes and let the water from sinks flow into a bucket for smaller amounts, or connect a laundry diversion pipe or a hose to the drainpipes and let the water flow into a holding tank. This water is referred to as 'greywater' and can contain soaps, food scraps, grease and bacteria. Check that this is permitted by the local government authority, particularly in closely populated areas.

Water with cleaning liquids and solvents that are harsh to the skin should be diluted before being used in the garden, and should not be used for animals. Do not use water from the dishwasher. You should be careful to use biodegradable soaps and completely avoid detergents with boron. When added to the soil, such detergents may be toxic to plants.

Use trickle irrigation to apply greywater, as wetting the leaves with it may cause leaf burn. A filter will be necessary to make sure any solid materials or residues in the greywater do not block the pipes and nozzles. Another method is simply to allow the water to run across the ground surface (flood irrigation) by pouring water out of a bucket or allowing it to run out of a hose. Remember to water different areas each time to get even coverage.

Apart from those required for domestic purposes, additional rainwater tanks might be located next to structures around the farm (e.g. shearing sheds, machinery sheds, hay sheds). Rainwater running off the rooves of these structures can be collected and stored for later use, providing good quality water for stock, or perhaps for use in pesticide applications.

Waste Water Treatment (Reed Beds)

A problem increasingly faced by some rural industries (i.e. piggeries, dairies) is the treatment and disposal of liquid wastes. The purification of waste water and effluent using reed beds has been practised for hundreds of years. It can be an effective method of treating waste water, and cheap in the long term. When such waste water is allowed to pass through wetlands planted

with reeds and rushes, the roots of certain plants release oxygen which helps micro-organisms break down and filter out impurities. The method can ultimately produce high-quality water which may be suitable for drinking. The plant biomass that grows in this system can also be harvested occasionally as a source of mulch, or even grown as a harvestable crop (e.g. bamboo in warmer climates, which can be used for furniture or crafts).

Occasionally a naturally occurring reed bed might be utilised by a farmer as a valuable resource for treating waste, rather than a problem area to be drained. It is, however, preferable to develop new areas by constructing and planting channels and beds. Given the current degree of environmental pressure on the few natural wetlands remaining, it would appear that further pressure on or usage of such wetlands is unwise. However, the deliberate building of new, well-designed wetland/reed beds could be a very useful enterprise.

Waste water normally contains a wide range of impurities in the form of solid particles or as dissolved matter. Heavy metals, disease-causing pathogens, detergents and bulk nutrients are often present, sometimes in high concentrations. These materials need to be removed if the water is to pumped back into public waterways, or if it is going to be used for stock watering or domestic applications.

BIOLOGICAL OXYGEN DEMAND

When micro-organisms break down water pollutants, oxygen is used up. This oxygen consumption varies with different materials and is known as the biological oxygen demand (BOD). For example, nutrient-rich wastes such as farm manures or silage effluent have a high BOD. When these pollutants find their way into waterways, the oxygen level in the water becomes seriously depleted as a result of breakdown processes causing parts of the natural flora and fauna of the waterway to die. When the water body is small and the flow rate is slow (e.g. in conditions of low rainfall) this problem can be quite severe. The blue-green species of algae are then able to flourish, poisoning and fouling the water even further.

Limited oxygen supply is a problem that can be overcome by the use of 'flow form' basins, pebble streams, waterfalls, deep rock beds, etc. In this environment of plentiful oxygen, micro-organisms such as bacteria, yeasts and fungi become established and thrive on the surfaces of the pebbles or rocks and consume the soluble polluting matter.

Plants may be used to supply the oxygen necessary for micro-organisms to break down these pollutants. Some plants, mainly reeds and rushes, absorb atmospheric oxygen through their leaves and transfer it down hollow stems to their extensive root systems. The oxygen is then released through fine root hairs into the soil, where it helps build up micro-organism populations and facilitates the breakdown of organic matter. Reed beds work most effectively when a dense layer of rhizomes and root hairs is formed. This may take about three years to fully develop.

WATER FLOW

The flow of water through a reed bed may be either horizontal (across the soil and reeds) or vertical (down through the reeds and soil). In both situations, the reed plants provide oxygen for the micro-organisms. If the degree of pollution is only slight, horizontal-flow reed beds are adequate. A shallow trench or pit about 60 cm (2 ft) deep, lined with plastic sheeting and filled with gravel or porous soil, can be planted with species of *Phragmites* (i.e. common reed) and the waste water allowed to pass through the bed for purification. The process take several days to remove most of the pollutants, including nitrates, phosphates and some disease pathogens. A shallower version, about 15 cm (6 in) deep and planted with *Typha* spp. (bullrushes), has been used in the purification of acidic water from mining operations.

Vertical-flow reed bed systems consist of beds about 60 cm (2 ft) deep, filled with layers of different-sized gravels (larger material to the bottom) with a layer of sand on top. Appropriate reed species are planted into this base. The beds are stepped or terraced, with an outlet pipe at the bottom of one bed draining water into the reeds of the next bed. Generally, the waste water is pumped in flushes and allowed to trickle down gradually before the next volume of water is applied.

A thin layer of sludge gradually builds up on the sand surface, eventually choking the system. The bed is then rested to enable the micro-organisms to break down the excess organic matter. It is therefore necessary to have more than one bed system when using the vertical-flow method — while some are in use, the others are resting.

Solid materials can be fairly easily removed by settlement and filtration techniques. Separate gravel and sand filter beds function well for this purpose.

ON-FARM WASTE WATER TREATMENT PLANTS

While the reed bed method is not really suited to cities or large-scale treatment plants because of the excessive volume of waste produced, reed bed treatment is very suitable for rural areas where on-farm treatment plants can be established. More than 100 reed beds have been built in the United Kingdom, some as part of improved rural sewerage works, others for country houses and hotels, and still others for treating waste water from farms, factories and mines. Reed beds are ideal for treating greywater from homes, although specialised systems are needed for treating toilet wastes. An area of about 5 sq. m (55 sq. ft) per person is generally sufficient for reed beds on a small scale.

Some of the advantages of reed beds over the more common mechanical waste water treatment methods are:

- They are cheaper and easier to install (low-tech).
- They are cheaper to run and maintain.
- They are easier to maintain (low-tech).

- They require less energy to run (gravity does the work).
- They are integrated with the local environment.
- They enhance biodiversity.

Some weeding may be necessary in reed beds, and vertical-flow systems need to be alternately rested. However, the low requirement for expertise for installation and operation means that reed beds can be used by a wide range of people, such as those in less-developed districts or countries.

In a well-planned farm production system, the inclusion of waste water treatment techniques is an important consideration, and reed beds are a very good option. In addition to purifying water and providing mulch materials, the artificial wetlands can be a home for a wide range of aquatic animals (including fish and shellfish) and plants, a water source and habitat for birds and terrestrial animals and a pleasant place to look at or explore for recreation. Planting trees that are tolerant of moist, nutrient-rich conditions (e.g. *Allocasuarina, Casuarina, Melaleuca*) adjacent to a reed bed can further diversify the water treatment site.

SUITABLE AQUATIC PLANT SPECIES

A large range of aquatic plants, operating in different ways, are used in reed beds. Reed and rush species which are used for enriching the soil with oxygen include *Phragmites australis*, *Phragmites communis*, *Schoenoplectus lacustris*, *Scirpus* spp. and *Typha latifolia* (bullrush). These plants are essentially the backbone of a good reed bed system.

Species which are suitable for pathogen removal include *Alisma plantago-aquatica* (water plantain), *Juncus effusus*, *Iris pseudacorus* (yellow flag), *Mentha aquatica* (water mint), *and Schoenoplectus lacustris*. Cyanide compounds, thiocyanates and phenols have been removed using *Juncus* species.

Other plants which may be used in reed bed systems include *Carex* spp., *Glyceria maxima* (reed sweet grass), *Lemna* spp. (duck weeds), *Nymphaea* spp. (water lilies), *Pista* sp. (water lettuce), *Phalaris arundinacea* (reed canary grass) and *Symphytum officinale* (comfrey). Many other species can be incorporated into the system, depending on the locality and prevailing climatic conditions.

NOTE: Care should be taken not to use species that are known weeds, or that might potentially become weeds; for example water hyacinth has been used in reed bed systems but is a noxious weed in Australia. Where possible, choose species that exist naturally in your area (e.g. Typha *and* Phragmites *are common in wetland areas in Australia).*

For more information on reed bed systems, read:

- Gray, K. & Biddlestone, J. 1994. 'Go with the flow'. *The Garden*. July: pp. 302–303.
- Mollison, B. 1988. *Permaculture: A Designer's Manual*. Tagari Publications, Tyalgum, NSW.

- Morrow, R. 1993. *Earth User's Guide to Permaculture*. Kangaroo Press, Kenthurst, NSW.

Waterlogging

Too much water in part of the property is a problem that can affect some farmers, particularly in higher rainfall areas, or areas with high groundwater tables. The problem can be a constant one, occurring all year round, or it may be seasonal. It may be just a low spot that collects all the water from the surrounding area. Whatever the reason, there are ways of turning a boggy or wet area to your advantage.

PROBLEMS WITH WET AREAS

- It is often difficult to get plants to grow. You must choose the right plants.
- Mosquitoes and other annoying insects are encouraged by stagnant and boggy areas.
- The presence of stagnant water can be a health hazard. It can also be very smelly.
- Access is restricted for both stock or for cultivation purposes (e.g: you can sink into muddy areas).
- Stock can develop foot problems (i.e. standing in wet conditions can cause certain diseases).

PROBLEM-SOLVING IDEAS

- Create a dam, or series of dams, to store the excess water. This could be used to water stock, crops, or to create an alternative enterprise such as aquaculture, or recreation activities for a host farm (see Chapter 12).
- Create a wetlands area, using indigenous vegetation as much as possible, to encourage local wildlife.
- Some plants thrive in wet areas, and with the right plants you can still achieve a productive area of crops or pasture.
- You may be able to divert the water elsewhere, where it could be useful (e.g. to irrigate pasture or crops).

CHAPTER 4

Alternative Enterprises

This chapter and the eight following chapters are designed to:

- provide options to consider to provide alternative sources of income from a farm;
- provide guidelines for the selection and establishment of such enterprises.

There is a great deal more information about some than others ... this does not mean that those dealt with in detail are the best options! Also, the list is not exhaustive. Use this and the following chapters as a guide; but remember that this is only a starting point. Once you decide on one (or several) enterprises, you will need to learn a lot more about them before investing too much money or time. This can be done through such means as:

- research (e.g. reading more specialist books, searching the internet, consulting your local Department of Agriculture adviser and other experts).
- doing a course (e.g. seminars, correspondence, agricultural colleges, vocational colleges, etc.)

NEW ENTERPRISES

In recent years, farmers from Australia (and many other countries) have looked increasingly towards growing 'new' (as distinct from traditional) types of crops or animals. There can be a distinct advantage in getting in first with potentially valuable products. At the same time, 'pioneering' can often be a disadvantage in that an infrastructure may not have been developed to deal with the product. For example, Australian farmers have been producing an increasing number of emus and ostriches, but there are few abattoir facilities developed to kill and process the meat, leather, feathers, etc.

Points to Consider

- Getting in first. This can allow you to:
  1. develop a market niche;
  2. develop a reputation, and a level of expertise that you can market to future industry members, for example by providing startup or breeding stock for the next wave of farmers.

- Starting later. It may be hard to break into the market in the face of established producers, but you may be able to bypass mistakes made by the earlier people in the industry.
- High prices are generally obtained for stock/produce at first, particularly if they are in high demand as breeding stock, but once numbers increase then price drops rapidly. You can lose a lot of money buying expensive stock, only to see prices plummet in a short time. Timing your entry into developing industries is crucial.
- You can often get extensive help, advice, support from various government agencies (e.g. agriculture departments) who are keen to develop new industries in conjunction with farmers.
- Some new products require more sophisticated facilities for processing than others, while some can utilise facilities already on hand for other crops or animals. You need to be aware of what processing equipment is needed and ensure you have reliable access to such facilities (or an ability to develop suitable processing facilities) before making a commitment to grow something new or different.
- Markets — are they already established, or will you need to develop market opportunities?
- New industries often have additional tourism potential; for example, uncommon animals often attract paying visitors as objects of interest, adding value to their existing potential for meat, fleece, or milk production.

Which New Enterprise to Choose?

The aim of this segment is to help you in the extremely important task of selecting which new enterprise/s to undertake. The wrong choice can result in expensive outlays for little return, a lot of work to produce a marketable crop or service, poor yields, poor quality product, or even total failure of the enterprise.

LET'S GET STARTED

Step 1

A simple process to get you started is to consider, *on a broad scale*, all the possibilities for potential enterprises. This could be done as a brainstorming session, perhaps with relatives, staff members, and/or fellow farmers. Don't limit yourself at this stage — no idea is too silly. You may want to do a little research to give you a few more ideas. What products or services that you might be interested in are being trialled in Australia, or are being grown overseas successfully but not yet trialled in Australia?

A little research, even a visit overseas, could extend the range of possibilities to consider.

List all the ideas you come up with. To give you a good head start, possible enterprises/activities are suggested later in this chapter.

Step 2
List all the things that you already have, or could readily get hold of, that could be potentially utilised as part of a new enterprise. Once again, don't limit yourself. Items to be listed could include, such things as:

- land — how much, its location (e.g. next to a major highway or near a big town), topography, soils, climate, etc.;
- water — how much, from what sources, cost, quality, reliability, etc.;
- established infrastructure — do you have sheds, buildings, dams, fences, roads, etc. on your property?
- What services are available (mains water, power, telephone, etc.)?
- What equipment do you have, or can readily get access to (e.g. tractors, harvesting equipment, cultivating equipment, sprayers, irrigation equipment, vehicles, etc.)? What enterprises are these resources suited to, or could be readily adapted to?

What skills and knowledge do you have — don't just consider farm production skills, also consider computer skills, marketing skills, cooking skills, handyman skills, business skills, etc.

- Some crops and animals are very difficult to grow; others are easy. Some services are easy to provide, others may be more difficult. If you are inexperienced, it is often best to start with the easy ones, even though profit margins may not be as high as for other products or services.
- What are your personal interests? You will put much more effort into something that really interests you.
- Can you get extra, suitably trained staff easily if required?

Step 3
Limiting factors must be considered. List the things that would limit you from engaging in certain enterprises. Could these limitations be readily overcome? You might, for example, have a water shortage problem, or your property may be well off the beaten track, or your property is subject to heavy frost. (See 'Overcoming Limitations' later in this chapter.)

Step 4
Go through each of the potential enterprises on your first list and cross-check them with your other two lists. Put a tick or an asterisk against those enterprises that you feel you could do, given the list of resources you have or could readily get hold of. Put a cross next to those enterprises where you feel you wouldn't have the necessary resources to carry out that project. Also put a cross against those enterprises where the items from your limitations list would make that undertaking difficult: for example, if you have water shortages, then trying to produce a crop or animal with high water demand (e.g. water chestnuts, aquaculture) is not likely to succeed.

Step 5
Start to carry out some initial research into the items that you have asterisked

or ticked. You may limit this step to those enterprises that particularly interest you, especially if your list of possibilities is still a long one. Don't throw away your original list, though. As conditions change (e.g. finances improve, irrigation channels are supplied to your area) you might later on want to reconsider some of the enterprises you at first rejected.

Step 6
Now consider the end of the line. Are you producing for your own needs, for commercial production, or for both?

A. If producing for your own needs
Your market is assured here. It is difficult to go wrong provided you do the following:

- Ensure that you have or can develop the skills required to produce the goods or service you have selected.
- Ensure that you have the right equipment, materials, etc. to produce the goods or service.
- Make sure that you can grow or produce or deliver each particular product or service cheaper than you might buy it. Even though it may seem ridiculous, it is often possible to buy something, or hire someone to provide a service, for less than it might cost you to grow it or do yourself.

B. If producing a product or service to sell
Your market is rarely assured, and when it is (e.g. contract growing) there are generally disadvantages involved. Choosing which product or service to grow or provide might involve any of these factors:

- Study the demand of alternative products or services under consideration and select high demand ones.
- If you choose a crop or animal, then how suitable is that crop or animal to the soil and climate of your area? Would expensive site modifications need to be made to allow that crop or animal to be grown successfully (e.g. greenhouse installation, windbreaks, soil works)?
- Could you borrow, lease or hire any other equipment you might need on a short-term basis, while you experiment with producing a new crop, animal, service, etc.?
- What is the cost and availability of planting material, breeding stock, specialist equipment? Can you get it, and can you afford it?
- Consider the keeping quality of any products. Those which keep for short periods only are a greater risk than those that keep well.
- Can the products you are considering growing be processed to give them a much longer life?
- Could processing (known as value adding) be used to increase the value of the products you are considering?
- Consider when the product or service will be sold/supplied and the likely changes in demand throughout the year.

- Consider the relationship between cost and return. Some enterprises require large capital outlay before any return can be obtained (e.g. with a walnut orchard, property, labour, etc. can be tied up for as long as 10 years before reasonable crops start to be obtained from the trees).
- Consider the scale on which the product or service is normally grown or delivered commercially. Crops grown on a large scale (e.g. wheat) are subject to economies of scale (i.e.: they need to be grown on a large scale to achieve a reasonable cost efficiency).
- Consider how well established is the particular sector of the industry you are considering, and study what other people growing that crop or providing that service are doing. If everyone grows a particular crop or animal, or decides to provide a particular service because there has recently been a high demand, next year may result in an oversupply of that product or service and very cheap prices.
- Consider the likely transportation and marketing requirements of the products or services.
- Consider the time that particular crops or animals take to mature and the length of production of that particular crop or animal. Some crop-bearing trees, for example, can take four or more years to yield a worthwhile crop but, if well maintained, will keep bearing for decades.
- Consider market presentation and preferences before beginning a venture. Some products or services require a larger capital outlay to package and present at market than others.
- For 'new' or experimental crops or animals, determine what grower support and information is available on their culture (e.g. Dept of Agriculture). Trying crops or animals that are new to your area, or are experimental, can be costly if results are poor; on the other hand, they also have the potential to be very rewarding if results are good. Researching overseas efforts with such (or similar) crops can often provide important information.

WHERE TO GET HELPFUL INFORMATION

There are numerous organisations and agencies that can be of great assistance to anyone considering growing a 'new' crop or animal, or providing a new farm-based service. The Appendix at the end of this book lists the contact details for a wide variety of organisations that may be of interest. In particular, for rural-based industries your local Department of Agriculture (or similar bodies/agencies) is your best start. Further sources of information can be found in Australia through the Rural Book produced by the Federal Government Department of Primary Industries and Energy. This and other useful information can also be accessed on their web site.

Field Days, Agricultural and Trade Shows are other good places to get a wealth of information and assistance if you are starting out in a new profession, or even just commencing to grow something new for your own use.

STATISTICS

Governments regularly collect and publish facts and figures that will tell you what was grown where, and in what amounts. These production figures are valuable in helping you understand the potential of a crop. Collect figures for several years and study the trends (growths and setbacks) in crops you might be considering. You can find contact details for the Australian Bureau of Statistics in your telephone book. Alternatively, the Australian Bureau of Agricultural Resource Economics (ABARE) has numerous publications relating to economic aspects of a wide range of agricultural activities.

Overcoming Limitations

When you do your third list in the process above (Step 3) you identify limitations that would normally restrict the type of enterprise you might be able to carry out/be involved in. Another way to look at such limitations is to start considering them as positive factors, and look at potential enterprises that could benefit from such conditions. Examples of this might be:

- an area of your property that is always wet/boggy, even in summer. Consider creating wetlands, dams or ponds that could be used for aquaculture or recreation, or encouraging wildlife or creating a wetland garden. All of these can be real attractions for farm holiday activities.
- properties with salinity problems. Is there enough saline discharge that it could be used for aquaculture of marine or salt-tolerant species?
- a property with steep hillside areas, perhaps also with rocky outcrops. Can you plant a productive crop of trees (e.g. timber species, fodder crops, jojoba, carobs) that will have additional environmental benefits, such as lowering groundwater levels and reducing erosion? Could you grow other crops that prefer such conditions, like lavender or rosemary, which can also look very attractive when in flower? Is there an ideal spot for a lookout or viewing point, perhaps at the top of a walking trail? Is there a good site for a water slide?
- Is there a water shortage in the area? Could you grow crops with low water requirements, such as succulents (e.g. aloe vera)?
- Do you have carp in your dams or irrigation channels? Could these be harvested (e.g. electro fishing) and processed as fertiliser or stock food?
- Does the property produce large amounts of nutrient-laden waste (e.g. from dairies, piggeries)? Can this waste be converted into fertiliser, or could it be used to generate power (e.g. powered by methane given off by wastes), or a combination of these?
- Can the nutrient-rich water be used to feed aquatic organisms in a dam, that can then be eaten by fish, in an aquaculture situation. Could liquid wastes (e.g. dairy runoff) be run through a wetland or reed bed to purify it, and at the same time fertilise a crop of wetland species (e.g. bamboo) that could be harvested?

- Do you have areas that could be more profitable if hired out, even temporarily, for such things as recreation (e.g. horse-riding activities), for agistment of other people's animals, or car parking (e.g. if located near a popular beach or picnic area, or a large craft market).
- Do you have plenty of old farm machinery and/or tools (e.g. old carts, milk cans, butter churns) cluttering up the property? Don't look at it as rubbish. Could some of this be recycled as ornaments for display at hobby farms, or to properties on the urban rural fringe. Could you do it up and sell it to a farm museum, or a farm tourism operation, or perhaps set up your own operation, particularly if you have old buildings? Can you get more old stuff from neighbours, perhaps offering to clear it away for them? Could you clean it up and paint it, or just sell it as it is?
- Do you have land that is marginal or that you don't use? Could you re-establish indigenous vegetation, perhaps for cut-flower production? Could you develop a site for recreational activities such as 4-wheel driving or motorbike riding, providing permanent features, and managing it to minimise environmental damage? Could you lease the land to someone else? For example, a farm tourism business, no longer requiring as much land to carry out operations as when it was a fully working farm, could lease unneeded land out to operations that would not impact on, or could perhaps enhance, its farm tourism operations (e.g. to a herb farmer or horse-riding operation).

Some of the above suggestions have been dealt with more fully in Chapter 3.

SOME IDEAS FOR NEW ENTERPRISES

The list below may give you some ideas of potential industries you might consider. Some might be tried individually, or you might consider a combination of different enterprises. A few selected ones are considered in a little more detail following this list. Your starting point for information on these and any other rural-based enterprise is through your local Department of Agriculture or equivalent body (see Appendix for contact details).

PLANTS

Asian vegetables

Beverages:
- Tea (green or black)
- Coffee
- Cocoa
- Juices
- Milk substitutes (eg. soy milk)

Bush tucker:
- Quandongs
- Lilli pillis
- Native spinach
- Carobs (fodder or pods as a chocolate substitute)

Cut flowers:
- Natives
- Bulbs
- Exotic flowers

Dates

Essential oils:
- Eucalyptus
- Tea-tree
- Peppermint
- Evening primrose
- Star flower
- Lavender
- Caraway
- Dill

Farm trees for:
- revegetation
- agroforestry
- firewood
- value adding by milling, wood turning, production of craft or furniture

Fibres:
- Hemp
- Sisal
- Jute
- Kenaf

Garlic

Ginseng

Grapes (fresh, juice, dried, wine)

Herbs (broad acre and small scale, fresh and/or processed):
- Aloe vera
- Echinacea
- Evening primrose
- Pyrethrum
- Peppermint
- Lavender
- Rosemary

Hydroponics (cut flowers, strawberries, vegetables, herbs, animal fodder)

Jojoba

Oil seeds (for seed and oil):
- Rape
- Mustard
- Sunflower
- Canola
- Linseed
- Olives

Water chestnuts

ANIMALS

Alpacas and/or llamas (for meat and fibre)

Aquaculture (for meat and/or stocking purposes):
- Yabbies
- Native fish
- Introduced fish (eg. salmon, trout, redfin)

Bees (for honey & crop pollination)

Camels (racing, rides, tourism)

Cattle ('new' varieties):
- Highland cattle
- Bison
- Water buffalo
- Miniature varieties

Deer (velvet, leather, venison)

Earthworms

Goats (for meat, fibre and dairy products):
- Angora
- Boer
- Cashmere
- Dairy

Poultry and game birds:
- Free-range eggs and birds
- Partridges
- Quail
- Pheasant
- Guinea fowl
- Squab
- Turkey
- Ducks

- Ostriches
- Emus

Rabbits (meat and fibre)

Sheep (for dairy products)

FARM TOURISM

Accommodation

Bed and breakfast

Exhibitions and demonstrations:
- 'New' varieties of animals
- Tours
- Animal or wildlife farm
- Open gardens

Farm shops:
- Art/craft gallery
- Produce shop
- Souvenir shop

Fish farms for fishing activities

Food:
- Restaurant
- Tastings
- Farm meals
- Light refreshments

Host farms/activities:
- Horse riding
- Adventure activities (walking, swimming, canoeing, abseiling, climbing)

Value adding (crafts and produce):
- Wine
- Herbs
- Jams
- Dried produce
- Preserves
- Chutneys and sauces
- Pickles
- Mustards
- Clothing (eg. woollen goods)
- Mail order sales

VALUE ADDING

By processing farm produce, partially or fully, before it is sold a farmer can increase the price for that produce. This is an increasingly important way to enhance the profitability of a farm. Typical examples of value-added products include:

- jams, preserves, chutneys and sauces produced from farm-grown fruit and vegetables;
- cheese, yoghurt and butter from cattle, sheep or goat milk;
- leather produced from animal hides — this can be further processed to create leather goods, adding significantly to its value;
- dried fruit or juice (from grapes or other fruit), or fermented juice to produce alcoholic beverages;
- cut flowers dried, pressed or treated in some other way to produce longer-lasting products;
- herb crafts, dried herbs, essential oils, produced from fresh herbs;
- wool/fleece from various animals (e.g. sheep, goats, alpacas), or plant fibre, can be spun and used to make yarn, fabric, clothing, blankets, etc;
- oil extracted from plant or animal products.

Value adding may make you subject to regulations which otherwise might not have applied. This is particularly the case with food products,

where the production, packaging and sale of foodstuffs is governed by health and other regulations.

Value adding can involve many extra costs; it could involve such things as processing equipment, extra water and power, licences and permits, packaging and labelling, as well as storage facilities, so you need to thoroughly investigate what is involved and weigh these considerations against the potential benefits before making any significant investment.

In some instances the value-adding operation might be best tackled as a joint venture or cooperative effort between several farms (e.g. canning fruit, production of fruit juices, etc.). This approach can offer many economies of scale — it might not be economically viable for one farm to set up a processing plant because they would not use the facility enough to achieve a pay back on the investment, but several farms might well profit by sharing the cost of establishing the plant. A cooperative effort can also offer marketing advantages — because there is a greater amount of produce, it can be more practicable to make a significant marketing effort.

In summary, value adding is becoming an increasingly important aspect of Australian agriculture.

CHAPTER 5

Plants I: Coffee, Tea, Wine

COFFEE (*COFFEA* spp.)

Coffea are small trees or large shrubs with reddish fruits that contain two seeds that are roasted to produce commercial coffee. There is considerable potential to grow coffee as a crop in tropical parts of Australia.

Although in the wild coffee grows in shaded situations, yields tend to be greater without shade. However, some commercial growers often use artificial shading on intensive plantings. Shade trees might be interplanted if land is plentiful. Pest and diseases can often present more problems in open plantings.

Coffea spp. will adapt to a wide range of soils but prefer moist, fertile and highly organic soil with lots of mulch and manure, and a pH range of 5.5 to 6.0. Coffee in commercial production has a very high demand for fertiliser. Leaf tissue analysis will keep farmers on track once deficiencies begin to occur.

A very light breeze can provide beneficial ventilation, helping to reduce fungal problems, but strong winds can readily damage the plants and fruit. Some form of wind protection is therefore an advantage.

Coffea spp. prefer frost-free subtropical climates. Most types of coffee grow best in climates with daily maximum temperatures of 18–25°C (64–77°F) (18°C in winter, 25°C in summer). All coffee varieties are killed if exposed to temperatures of 0°C (32°F) for very long (*Coffea canephora* is even more sensitive). Temperatures below 7°C (45°F) and above 33°C (90°F) can slow growth and reduce production.

For most of the year an even rainfall/irrigation is beneficial. To maximise efficient harvesting and good yields, in areas where winter and spring are dry, aim at achieving a water-stressing period for the plants followed by a heavy watering. Mechanical harvesting is aided by a dry winter.

The major pests and diseases of coffee do not occur in Australia at present. The existing problems in this country include green coffee scale, mealy bugs and grasshoppers.

Pruning of plants for the purpose of maintaining good rows for harvesting may reduce the yield in the subsequent year.

VARIETIES

There are around 70 species, but the two main species grown commercially are *Coffea arabica* and *Coffea canephora* (syn. *robusta*). Research has developed many different cultivars and hybrids.

Coffea. arabica is planted at 1000–2500 trees per hectare (400–1000/acre). Some farms go up to 4400 plants/hectare (1760/acre).

Coffea. canephora is planted at 1000–2000 trees per hectare (400–800/ac).

Commercial yields are not expected until the third year after planting. Better yields will be achieved in the fifth year.

HARVESTING

Mechanical harvesting has allowed countries like Australia to compete with producers in countries with low-cost labour forces.

Farmers may select from two different harvesting techniques to produce different grades of quality:

- 'dry' — when fruit are black (over-mature) they are harvested then sent off to be air dried (10–12 per cent moisture content) and hulls removed, which leaves a green bean.
- 'wet' — when fruit is red (ripe) they are harvested, pulped to remove the two halves, then fermented, dried (11 per cent moisture content), skinned, then hulled and polished, leaving a green bean.

The 'wet' method produces the higher grade product. It takes about 6–7 kg (13–15 lb) of ripe cherries/fruit to produce 1 kg (2˜ lb) of green bean coffee. Any unripe beans processed with the other beans will reduce the overall quality of the bean product.

Farmers may elect to sell green beans to processors for blending and roasting, or they may choose to do this themselves.

MARKET

The world coffee trade is estimated at about $A24 billion annually, and is dominated by Brazil, Mexico, Indonesia and Central American countries.

Australia imported 4900 tonnes of green beans in 1996 compared to the 200 tonnes actually produced in the country.

Coffee prices vary greatly around the world from year to year, but are primarily controlled by the yields of Brazil, where about one quarter of total production occurs. Prices for 20 years have fluctuated between $2.50 to $12/kg ($1–$5/lb) for green beans, with the average at $4/kg ($1.80/lb).

TEA (*CAMELLIA SINENSIS*)

Discovered by the Chinese around 2700 BC, tea has been cultivated ever since. It is a very popular beverage in Australia, where it could readily be more widely grown.

Tea is commonly grown at high altitudes close to the equator, but can be grown in other areas. Tea does well in temperate climates if humidity is relatively high. It is grown commercially in areas ranging from Georgia (USA) at latitude 43° north to Argentina at latitude 27° south.

Ideal growing conditions for tea are:

- 70–90 per cent humidity;
- annual rainfall over 1500 mm (60 in);
- average temperature 18–20°C (64–68°F);
- 5 hours sunshine per day;
- permanent shade, wind breaks or spray irrigation can be beneficial;
- a soil pH of 4.5–5.5;
- high soil fertility and lots of organic matter (mulch and manure);
- well-drained soil.

The plants can grow to 15 m (50 ft) tall in the wild, but are generally kept much lower with regular harvesting in cultivation.

Normally, selected clones are propagated by cuttings (seedlings can be used, but may be subject to variation in characteristics).

The product can be either black or green tea, according to whether or not it undergoes fermentation. Black tea is manufactured through a fermentation process.

The most common planting densities are 10 000–15 000 plants per hectare (4050–6075 per acre) at a spacing of 1.2 ∞ 0.6 m (4 ∞ 2 ft).

It is important to eliminate persistent weeds before planting. Initially, young plantings are often protected with mulching and temporary shading (e.g. laying bracken fern leaves over plants, or interplanting with a taller leguminous crop, e.g. beans. Young plants are pruned (top removed) during the formative stages to produce a strong, low stump with a large number of low branches.

Harvesting is periodically performed by hand plucking or mechanically removing a bud and 2–3 leaves — the chemicals which give tea its quality are in the youngest growth, so removal of this small amount of foliage is a balance between getting sufficient yield and maintaining adequate quality. Plucking frequency can vary from 6 to 14 day intervals. The plants grow fast when temperatures are hot and humid; growth is slower when temperatures are cooler.

The plucking table (shape of the plant) should be kept parallel to the ground.

VARIETIES

There are two main varieties:

1. China tea (*sinensis*) has small leaves.
2. Assam tea (*assamica*) has large leaves.

There are also other types (e.g. Cambodian tea, Wilson's tea, hybrids, etc.) but these varieties account for only a small percentage of overall production.

More than 80 per cent of the world's tea production originates in Asia. The majority of tea consumed in Australia is imported, although a small number of growers, producing generally high quality tea, operate in this country.

VITICULTURE

Vitis vinifera, the European grape, probably originated in the Caucasus mountains between the Black Sea and the Caspian Sea and has been cultivated for thousands of years. Many areas of temperate Australia are suitable for grape production, and there is a very strong demand currently for Australian-produced wines. The main deterrents to many potential producers are the high establishment costs (which can be around $A25 000 per hectare ($10 000 per acre)) and that it takes 4–5 years before full scale production is reached. However, a major advantage is that, once established, grapes will produce good crops for many decades if well looked after.

Grapes require a warm temperate climate, with minimum temperatures of –2°C (28°F) while dormant, –1°C (30°F) at bud burst, and –0.5°C (31°F) when in full flower. The root system is deep, and as such can draw water from lower levels of the soil, hence the need for high rainfall or irrigation is only moderate. It does not tolerate wet soils in summer but will accommodate some wetness in winter.

When on a trellis grapes will tolerate wind reasonably well, but not strong gale-force winds. Though sandy soils are preferred, grapes will tolerate most soils provided they are deep and well drained.

What to Plant

Table grapes need ample heat and a good water supply, such as is found in places like Sunraysia, the Murrumbidgee Irrigation Area and the Riverland region. Wine grapes can be grown in a wider range of environments, but generally do not like humid conditions. Although wine grape *quality* often improves the more a vine struggles, this must be balanced against the *quantity* of grapes produced. Wine grape growers, then, must aim to grow the maximum amount of grapes possible without sacrificing the quality of the crop, as a wine's quality is directly related to the quality of the grape.

WINE GRAPES

When selecting what type of grape to grow, the prime concern should be the suitability of the varieties to your locality. Large vineyards can experiment, but small operations need to consider their selection very carefully.

The factors governing the choice of grape variety are set in an exquisite balance of degree days (see later), latitude-temperature index, local climate, soil type and market potential — it is clear that you will need the advice of an expert who is versed in the characteristics of your locality.

Before approaching your expert, obtain details of the highest and lowest temperature for each day in the growing months (October to April in Australia) in your particular area, which will enable the viticulturist to calculate the degree days (heat units) that pertain to your place. This, combined with consideration of the other elements mentioned above, will point to the varieties most suited to your location.

Wine tasting at Domain Chandon winery in the Yarra Valley (Victoria), overlooking the vineyards.

The wine variety chosen should be based, not only on what can be produced, but what will sell the best or, if you intend to produce your own wines, on the type of wines you want to create.

YIELD

The yield per hectare (or acre) should be considered in choosing what to plant. This will obviously affect the economic viability of your operation. As mentioned previously, a high yield may produce lower quality grapes; it may therefore be more beneficial to produce a smaller quantity, saleable at a higher price, than a larger quantity of low quality grapes. Depending on the type of grape and the location, quantity achieved can be as low as 0.8 to as high as 2.4 tonnes per hectare (⅓ to 1 tons per acre).

PURCHASING PLANTS

It is wise to buy stock rather than try to propagate your own. The productivity of your vineyard will depend, perhaps more than anything else, on the quality of the plants you place there. Apart from this, it will take you more than a year to produce what can be bought at a very reasonable price.

You must decide whether to buy rootlings (cuttings) or grafted plants. Obviously grafted plants are better as they will bear fruit sooner, are of reasonable size and are usually grafted onto a disease-resistant rootstock. In a disease-free area grafted plants may not be necessary. Suppliers should also be able to offer you virus-free stock. Check prices and quality with several different suppliers; don't buy from the first nursery you see. Generally, there are vine propagation nurseries to be found in most established vineyard areas. Check in the telephone books for those areas.

Setting Up

LAYOUT

Square or rectangular plots are easiest to manage and most efficient to use. Tractor operation is easier, access by workers is easier, and there is less wasted space. Generally rows are kept on a north–south orientation, to ensure both sides of the vine get equal amounts of sunlight. If there is a prevailing wind it may be best to have rows at right angles to the wind in order to prevent wind tunnelling occurring between the rows.

Vineyards planted on slopes usually have the rows running up and down the slope, in the belief that this allows cold air to move away more quickly on frosty nights, and warm air to drift up the slope in summer. Usually the orientation chosen will be a compromise of all these considerations.

Rows should be spaced with machine harvesting and pruning in mind, regardless of whether you intend to work the block with machines or by hand. This will allow you to keep your options open and will increase the resale value of the land.

SITE PREPARATION

If there is any type of impermeable layer in the subsoil, deep ripping on subsoiling should be done to break this layer. This is best carried out when the soil is relatively dry, towards the end of summer. (If deep ripping is done in wet soil it can do more harm than good.) Deep ploughing (not rotary hoeing) to 40 cm (15 in) or more, should be carried out at this stage.

All perennial weeds should be eradicated prior to planting. Shelter belts may need to be planted on large properties, particularly in wind-prone areas.

PLANTING

Planting should be carried out over winter when the plants are dormant. In frost-prone areas, soil is sometimes mounded up around the vine when it is planted, to protect the emerging buds from frost damage. Once the buds start growing, the soil is pulled away from the plant.

CHAPTER 6

Plants II: Olives, Nuts, Sesame, Mung Beans

Olives (*Olea europea*)

Olives are a major crop worldwide, grown for both the edible fruit and the oil extracted from the fruit. In the mid 1990s about 95 per cent of the world's olive production came from Spain, Italy, Greece, Portugal, France, Turkey, Morocco and Tunisia. There is a strong potential for, and considerable interest in, farming olives in other countries, including Australia.

Olive trees grow best in a Mediterranean-type climate — hot and dry, with short but reasonably cold winters. The cold of winter helps destroy pests which might otherwise build up to proportions that could seriously damage the trees. Some winter chilling is also necessary for fruit initiation.

Trees can take up to five years or more before producing a crop, and 10–20 years to reach full production; but they can keep bearing for as long as 600 years. A tree may grow 6–12 metres (20–40 ft) tall.

Olives need good drainage; sandy loams or sloped slopes are generally suitable. Young trees are shaped so they develop 3–5 main branches above a clean trunk, after which they are pruned only when necessary (e.g. for shape or to remove dead wood, etc.). Organic mulch is useful in colder areas to protect trees from very cold weather, but in wetter areas a stone or gravel mulch is better, to minimise any humidity. Irrigate as necessary to keep soil moist during warmer weather (i.e. when putting on growth). Over winter, water only sparsely, to avoid extreme dryness.

Olive trees make good windbreaks, and can be used to protect other crops growing nearby. This could be a good way to trial different varieties of olives as to their suitability to your climate, soils, etc.

PROPAGATION

Propagation is usually effected by grafting desired cultivars onto seedling or selected rootstock.

Sometimes fruiting can occur every second year (biennial). In such cases fruit or flower thinning may help produce a more even crop each year.

The final product (oil or fruit) can vary considerably — this variation depends upon:

- the variety or cultivar grown;
- climatic conditions;

- soil conditions;
- handling and processing methods:
  - minimising bruising is important;
  - processing must occur within 1–3 days of harvest, depending on weather conditions, otherwise oxidation can affect flavour;
- the stage at which fruit is picked affects flavour, colour and quality of the finished oil.

In colder areas, fruit may need to be harvested earlier to protect it from early frosts (some produce a green colour in the oil only if harvested before maturity, while others produce greenish oil irrespective of when they are harvested). The oil content is normally at its maximum when fruit are fully mature. Developing fruits change from green to violet, then red, and finally black at full maturity.

EXTRACTION METHODS

Cold pressing

This is the traditional method. Olives are washed, then stone mills are used to crush the fruit and produce a pulp. The pulp is spread over synthetic mats which are stacked on top of each other in a hydraulic press. The press is used to extract oil, which is then separated from water using a centrifuge.

Modern extraction

Olives are washed several times then crushed to produce a pulp, using stainless steel blades. The pulp (including water, oil and fruit flesh), is then placed in a stainless steel container at around 30°C (85°F) and oil is extracted using a centrifuge.

NUTS

Australia imports much of its nut requirements. There is considerable scope to produce much or all of these needs in this country.

Nut trees are considered to be a medium- to long-term investment. If grown commercially, most nuts (except peanuts, which crop in six months) take five or more years to bear and up to 15 years to fully mature. In many cases you will need to grow at least two different varieties of your selected nut crop to ensure adequate pollination and hence nut set.

Nut tree plantings can complement other farm operations. Animals can be grazed under many types of nut trees. Some types of animals may damage the bark or eat low-hanging branches, in which case the trunk may need to be protected and the branches pruned to keep them away from the animals' reach. Excessively close planting can significantly decrease pasture production, but appropriate nut tree spacing can provide protection for both stock and pasture species.

The important thing is to select compatible types of animals and trees, and balance the planting and stock densities properly. This type of information is not readily available, so some experimentation may be

Nuts are an excellent crop because of their ability to be stored for a long period without sophisticated or costly treatment.

needed to get it right. However, the long-term advantages could be very significant.

Successful nut growing has much to do with choosing the right variety for your place. Knowing a variety's limitations will help you cope with environmental variations and prevent disappointment after years of hard work nurturing and training trees.

In nearly all cases well-drained, fertile soil is important, and irrigation is desirable for early maturity and bearing. In dry summer climates watering is essential.

Generally speaking, healthy nut trees are not susceptible to many pests and diseases. However, Australia's famous cockatoos and parrots are very partial to ripe nuts.

Nowadays mostly grafted nut trees are used, for vigour and disease resistance. There is generally a range of varieties for each type of nut, covering different qualities of nut (e.g. flavour, size, maturing time) or suitability to different growing conditions.

A young nut tree develops a strong root system if the planting area is kept weed-free. When the root system has been established, a grass and clover cover can be maintained (mown) around and between trees.

In temperate climates, most nuts are harvested in autumn, usually after falling to the ground, although they can be picked from the tree as they ripen. If kept in dry, cool conditions, most nuts will keep for many months.

VALUE ADDING OPPORTUNITIES

Apart from the consumption of nuts in the fresh and roasted state, culinary experts are continually coming up with new and exciting ways to use these

delicacies. Being rich in oils, which concentrate their particular flavours, a small quantity of nuts can transform bland food. They can add subtle flavours to soups, seasonings, purées, pasta, Asian foods, cakes and ice-cream, to name just a few.

What to Grow

The Australian native macadamia nut is well known in this country and around the world. Australian macadamia nut farms, after facing strong competition from Hawaiian nut production, have developed a strong industry. Many of these farms had to unite to form an association that could tackle the international market.

In Australia new interest developed throughout the 1990s in the potential of nuts such as cashews, pecans, pistachio, hazelnuts and coconuts. Many growers are now successfully producing commercial crops of such nuts.

Table 6.1 outlines the growing conditions necessary for successful production of selected nuts in Australia.

LESS COMMON VARIETIES

With an innovative approach to marketing (and perhaps processing), the following nuts may offer Australian farmers an opportunity to develop a new and profitable industry.

***Brazil Nut* (Berholletia excelsa)**

The Brazil nut tree is a native of the South American rainforests and grows to a height of 30–50 m (100–165 ft). The fruit is 12–15 cm (5–6 in) diameter with a woody outer shell and contains 12–24 triangular-shaped nuts inside.

The tree requires an equatorial type climate with a mean annual temperature of 25°C (77°F) and an annual rainfall of 1700–2700 mm (67–105 in), with a short dry season. Most soils are acceptable, although trees grow best on deep soils near watercourses. They do not withstand flooding.

Propagation is by seeds. In Malaysia this crop is planted 12 metres (40 ft) apart in rows. The fruits does not open naturally; they need to be cut to obtain the nuts.

***Beech* (Fagus)**

The most common is the European beech *(Fagus sylvatica)* which is more commonly grown as an ornamental tree than as a nut tree. Seeds are small and tedious to separate from the shell, otherwise they would probably be grown commercially.

***Oak* (Quercus)**

There are over 450 varieties of 'acorn' trees. Many are edible and can be roasted and/or ground and used as a flour. The American Indians collected and stored acorns for food. Generally the white oak types are better than the black oak varieties. More useful species include: *Quercus alba, bicolor, prinoides, stellata* and *macrocarpa*. *Q. robur* acorns have been used in Europe for centuries as a famine food.

Table 6. 1 Quick guide to choosing and growing nut trees

Crop	Tree size & Spacing	Bearing age & yields	Harvest period	Preferred climate/rainfall
Almond	Medium 7 x 7 m (23 x 23 ft)	3–5 yrs 4–12 kg (9–26 lb)	Feb/May	Warm dry summers; 700–900mm (28–35 in)
Cashew	Medium 8 x 8 m (26 x 26 ft)	3–4 yrs 4–6 kg (9–13 lb)	Apr/June	Warm, dry coastal tropical areas
Chestnut	Very large 15 x 15 m (50 x 50 ft)	5–7 yrs 90+ kg (200+) lb)	Apr/May	Mild summers, protected from wind; 1000+ mm (40+ in)
Hazelnut (Filbert)	Small 6 x 6 m (20 x 20 ft)	5–6 yrs 3–5 kg (6.5–11 lb)	March	Cool to mild year round best in coastal regions
Macadamia	Large 10 x 10 m (33 x 33 ft)	5–7 yrs 18–20 kg (40–44 lb)	Mar/June	Sub–tropical, frost-free; 1600+ mm (40+ in)
Pecan	Large 8 x 8 m (26 x 26 ft)	7–10 yrs 20–30 kg (44–66 lb)	May/June	Long frost-free growing season with warm days and nights; 1000+ mm (40+ in)
Pistachio	Small 10 x 8 m (33 x 26 ft)	5 years up to 30 kg (66 lb)	March	Long, hot, dry summers cold winters
Walnut	Large 16 x 16 m (53 x 53 ft)	10 years 25–50 kg (55–110 lb)	March	Limited by spring frosts and extreme heat 1400 mm (55 in)

– ***Sunflower*** **(Balsamorhiza sagitta),** ***Safflower*** **(Carthamus tinctorius)**
The common sunflower is normally grown as a garden flower or as an oil crop, but the seed can also be roasted and eaten as a nut. Sunflowers are adaptable to a wide variety of soils and growing conditions. The safflower can be treated similarly.

– ***Pili nut*** **(Canarium *sp.*)**
A native of the Philippines, this is one of the most important edible nuts in the world. More than 75 different types grow throughout India, South East Asia, Australia and the Pacific. They can produce up to 30 kg (65 lb) of nuts per tree per year. *Canarium ovatum* grows to 20 metres (65 ft) and is perhaps the most common species grown in the Philippines. Oil from other species is used for cooking (though the oil can turn poisonous if not fresh).

A nut harvester that sweeps up nuts which have fallen to the ground. Many crops are now harvested mechanically, reducing labour costs significantly.

Cola nut **(Cola *sp.*)**
After the oil palm, this is the most important nut crop in Africa. The nuts are in worldwide demand for chewing; they are also the source of cola flavouring.

Cocoa **(Theobroma *sp.*)**
This native of tropical American is the source of chocolate and is grown commercially mainly in Africa and the Americas. Trees are grown as seedlings, cuttings or budded and grafted, and may be raised under the protection of taller rainforest trees or as an open crop. Pest and disease problems overseas in 1998 seriously reduced production and there is considerable interest overseas in finding new areas to boost production. Parts of tropical Australia have high potential.

Hausa groundnut **(Kerstingiella geocarpa)**
Cultivated in tropical Africa and grown similarly to peanuts.

Wattle seed **(Acacia *sp.*)**
Certain varieties of native acacias may offer potential for eating. For example, *Acacia longifolia* seed was roasted and eaten by Aboriginal people in Tasmania, and the Aborigines of South Australia eat *Acacia aneura.*

The seeds of *Castanospermum australe* were eaten by Aboriginal people in Queensland after careful preparation. (Stand in water for ten days, then dry, roast and pound into a fine flour. Mix the flour with water and bake.) People eating them without proper preparation have been hospitalised.

OTHER EDIBLE NUTS

Some other plants which can provide edible nuts are: *Araucaria bidwilli* (bunya pine), *Juglans cinerea* (butternut), *Pinus coulteri* (coulter pine), *Pinus pinea* (umbrella pine), *Ginkgo biloba* (maidenhair tree), *Fagus grandiflora* (American beech), *Gevuina avellano* (Chilean nut).

SESAME SEED (*SESAMUM INDICUM*)

Sesame seed can be used for oil extraction or for blending into paste, cakes, flour and confectionery. Traditionally a staple ingredient in Asian foods, it is now becoming more widely accepted as a basic culinary ingredient throughout the world. A more recent use of sesame oil is in massage and as a vehicle for essential oils.

In mechanised countries like Australia much more research is required into the potential that mechanisation (cultural and harvesting) can have in the production of sesame seeds in order to make the enterprise financially viable. One advantage is that oil-pressing facilities are already available in many parts of Australia.

CULTURAL REQUIREMENTS

This crop requires well-drained soils that are neither very acidic nor saline. It can be grown from the tropics to the warm temperate districts, but prefers summer growing. Cultivation of this crop should be timed so that flowering will take place when the full heat of summer has passed, as temperatures above 40°C (100°F) during flowering may reduce capsule and seed development.

Seed sowing is recommended at 3.3 kg/ha (3 lb/ac) into moist soil at a depth of 2.5 cm (1 in). In cooler areas of its preferred cultivation range a slightly higher rate is recommended.

Fertiliser rates may vary, depending on existing soil fertility levels. An application of around 60 kg/ha (52 lb/ac) of nitrogen is considered adequate. Soils deficient in a range of micronutrients may need trace element applications.

Irrigation is usually not required except in dry spells. Sesame is known to survive with 600–1000 mm (24–40 in) annual rainfall. Critical times of moisture requirements are at post seed establishment stage, and between first flower and completion of flowering. Stop any irrigation when lower capsules begin to turn yellow.

Problems that the crop may experience include hail, strong winds, frost and waterlogging. Pests include sesame leaf webber, caterpillars and green vegetable bugs.

HARVESTING

Seed should be harvested when they have achieved 6 per cent moisture content. The guide for farmers is to commence harvesting when at least 70 per cent of capsules have changed colour to light green or yellow.

Mechanical harvesting can be achieved with a reel harvester and an extended table to maximise knife-to-auger distance.

Seed vigour (germination ability) may be reduced with the presence of impurities (e.g. leaf debris, chaff) and by damage to the surface of the seed (e.g. bruising). These two factors may also increase disease and result in tainted stock.

MUNG BEANS (*VIGNA RADIATA*)

Mung bean is a short-term, warm-season crop that can be grown in most warm districts. With a crop life of 75–90 days, it is frequently used as a filler crop between rotations of other crops, with the benefit that because it is a legume it will not require additional nitrogen. It is grown for its highly nutritious seeds, its edible green pods, and for its young sprouts.

The preferred temperature for successful growth is 27–30°C (84–86°F), although it will tolerate temperatures as low as 15°C (60°F), and is usually grown as a summer crop.

CULTURAL REQUIREMENTS

Loam soil is preferred, with a pH range of 5.5–7.5. Mung beans don't like saline or heavy clay soils.

Sow seeds into moist soil at a rate of 200–350 thousand plants/ha (80–140 000/ac) for dryland cropping and 400 000 plants/ha (160 000/ac) under irrigation. Row spacing will vary depending upon the farming practices used.

Fertilisers are not normally applied, although the use of symbiotic Rhizobium inoculum is advised. Leaf tissue analysis carried out periodically throughout the season will identify any deficiencies, and these will need immediate attention. Zinc deficiency is common with mung beans.

Irrigation is usually not an important factor for such a short-lived crop, but moisture is essential during the stages of flowering and early pod fill.

Major pests of this crop include green mirids, thrips, caterpillars, bugs and beetles, and a range of diseases can affect the vigour of the crop and the quality of the harvested seed. Where appropriate, chemicals can be used to control pests and diseases. Good hygiene (e.g. clean farm and harvesting machines, removal of infected plants) and good cultural practices (e.g. crop rotation and monitoring crop health) can also reduce use of chemicals.

HARVESTING

Harvesting is best carried out when approximately 95 per cent of pods are mature and dry. Preferred seed moisture at harvesting is 14 per cent–16 per cent, which will reduce the incidence of seed splitting and damage.

CHAPTER 7

Plants III: Flowers and Herbs

CUT FLOWERS AND FOLIAGE

If you are to make a profit from cut flowers or foliage, the critical considerations are what to grow, how to produce quality blooms, and marketing. Once you've got it right, cut flowers and/or foliage can be a very profitable mainstream crop or an equally valuable 'sideline' cash crop.

Many common cut flowers (e.g. bulbs, perennials and annuals) are quick cash crops, which require a great deal of attention but can produce a return within 2–6 months of planting. Plants in this category, such as gladioli, carnations and chrysanthemums, might be grown in paddocks; some (e.g. carnations) can be grown as a hydroponic crop.

Other cut flowers and foliage plants are woody, and can take several years before they are producing good crops (e.g. thryptomene, proteas, banksias, dryandras, roses, Geraldton wax). While many cut flower farms devote paddocks solely to such crops, there is also potential for them to be integrated with other enterprises. For example, when the principal crop is not in production (e.g. dormant bulbs) a farmer could utilise the land by grazing cattle or other animals to make use of any pasture species present. Consider:

- roses grown at the ends of rows of fruit trees or vines;
- proteas or banksias grown as a windbreak in a fenced-off strip between two paddocks;
- natives growing wild in remnant vegetation, or deliberately revegetated and allowed to grow with minimal attention until harvest time.

These flowers can be picked and sold in a farm shop, or sold as a 'bonus' cash crop to a local florist or, if production is large enough, to a wholesaler.

Mainstream cut flower production can require long hours (often more hours than many other horticultural crops) and needs precise cultural procedures. Competition is strong both domestically and internationally, with emphasis given to top quality blooms that have uniformity and are free from blemishes. New colours and varieties in many cases can offer an advantage over product from other growers.

Farmers interested in further investigating this area for potential diversification can contact a variety of associations and organisations (e.g. agricultural departments, cut flower growers' groups). See Appendix for more detailed information.

Protea nerifolia. Proteas are excellent, hardy plants for mild temperate climates as both a windbreak and a cut flower crop.

Some of the popular flower or foliage crops grown are:

- bulbs: daffodils, jonquils, etc;
- tropical plants: heliconias, gingers, cordylines, etc;
- natives: banksias, wildflowers, kangaroo paws, gum leaves, etc;
- other: lavender, asters, gerberas, roses, carnations, etc.

HERBS

The boom in the industries of natural health and tourism has resulted in an increased demand for locally produced herbs.

Herbs can be supplied as either fresh produce for culinary, medical or essential oil extraction, or as dried matter for culinary and craft uses.

Essential Oils

Some possibilities are listed below, followed by more information on selected herbs that might be suitable for your locality.

Benzoin *Styrax* sp.
Bergamot *Monarda didyma*
Cedarwood *Cedrus atlantica*
Chamomile, Roman *Anthemis nobilis*
Chamomile, German *Matricaria chamomilla*
Chamomile, Moroccan *Ormenis mixta*
Clary sage *Salvia sclarea*
Eucalyptus *Eucalyptus globulus* and other species
Geranium *Pelargonium graveolens*
Juniper *Juniperus communis*

Lemon *Citrus limon*
Lavender *Lavandula angustifolia*
Sweet marjoram *Origanum majorana*
Orange, bitter *Citrus aurantium* var. *amara*
Orange, sweet *Citrus aurantium* var. *sinesis*
Peppermint *Mentha piperita*
Rose Otto *Rosa centifolia*
Rosemary *Rosmarinus officinalis*
Sandalwood *Santalum album*
Tea-tree *Melaleuca alternifolia*
Sweet thyme *Thymus vulgaris*
Ylang ylang *Cananga odorata*

TEA-TREE OIL

Traditional harvesting was carried out by hand. Cutters walked along existing established trees and carefully placed leaves and branches into carry bags to prevent bursting the oil glands. These bags were then carried to the distillation plant. More modern plantations generally go for regimental planting arrangements which permit easy mechanical harvesting. These machines drive 'over' the rows of plants and remove a predetermined section of branches that protrude outward. This is collected, then taken to the distillation plant.

Some farms have sown seeds on a broadacre format or in rows, so that when plants have reached a predetermined height, the whole plantation can be harvested. Next season the entire 'crop' is replanted by seed. For commercial growers, the decision on optimum harvest time is somewhat complicated. They must consider not only the total biomass and amount of oil present in the leaf at the time, and the amount of material that can be processed at any one time, but also the speed with which the tree will regrow in their locality.

The percentage of oil in fresh tea-tree material varies significantly in natural cultivars from 0.4 per cent to 1.18 per cent, and selected cultivars have shown a range from 1.2 per cent to as high as 1.6 per cent of leaf and stem. Poorly designed distillation plants can cause high losses. Some operators have experienced up to 50 per cent oil loss.

LAVENDER

The essential oil is contained principally in microscopic glands in the calyx and, to some degree, in the lip of the corolla of the flower. Traditional hand harvesting, though labour intensive, could ensure uniformity of plant material to be distilled. Nowadays, modern mechanical harvesting tends to produce a variable product for distillation (i.e. it includes flowers, leaves and small stems).

As soon as possible after harvesting, the plant material should be taken to the distillation factory for immediate processing. Lavender oil has a raw odour immediately after harvesting and is best left to mature to develop

optimum aroma. It can be used four months after distilling, but is best if left for a few years.

High-yielding (but low camphor content) *Lavandula angustifolia* cultivars (English lavender) are most commonly grown for oil production.

Methods of Extracting Essential Oils

The main techniques used for extracting essential oils include:

- hydro distillation;
- steam distillation;
- solvent extraction;
- head space analysis;
- liquid CO_2 extraction.

A scientific comparison of these techniques can be found in the following reference: Charles, DJ and Simon, JE, 1990. 'Comparison of extraction methods for the rapid determination of essential oil content and composition of basil'. *J Amer. Soc. Hort. Sci.* 115 (3): 458–462.

Producing Essential Oils

A means of adding value to herbs is to extract the essential oil from the plant material. Much of the flavour and fragrance of herbs is due to their aromatic compounds and when these are extracted by distillation, the resulting product is a volatile oil-like material. Distillation techniques have been recorded from as long ago as 3000 BC. Other methods for extracting herbal essences are enfleurage, maceration and pressing; however for most herbs distillation is the preferred process of extraction.

The yield of essential oil is usually very low in relation to the amount of plant material used. Depending on the quality of the herb and the distillation method used, yields of between 0.005 per cent and 5 per cent may be obtained. Different plants contain their aromatic compounds in different parts. Often the leaves and flowering tops are distilled, e.g. lavender and sage, but fruits, seeds, wood, leaf and stem, roots and bark are all used to obtain essential oil, depending on the plant.

The two most common distillation techniques used to extract essential oils are:

Water distillation

The herb material is placed with water in a closed vessel (usually made of glass or metal) and heated rapidly. As the water boils and becomes steam the aromatic compounds in the herb are released and turned into a vapour. The two vapours mix as they rise, then enter a condensation chamber where they are rapidly cooled. Cooling cause the vapours to become liquid again, with water reforming and essential oil forming on top of the water. The two parts are now separate; the water can be drained off and the essential oil collected.

Steam distillation

This method is similar to water distillation, but the herb is placed on a mesh surface in the closed vessel and steam is pumped into the vessel. The steam 'boils' the herb very quickly and draws of the vaporised oil. Again, the two vapours are rapidly cooled, separated and the essential oil collected. Modern essential oil producers may perform this process under a partial vacuum. This reduces the boiling point of the steam, allowing a 'cooler' distillation which does less harm to the more fragile fragrance components.

In water distillation, interaction of the essential oil with water can cause an acid reaction, altering the quality of the oil. Steam distillation creates less interaction with water, and is preferable for this reason. The greater control of heat in steam distillation is also advantageous and it is therefore the method normally used commercially. For many people, however, the equipment used to produce steam may not be available or accessible.

The distillation is affected by temperature, the amount of pressure within the chamber, the amount of time needed for the process, the oils present in the plant and the amount of plant material required. These many variables are part of the reason for the wide range of prices for essential oils.

OTHER METHODS

Maceration

Flowers, leaves or fruit material are placed in steeped oil at room temperature (although some plant materials require hot oil at 60–70°C or 140–158°F). The heated oil releases the essential oils. Plant material needs to be in full contact with the heated oil throughout the process and immersed no longer than five minutes at a time. Common oils used in this technique include olive, apricot, almond or avocado.

Rose petals are extracted by cool temperature maceration. Commercially, the petals are removed at the end of 48 hours and the oil is recharged with fresh petals. It is advised no to blend petal colours in the same oil maceration.

Enfleurage

This technique involves transferring the volatile oil to a thin layer of carrier grease (usually clarified lard or mutton fat for traditional techniques) at room temperature. Glass is smeared with a thin layer of the grease, on which the petals are placed. Another greased sheet of glass is placed on top of these petals and this is repeated up to about five layers. It is important that not too many layers be used, as crushing the petals is to be avoided — the petals are required to release the essential oils freely, not be pressured to release unwanted oils. Petals are replaced each day for up to a week for maximum effect. The result is 'pomade', which is used for further extraction by alcohol.

Enfleurage is commonly used for flowers which have unstable essential oils, but the flowers must be able to retain their fragrance for 12–24 hours after cutting in order for this method to succeed. Understandably, this is a very expensive technique with high labour costs. Flowers extracted this way include daphne, jonquils, tuberoses, orange blossom, freesias and carnations. The final product, called 'Floral Absolute', is a concentrated mixture of essential oils and is very expensive.

Expression

In this technique, oil is mechanically released from ruptured oil glands. Plant material is either crushed or pressed to release fragrant essential oils, which are then collected (these days by centrifuges). All the citrus-related oils can be extracted by this method.

Farming Medicinal Herbs

Similar practices to those used for vegetable production can be employed for essential oil production of many herbs, particularly the smaller (non-tree) types. Individual herb cultural requirements need to be identified, then met. This may refer to spacing of plants, site slope preferences, correct species selection for location, nutrient demands, pest and disease practices, harvesting techniques, etc.

HARVESTING MATERIAL FOR MEDICINAL USE

Leaves, flowers, roots, bark, bulbs, etc. are commonly used in botanical drugs. To get the best results from such herbs they must be harvested and handled properly and, most important of all, collected at precisely the correct time of year. The demand for pure, clean, properly handled material is high, both in Australia and throughout many other parts of the world.

Leaves should always be collected mid-morning on clear days, after the dew. For most medicines, collect when the plant is starting to flower. Leaves of biennial plants are best collected in the second year of growth. To dry, spread out on a clean, dry surface and stir occasionally until thoroughly dry. Remove stems from leaves and only keep leaves that have retained their natural colour. Leaves can turn black due to dampness — leaves so affected should be discarded.

Flowers should be collected immediately after they open. Dry in the same way as for leaves and only retain flowers that keep their natural colour.

Bulbs should be collected immediately after the leaves of the plant die (usually autumn). Remove the outer scales of the bulb, slice it, then dry it using artificial heat, but not over 38°C (100°F).

Bark should be collected in autumn or spring. It is normally the inner bark that is required (remove the outer bark first). Most barks should be dried in sunlight.

Seeds should be gathered on ripening. Only larger, fully developed seeds are useful.

Cultivation of Herbs

Some herbs can be damaged by extreme conditions such as heat/sun in summer and cold in winter. Most, however, are fairly hardy. Herbs which

might cause some problems in extreme cold or severe frosts include chamomile *(Anthemis nobilis)*, tarragon *(Artemisia dracunculus)*,lavender *(Lavandula officinalis)* (some varieties are a problem, others not), marjoram *(Origanum majoram)*,pennyroyal mint *(Mentha pulegium)*, parsley *(Petroselinium crispum)*, rosemary *(Rosmarinus officinalis)*, sage *(Salvia officinalis)*, clary sage *(Salvia sclarea)* and thyme *(Thymus vulgaris)*.

Herbs that are extremely hardy to cold include garlic *(Allium sativum)*, camphor plant *(Chrysanthemum balsamita)*, echinacea *(Echinacea angustifolia* and *E. purpura)*, hyssop *(Hyssopus officinalis)*, lemon balm *(Melissa officinalis)*, field mint *(Mentha arvensis)*, water mint *(Mentha aquatica* var. *crispa)*, ginger mint *(Mentha gentilis)*, peppermint *(Mentha ∞ piperita)*, apple mint *(Mentha suaveolens)*, spearmint *(Mentha spicata)*, rue *(Ruta graveolens)*, tansy *(Tanacetum vulgare)* and wild thyme *(Thymus serpyllum)*.

BROADACRE CULTIVATION

Young herb plants often need protection when first planted. Immediately after planting, water in (ensuring the root zone is thoroughly wet) and if possible sprinkle a light organic mulch (e.g. compost) around the base to help minimise water loss from the soil. Watering should be frequent and light (perhaps twice daily) until plants begin to grow.

NOTE: Planting out seedlings into the open ground is best done in the late afternoon. Never plant in the middle of a hot day.

Soil conditions of many herbs in their native regions are commonly harsh ... and to some extent the same conditions need to be reproduced by the farmer (certainly once the young plants have taken hold). The aromatic oils in the foliage generally are stronger if the herbs are grown in full sun and in soil that is on the dry side (though there are exceptions).

Table 7.1. Traditional plant row spacings

Herb	Between plants in row		Between rows	
	cm	inches	cm	inches
Celeriac	10–15	4–6	30–90	12–36
Chervil	15–25	6–10	30–45	12–18
Chicory	10–25	4–10	45–60	18–24
Chives	30–45	12–18	60–90	24–36
Dandelion	7–15	3–6	35–60	14–24
Fennel	10–30	4–12	60–105	24–42
Garlic	3–7	1–3	30–60	12–24
Horseradish	30–45	12–18	75–90	30–36
Onions	3–10	1–4	40–60	16–24
Parsley	10–30	4–12	30–90	12–36
Peppers	30–60	12–24	45–90	18–36
Shallots	10–20	4–8	90–120	36–48
Sorrel	1–2	0.5–1	30–45	12–18

HARVESTING OF SELECTED HERBS

Basil: Cut stems close to ground about time of flowering, then treat like mint. Regrowth will provide one or two additional crops in a season.

Caraway: Seed is harvested in early autumn as it changes colour before it reaches full maturity.

Chervil: Fresh leaves can be harvested and used like parsley. Seeds can also be used for culinary purposes (e.g. flavouring vinegar).

Dill: Foliage is usually used fresh or simply cut and dried. Seed is harvested when heads begin to brown.

Echinacea: Roots and foliage are harvested, although roots are regarded as more potent. The product is then dried and sold to processors.

Fennel: Foliage is simply cut, dried, then crumbled. Seed is harvested like dill.

Fenugreek: Fruits are picked as soon as ripe, before seed pods shatter. Seeds are shelled or threshed from pods, then dried using artificial heat.

Lemon verbena: Leaves are picked individually and dried.

Lovage: Leaves are picked while young, thin and tender, then dried. Roots are dug in late autumn of the second year, washed, sliced then dried at about 52°C (125°F). Seeds are handled similar to caraway.

Mint: Shoots are cut on a dry day, just before flowering, and air dried in the shade. Leaves are stripped after drying and stems discarded.

Parsley: Foliage is handled like mint. Seed heads are harvested on maturity and laid on dry surface, dried, then beaten or thrashed to obtain seed. Roots are occasionally dug (autumn of second year) and dried.

Rue: Used mainly fresh, but may be dried.

Sage: Tender herbaceous parts can be cut and handled like mint. Only one cut should be done in the first year, but two or three each year can be done after that. Plants become increasingly woody over the years, and are usually replaced after 5–6 years.

Summer savoury: Cut at ground level when flowering starts, and treat like mint.

Sweet Marjoram: Normally used fresh, but can be fried.

Tansy: Cut in full bloom. Air-dry leaves and flowers in the shade. Discard stems after drying.

Thyme: Cut when flowering and air dry. Flowers and leaves can be powdered or chopped; discard coarse stems. Two or three harvests in a season can normally be made.

Winter savoury: Cutting stimulates growth; normally cut twice or more each year.

Post-harvest Handling of Herbs

There has been a considerable rise in the availability to the general public of fresh and packaged herbs. A number of factors need to be considered to optimise post-harvest handling to extend shelf life and, although much research has been done for fruit and vegetables, little has been done for

Table 7.2. Expected yields of selected herbs

Herb	Estimated yield* Tonnes per haectare	Tons per acre
Chamomile (flowers)	1.8	0.8
Comfrey (leaves)	11.2	5.0
Comfrey (roots)	1.8	0.8
Dandelion (roots)	3.4	1.5
Dill (leaves)	3.4	1.5
Fennel (seeds)	2.2	1.0
Garlic (bulbs)	1.6	0.7
Lemon balm (leaves)	6.7	3.0
Marjoram (leaves)	4.5	2.0
Mint (Peppermint–leaves)	1.8	0.8
Mint (Spearmint–leaves)	2.7	1.2
Mint (Apple–leaves)	6.3	2.8
Mint (Winter–leaves)	6.7	3.0
Oregano (leaves)	4.5	2.0
Parsley (leaves)	3.4	1.5
Raspberry (leaves)	4.5	2.0
Rosemary (leaves)	2.2	1.0
Sage (leaves)	3.4	0.5
Savory (leaves)	3.4	1.5
Strawberry (leaves)	2.2	1.0
Tarragon (leaves)	3.1	1.4
Thyme (leaves)	2.2	1.0

*Yields per acre are estimated figures based on information from USA Dept of Agriculture and a variety of opinions, magazine articles and books from both Australia and abroad.

herbs. The following information comes from research specific to herbs (basil, coriander, mint, rosemary, thyme, small- and large-leafed oregano, parsley, sage, marjoram and summer savory) and other leafy vegetables.

Changes in texture, taste and aroma of freshly harvested herbs can all be attributed to natural breakdown in cellular tissue. However, this same process also allows access for micro-organisms. The selection of the appropriate method of post-harvest preservation depends upon the commodity, intended use of the material, and qualities that need to be modified. For fresh herbs, marketability is determined by turgor, texture, colour, oil concentration and aromatic compounds.

HARVESTING AND HANDLING

Plants grown under optimum environmental and cultural conditions, and harvested at the correct stage, will have the best qualities during and after storage. Those that are stressed or damaged during growth or harvest will deteriorate more quickly. The stage of plant growth at which to harvest for

best quality is known as the maturity index. This is related to the concentration of chemical components and the use of the herb. With herbs such as lavender, rosemary and sage, it is the aromatics, tannins, and other volatile essential oils that give the plant odour, flavour or medicinal properties. These usually become most concentrated prior to or at flowering. Culinary herbs may be harvested at almost any time of the growing season. Early morning harvesting is recommended to minimise loss of important volatile oils and to ensure that the herbs are cool for storage.

FRESH PRESERVATION

Temperature and relative humidity are the two most influential factors in storing fresh herbs. A 10°C (50°F) drop in temperature will slow biological reactions such as respiration by 50 per cent in detached plant parts. Growth of micro-organisms is also slowed down by cold temperatures. Refrigeration at 1–5°C (34–41°F) is appropriate for most herbs except those with cold-sensitive foliage.

A high relative humidity in the storage bay will reduce the rate of transpiration. By stopping this water loss, the plants will maintain turgidity and quality through storage life. A relative humidity of 90–95 per cent will slow water loss enough to prevent desiccation. Higher humidity may result in condensation and lead to spread of organisms.

Altering oxygen, carbon dioxide and ethylene can drastically affect life and quality of plant material. Low oxygen levels slow respiration and inhibit production of ethylene. High levels of ethylene stimulate breakdown of cell walls, loss of pigment (chlorophyll), softening of tissues and leaf drop. High levels of carbon dioxide inhibit ethylene activity and growth of some organisms.

MODIFIED ATMOSPHERE PACKAGING (MAP)

Modified atmosphere packaging plastics are polymeric films with tiny 'pores' that allow for differential transport of gases through the film, depending upon the mass and shape of the gas molecule. These MAP films are primarily to impede water loss and provide a specific low oxygen/high carbon dioxide in-package atmosphere. Various MAP levels are designed, though primarily for fruit and vegetables. For most plants, respiration is minimised when oxygen is 1–4 per cent. Not only should the individual fruit or vegetable need to be considered in regard to gaseous composition, but also the surrounding produce. Plants together in a MAP can modify the gas environment within.

CHAPTER 8

Plants IV: Plant Fibres, Agroforestry

PLANT FIBRE CROPS

Broadacre fibre crops have great potential in Australia. Such crops are grown for the production of extractable cellulose fibres for use in textiles, ropes, threads, twine and paper. Because they are quick-growing and renewable, they provide an excellent alternative to the logging of diminishing forests for paper pulp production. Increased use of locally grown plant fibres could considerably reduce Australia's imports of paper and pulp material, which in 1994–95 totalled $1.5 billion.

Increasing demand for paper, and the reduction in useable wood material suitable for pulping, has created a need to develop non-wood pulp. Asian countries have long recognised the importance of non-wood pulp and many plan to increase production in order to meet the ever-increasing demand.

Table 8.1 (page 82) briefly summarises the growing conditions of fibre crops with commercial potential in Australia.

Other plant crops used for fibre include wheat, sorghum, rice, sugarcane, linseed, abaca *(Musa textilis)* and jute *(Corchorus* spp.*)*. Due to expanding production in overseas countries and a high labour requirement, there is probably little potential for jute and abaca in Australia.

Bast fibre comes from the bark component of the stem of jute, kenaf, rosella, sunn hemp, industrial hemp, ramie and flax. Bast fibre is considered to have the best potential for Australian production, with the option to export raw material overseas for processing. Once production is large enough to support it, a pulp processing facility could be built in Australia.

Getting it to Market

PRODUCTION

Plant variety and temperature may influence the exact flowering time, but fibre crops need to be harvested before flowering commences. In the semi-arid tropics and subtropics fibre crops tend to be best grown during summer, when they will grow quickly, but in temperate districts spring and summer production is recommended.

Kenaf, rosella and **ramie** are very adaptable to soil conditions. Sunn hemp prefers well-drained soils, either sandy or loamy alluvial.

Hemp is illegal in Australia due to the presence of hallucinogenic tetrahydrocannabinol (THC), even though it is present at only 0.35 per cent in industrial hemp. All Australian states at present allow restricted growing of low-THC seed for experimental evaluation. As our sources of woodchips diminish, a hemp fibre industry may develop in Australia if and when restrictions are relaxed.

Farmers who remain aware of these developments will be best placed to take advantage of any opportunities that develop. Hemp needs a well-drained clay loam or silt loam soil with neutral or slightly alkaline pH. It is sensitive to drought.

Flax prefers abundant moisture during the growing season, which commences in spring. Soil needs to be well-drained and slightly acidic to neutral, but flax does not have a high nutrient demand. There is little tolerance to salinity.

The **perennial ramie**, which lives 7–20 years, needs about 1000 mm (4 in) of irrigation spread evenly throughout the year. It prefers a well-drained soil, with a pH of 5.5 to 6.5. Ramie is usually harvested by hand three times per year, however more frequent harvesting and greater yields are obtained under optimum conditions. Best yields are produced from plants 3–6 years old.

Sisal and **henequen** are perennial plants living 6–20 years. Planting is usually carried out prior to commencement of the wet season at a rate of

Hemp is grown as a fibre crop widely throughout the world, although development of this crop in Australia and some other countries has been slow due to the hallucinogenic nature of closely related varieties of this plant. Note: Fibre hemp is not the same as the marijuana drug plant.

Table 8.1. Some fibre crops with commercial potential in Australia.

FIBRE	BOTANICAL NAME	CLIMATE	SOWING/PLANTING RATE	USE
Flax	*Linum usitatissimum*	Temperate	80–110 kg/ha (70–98 lb/acre)	Excellent for textiles; also grown for its oil
Henequen	*Agave fourcroydes*	Semi-arid tropics and subtropics	1 m (3.3 ft) apart in rows 3–4 m 10–13 ft) apart	Strengthening recycled paper products and for twine
Kenaf	*Hibiscus cannabinus*	Tropical, semi-arid and sub-tropical districts with average temperatures over 20°C (68°F)	10–15 kg seed/ha (9–13 lb/acre) in summer, after first rains	Paper, textiles, non-woven earth mats, fibreglass substitute, animal bedding, oil-absorbent mats, acoustic tiles, kitty litter, potting medium ingredient
Industrial hemp	*Cannabis sativa*	Mild temperate climes of 14–17°C (57–63°F)	900 000 plants/ha (360 000 plants/acre) sown in spring to ensure good harvest prior to flowering	Usually blended with other fibres, textiles, rope, paper
Ramie	*Boehmeria nivea*	Semi-arid tropics to humid subtropics	30–50 cm (12–20 in) row spacing, 70–80 cm (27–32 in) apart	Linen and other fabrics, usually blended
Rosella	*Hibiscus sabdariffa*	Tropical, semi-arid and subtropical with average temperatures over 20°C (68°F)	10–15 kg seed/ha (9–13 lb/acre) in summer after first rains	Paper
Sisal	*Agave sisalana*	Semi-arid tropics and subtropics	1 m (3.3 ft) apart in rows 3–4 m (10–13 ft) apart	Strengthening recycled paper products, twine, rope, building reinforcing fibre, bedding stuffing
Sunn hemp	*Crotalaria juncea*	Subtropics and tropics	25 kg seed/ha about 500 000 plants/ha (22 lb/acre; 200 000 plants/acre)	Paper

1 m (3.3 ft) apart in rows 3–4 (10–13 ft) m apart. Excellent drainage is essential.

All fibre crops have a relatively high demand for weed control and fertiliser.

Pests and disease seem to be relatively few in Australia compared to other countries, possibly because of the recent introduction of these crops to this country. Problems for kenaf include loopers, root knot nematodes and 'kenaf crinkle disease', while hemp is subject to attack from lucerne flea and black beetle.

HARVESTING

The optimum time for harvesting all fibre crops is once vegetative growth stops and just before flowering commences. Consequently, a long growing season is important and early flowering is undesirable. Timing flowering to occur at the end of the rainy season can maximise production.

While traditional harvesting techniques can be commercially viable for countries with abundant cheap labour, mechanisation is essential in developed countries like Australia if they are to be competitive in the world market.

MARKET POTENTIAL

Many non-wood fibres have been successfully used in the production of textiles. As fashion will vary from year to year, and demand will vary accordingly, it is important to plan for alternative markets. As Australian demand in this area is perceived as low, it is recommended to concentrate on production for paper pulp or building materials, with textiles as a secondary product.

Pulp and paper production is very successful with kenaf, and exhibits great potential in Australia.

Industrial hemp has been estimated as being more expensive than woodchips, and the need to cut the fibres into 2.5 mm (0.1 in) lengths tends to negate the characteristic benefits of longer and stronger fibres. Industrial hemp appears to be more expensive than sisal and jute for similar uses due to higher production and preparation costs. As a substitute for fibreglass for reinforcing, industrial hemp is neither cost-effective nor uniform in characteristics.

AGROFORESTRY

This involves the integration of agricultural and forestry production. Trees become multi functional, acting as a resource to be harvested in the future, and as an asset for the existing farm.

There is currently very strong interest in the development of timber plantations on farms for a variety of purposes. In addition to the benefits already listed in Chapter 3 under 'How Trees Can Help the Farmer', the advantages of such plantations are:

- They reduce the need for harvesting (both timber and firewood) in state

forests. It is hoped that eventually plantations will be able to provide much or all of Australia's timber and firewood needs.

- Trees use up and store a lot of carbon dioxide from the atmosphere, particularly in their earlier years when growth is most active (they act as a carbon 'sink'). This helps counteract the release of carbon dioxide and other gases during burning of wood and other materials (i.e. fossil fuels).
- Plantations can be used to link remnant vegetation patches, allowing increased opportunities for migration, feeding and breeding of native animals. Stock animals also may benefit from the shelter provided by these trees.
- They can help offset or minimise the effects of land degradation. Marginal land (e.g. degraded, waterlogged, steep areas) can often be turned into very productive property. Waterlogging can also be reduced in the immediate area of established trees.
- Plantations can provide significant alternative sources of income for farmers when returns from other farm activities are down. Thinnings harvested as the plantation matures can also provide some return to the farmer, prior to final harvesting.

The functional layout of tree specimens will usually depend on the site or farm plan, the species being used and the future use of the tree species. Common arrangements include wide spacing (e.g 10 m ∞ 10 m (33 ft ∞ 33 ft) grid spacing), spiral, narrow belts; clumps/clusters or woodlots.

Shelter belts, common on farms, usually run along the perimeter of the farm lot. Evidence exists that crops placed within the 1.5H zone (a distance out from the edge of the shelter belt equivalent to 1.5 times the height of the shelter belt) may experience the greatest competition from the trees for water and nutrients. Between 1.5H and 9H, the crops tend to show the greatest protection benefit. Crops placed beyond 9H showed the effects of reduced protection from the shelter belt and consequently lower yields. Some protection can be obtained as far as 15H–20H downwind of the shelter belt.

Even if as little as 5 per cent of the farm is devoted to a shelter network, the profitability of the farm will probably be increased in the long term. The high costs of harvesting the trees can be a problem if timber sales do not offset harvesting costs, therefore careful selection of species grown, and subsequent management, is important to ensure that the crop produced is as valuable as possible. In many cases it may be decided that the benefits of retaining any plantings outweigh returns from harvesting.
The economic viability of agroforestry will therefore depend on:

- timber species used:
  –growth rate;
  –suitability to soil and district;
  –demand and yield profit for the timber;
  –maintenance of the forest species.

- agricultural production:
  –animal or plant species;
  –compatibility to soil, climate, timber species;
  –management practices;
  –demand and yield profit based on production;
  –impact of the plants and animals on the tree plantings and vice versa.

AGROFORESTRY MAINTENANCE

Trees will need to be pruned, mainly for the following reasons:

- to maintain high quality timber;
- to maintain access for animals and machinery;
- to reduce potential wind damage;
- to reduce shade on the ground which would diminish growth of pasture grasses;
- to supply fodder for animals.

TREE SELECTION

As each site carries with it a range of characteristics, it is important to identify those tree species most suitable for that particular area. Species that may be perfect for one farm may not thrive on another property 10 kilometres away, e.g. the soil characteristics may be different, climate may actually vary, etc.

THE 2020 PROGRAM

This is an Australian Federal Government initiative, supported by state and territory governments, that aims to treble the current level of plantation timber, both publicly and privately owned, by the year 2020. Advice, incentives, and assistance are available through the various state forestry (or similar) bodies.

CHAPTER 9

Plants V: Hydroponics, Organic Farming

HYDROPONICS

Growing plants without soil has intrigued and challenged gardeners, hobbyists and commercial growers for many years. The terms 'hydroponics', 'water culture', 'sand culture', 'gravel culture', 'solution culture', 'mist culture', 'soilless culture' and more are often used describe a particular system of applying nutrients to the roots of plants and each, in its own way, is a method of replacing soil with some other media.

In general the term 'hydroponics' has gained popular appeal and is widely used to cover all ways of growing plants without the use of soil. The word 'hydroponics' is derived from two Greek words, *hydro* meaning water, and *ponos* meaning to work or labour.

It is reported that hydroponic production can yield around 25 per cent more than ground-grown crops, and averages four times the number of crops per year. The economic benefit of this can be enormous, however set-up costs can be very high due to the infrastructure required.

The Nature of Hydroponics

Soil does four main things for the plants which grow in it. It provides support, supplies water and air to the roots, and provides nutrients. To be successful, hydroponics needs to cater for these four functions.

There are endless possibilities with hydroponics. The options open to you in creating a system are only limited by your imagination and your budget. Provided you can supply the plant with those things it needs to achieve good growth, you can develop a system any way you wish. Systems can be very simple or very complex. They can be cheap or very expensive. On a farm it may be possible to utilise existing materials to some degree (e.g. plastic irrigation pipes, greenhouses). You might limit yourself initially to supplying enough product for your own use, perhaps expanding into commercial production later as you gain more expertise. If you have the expertise to grow plants commercially in the ground, then it is likely that you could convert to soilless production quite readily.

THE LOCATION

Location is a key factor because it influences everything else. If the system

is grown under cover (e.g. in a greenhouse) then the environmental conditions are more readily controlled and the temperature may fluctuate less than in outside conditions. Wind problems will be reduced and so on, but natural rainfall can't be readily utilised unless it is captured (e.g. in tanks or a dam) for later use.

If the system is outside it will be exposed to rain, which may dilute the nutrient solution, and to wind, which can damage plants or blow debris into the system. Frost, hail, snow, etc. could also create problems. Temporary frost protection (e.g. removable covers) might be provided for outdoor systems at frost or hail danger times. Well-designed windbreaks can help reduce the likelihood of damage to both the plants and the hydroponic system itself.

Pests and disease can usually be reduced by keeping the hydroponic system isolated from those problems by growing indoors, by raising the system off the ground (away from the soil, which is a major reservoir of pest and disease problems), or locating your system in an isolated area away from other crops that may act as potential sources of pest and disease infestations. Outdoor systems will need to be securely fenced off from animals, e.g. goats (in particular), cattle and sheep, otherwise plants may be eaten or trampled.

THE CONTAINER

The plant roots, as well as the nutrient solution and media, need to be contained by something, otherwise nutrient solutions and any growing media would quickly run/fall away. You might, for example, have gravel, sand or perlite contained in plastic bags, in pots or in tubs. You might have rockwool fibre, sand, gravel or scoria contained in a raised bed built from timber, metal, concrete or plastic. You might use polystyrene boxes, fibreglass tanks, PVC pipes with slots in them, plastic roof guttering, square cross-sectioned PVC channel specifically designed for hydroponics, and so on. The list of possibilities is endless. The main criterion is that the container is large enough to support the particular plant/s you are growing, will contain the nutrient solution for long enough for the plant to utilise the nutrients in the solution, is stable so it won't fall over, is durable enough to last at least until the crop is harvested (it will preferably last much longer), and is chemically inert (i.e. doesn't release chemicals that might affect plant growth — some metal guttering, for example, corrodes over time).

WATERING AND NUTRIENTS

Water quality is critical to the success of hydroponic growing — ideally, it should be as pure as possible. Impurities such as sediments, salts, pathogens, etc. can block up dispensing systems (e.g. nozzles), cause toxicity problems, affect the balance of nutrients in the solution, or rapidly spread disease. The water may need prior treatment before it is suitable for use (e.g. settling tanks to reduce sediments, filtering, disinfecting). The quality of any water

you use should be regularly monitored. Reliability of supply also is critical, particularly if you are not recycling the water through the system.

Nutrient solutions may be applied automatically at predetermined times or as required. In the case of nutrient film technique (NFT) a continuous thin stream of nutrient solution flows through a channel in which the plant roots sit. The solution could be supplied at the bottom of the growing media (e.g. sand, gravel) and allowed to move upwards through the media by capillary action or, alternatively, supplied at the top of the media (e.g. through drippers) and allowed to filter downwards.

It may be pumped onto the media, moved manually (e.g. from a watering can or bucket), or be gravity fed, e.g. from a tank up-slope of the hydroponic system. The excess (runoff) might be collected and re-used (this is known as a closed or recirculating system), which reduces waste of both water and nutrients, but needs careful management to control nutrient levels in the solution and minimise the risk of recirculating any disease problems that may have entered the system (the re-used water may need to be disinfected). Alternatively, the nutrient solution may be lost after passing through the media (known as an open or run-to-waste system). This type of system uses more water and nutrients, but can reduce the likelihood of disease problems or salt build-up in the system.

TRELLISING

This is not always needed, but when growing tall or creeping plants such as tomatoes, cucumbers, carnations and roses, the media may not be strong enough to support the plant. Trellising also helps control the direction of plant growth and better utilises space (more plants can be grown, with higher yields, if they are grown upwards, rather than being allowed to sprawl). Trellising can be made from such things as wire (single strand or mesh), plastic mesh, strings, wooden posts or trellis, fishing line, etc.

Types of Systems

There are two main groups of systems. These are:

- water, where the roots grow directly in water, or a mixture of water and air;
- aggregate, where the roots are grown in a solid material, such as sand or gravel.

In **water culture** systems, nutrients are dissolved in water which is brought into direct contact with the roots. The water is either aerated, or the roots are allowed to contact air as well. Trellis, wire mesh or some other support is needed above the nutrient solution to provide support to the plant. Examples are NFT and mist (aeroponic) systems.

With **aggregate culture**, nutrients are dissolved in water which is moved into the root area. The roots are grown in a solid material which is chosen for its ability to hold sufficient moisture, but drain off any excess to allow

Hydroponic lettuce farm

sufficient aeration. The solid material in which the roots grow contributes to providing support to the plant, although further support such as a trellis may be needed in some cases (e.g. plants that grow tall, climbing plants, plants heavily laden with fruit). Examples of aggregate culture are beds or pots containing gravel, scoria or sand, and beds or benches containing/supporting rockwool.

Solid Media

In hydroponics, 'media' is the name given to the solid particles (e.g. sand, perlite, gravel) in which the plant roots grow. All hydroponic media must be sterile (free of pests and diseases), and inert (free of nutrients). Other important characteristics that must be considered include its water-holding capacity, its air-holding capacity, its drainage and its nutrient-holding capacity.

A medium which drains well (e.g. gravel, coarse sand) is usually well-aerated, but can have a low water-holding and nutrient-holding capacity. These types of media need to be irrigated more often; in some cases, irrigation should be a continuous flow. There is therefore a relationship between the type of medium you might choose for a system and the way in which it is irrigated. A medium which holds water and nutrients better (e.g. rockwool) can usually be irrigated less frequently (it might be as infrequently as 3 days in summer, or up to 7 days in winter).

Commonly used media in hydroponics are:

Vermiculite

This is a mineral derived from mica, which is commonly mined in South Africa and the USA. It needs to be mixed with other media to get the best

results. Even though it retains air well (high air-holding capacity), it can retain too much water for many plants. If used on its own it can, after a year or so, turn puggy (i.e. the structure can collapse). Mixed with gravel or sand (no more than 40–50 per cent vermiculite) this collapse of structure is less likely to occur, drainage is improved, and it becomes a more ideal medium.

Sand

Coarser granitic or silica type sands should be used. Beach sand is not suitable because it contains high levels of salt. The best type of sand is a coarse, washed, granitic sand. This is the same type of sand used by nurseries in plant propagation media, and used in fish aquariums. Fine sands may hold too much moisture and may be much harder to contain (i.e. they will ooze out of drainage holes when wet).

Gravel

This has similar properties to coarse sand, but is even better drained. Be careful of using sharp-edged gravel on soft tissued plants (it can abrade stems as the plants move in air currents, when knocked, etc.).

Perlite

Like vermiculite, this is a processed mineral. It has excellent water-holding properties but is less spongy and better drained than vermiculite. Perlite is often used by itself or in a 50/50 mix with vermiculite. Its main disadvantages are that it is fairly expensive, it is very light and can be easily blown way, and it can be easily crushed or broken down with use, reducing its good drainage and air-holding abilities.

Expanded plastics

These materials are inert, and in many cases relatively inexpensive (e.g. polystyrene bubbles). Their major disadvantages are that they have poor moisture- or nutrient-holding abilities, they are very lightweight, when mixed with other materials tend to separate out and float to the top of the mix, and they provide little support for the plant.

Scoria

This is a porous volcanic rock which can be obtained in a wide variety of grades. It is fairly cheap, but it tends to hold nutrients too well, and there may be salt build-ups. There may also be a problem with pH (the measure of how acid or alkaline the medium is). It tends to be a bit sharp-edged, and can be abrasive to soft-tissued plants.

Rockwool

This is a fibrous material made from spun rock fibre, that was originally produced as an insulating material. Only horticultural grade rockwool should be used in hydroponic systems. Rockwool is around 97 per cent air space, totally sterile and holds a very large amount of water, while still holding an ample amount of air for most plants. It is excellent for both

propagating plants and for growing longer-term plants in hydroponics. It does tend to collapse, though, after a few years' use. Disposal of used rockwool can be a problem, and it can also cause itching and allergies when handled.

Nutrient Solutions

Studies into plant nutrition have shown that nutrient solutions must contain nitrogen, phosphorus, potassium, magnesium, calcium and perhaps sulphur to obtain reasonable growth. These are added in the form of chemical salts or compounds. In addition to these, the plant also needs oxygen, hydrogen and carbon, but these are provided from air and water. These elements are commonly called the major or macro elements.

Research has also shown that a large number of other nutrients are also required, but in very small quantities (these are known as trace elements or micro nutrients). These were not picked up in early research into nutrient solutions because they where almost always supplied as impurities in the water used in the solutions (they could also have been contained in contaminants such as dust from the air). These so-called trace elements include iron, copper, boron, molybdenum, zinc and manganese. They are just as important for healthy plant growth as the major elements, but are generally only required in small amounts.

Although there are rough similarities between the amounts of nutrients that most plants require, to get the best out of plants you grow in hydroponics certain balances of nutrients are needed for different plants. There are also different requirements at different stages of each plant's growth (e.g. vegetative growth, producing fruit). Nutrients are fed to the plants in the form of a solution that contains chemical fertilisers dissolved in water.

If you want the best out of hydroponics you have to know a lot about plant nutrients and, unless you are a chemist, that takes a bit of learning. Don't be put off. You can still grow plants hydroponically quite successfully without getting too involved in the chemistry aspects. It is possible to buy standard nutrient mixtures from hydroponic suppliers. These may be quite good for your needs, or at least adequate. As you gain more expertise you can modify these basic mixtures to get better results with specific types of plants, or even start developing your own tailor-made mixes.

Although the best results are generally obtained from tailor-made mixes, a very basic solution for the beginner can be made as follows:

- 6 parts of a standard liquid fertiliser such as Aquasol or Thrive (in dry form)
- 1 part epsom salts
- 5 parts gypsum

Take one teaspoon of this mixture and mix it thoroughly with 9 litres (one bucket) of water. This solution will grow most plants reasonably well.

Plant Problems in Hydroponics

There is very little difference between what can go wrong with plants in hydroponics compared with plants grown in soil. The three main problem areas are pests and diseases, nutrition and environment.

Generally pest and disease problems are lower than for plants grown in soil, particularly those diseases that are commonly soil-borne. Fungal problems are most likely to occur in moist and humid conditions. If you are not careful in your selection of a medium and the irrigation rate used, you might have more fungal problems in hydroponics than in soil.

Obviously you are more likely to have problems with nutrients than you would in soil, because nutrition is totally dependent on the operator of the system. Wind can sometimes be a greater problem for outdoor hydroponic systems than in-ground production because the plant does not have as strong a support system for its roots. Keeping correct moisture levels might also be a problem in some systems. Many of these problems can be reduced as you gain more expertise, and start tinkering around or modifying your system.

Further Information

Hydroponic suppliers can be found listed in the Yellow Pages of the telephone directory, usually under the heading 'Hydroponics'. They are generally an excellent source of information. There are also many books written on the subject, including *Commercial Hydroponics* (Kangaroo Press) written by the author of this book. The magazine *Practical Hydroponics*, produced in Australia, is also well worth reading.

ORGANIC FARMING

In the past organic farm production was often considered as being only for radicals or hippies. Now it is seen as a viable economic move — with benefits to the farm soil, to the environment, and to the purchasers of the products. An organic approach can contribute towards making a farm more financially viable in several ways:

1. It is a low input way of farming. You do not need to invest so much money in expensive chemicals and fertilisers. Any declines in initial production are balanced against these reduced costs.
2. It is less likely to result in land degradation than many other production methods; hence the long-term cost of sustaining production is less.
3. Public demand for organic produce has markedly increased over recent years.

To be recognised as being an organic producer you need to abide by guidelines that are set by various bodies in each country (e.g. the Biological Farmers Federation of Australia). Guidelines exist for vegetables, fruit, meat, etc. For contact details see Appendix.

One of the problems with marketing organic produce, particularly fruit and vegetables, is that most people believe that slightly blemished produce indicates that it is of poorer quality. However, as organic produce has become more readily available and more widely marketed, the public are becoming more aware that such superficial blemishes do not indicate poor quality, but in many cases may indicate better flavour.

Consumers will often pay a higher price for organically grown products than non-organic produce, consequently profits can be improved. However, it should be noted that without good cultural knowledge of the crops/animals a farmer is producing, serious losses can occur.

Organic farming is not a 'lazy farmer's' technique. A lot of work is involved in utilising integrated pest management and hygiene above and beyond most normal farm enterprises. Once an organic production management system is in place, however, and operating, it tends to stabilise over a period of time and becomes easier to manage.

Some of the most important features of organic production, as recognised by the International Federation of Organic Agriculture Movements (IFOAM) include:

- promoting existing biological cycles, from micro-organisms in the soil to the plants and animals living on the soil;
- maintaining the environmental resources locally, using them carefully and efficiently, and re-using materials as much as possible;
- not relying heavily on external resources on a continuous basis;
- minimising any pollution both on-site and leaving the site;
- maintaining the genetic diversity of the area;

Typical practices in organic systems are composting, intercropping, crop rotation and mechanical or heat-based weed control. Pests and diseases (e.g. predatory mites) are tackled with naturally produced sprays and biological controls. Organic farmers generally avoid the use of inorganic fertilisers and synthetic chemical herbicides, growth hormones and synthetic pesticides.

For more information on organic farming, see *Sustainable Agriculture*, another book written by John Mason (published by Simon & Schuster/Kangaroo Press).

CHAPTER 10

ANIMALS 1: Ostriches, Emus, Alpacas, Llamas, Deer, Goats, Horses

OSTRICHES

Ostriches are very large flightless birds that naturally occur in semi-arid parts of Africa and will survive in very harsh conditions. They are bred and raised in every Australian state. A warm, dry climate is considered the most favourable for breeding and growing them.

Ostrich hens mature at 2–2' years and cocks at 2'–3 years, depending on nutrition, environment, genetics and climate. The life expectancy of ostriches is about 80 years.

A hen will lay from 30 to 100 eggs a season from July to April. Under commercial conditions hens lay full clutches for about 20 years, but will continue laying on a decreasing scale for another 20 years. The number of chicks reared per pair over their life will generally average 10–30. This is based on an 80–90 per cent fertility level, and similar hatchability rate.

Ostriches have a live weight of 70–75 kg (155–165 lb) at 12–14 months when fully grown. This will give a dressed weight of about 40 kg (88 lb).

Feathers are plucked at slaughter and also plucked from the body and cut from the wings and tail every 8 months from about 6 months of age.

A hatchery/incubation structure may be needed; alternatively farmers may buy chicks to stock up their farms.

In drought conditions, when maintaining bird health is difficult, the use of fodder crops such as saltbush can reduce expenditure.

Fencing is crucial for ostriches and emus. The traditional constructions suitable for deer are making way for cheaper electric fencing systems.

Like any fashionable new industry, it is important to establish the markets and the demand for the products of ostriches, such as meat, skin/leather, oils, feathers, etc. There have been several failures of big ostrich farming operations in Australia. Ostrich skin can fetch high prices per square metre for A-grade finished skin, but signs of blemishes and knife marks during husbandry and processing can dramatically reduce the value of the hide.

EMUS

Emus are now farmed in all states of Australia as well as overseas. There are a small number of registered emu-processing plants around Australia. Products from emus include:

- meat — low fat (less than 3 per cent) red meat;
- oil — used in the treatment of arthritis, manufacture of cosmetics and ointments;
- leather — used in manufacture of clothing, shoes, wallets and belts. It is easily recognisable by the raised areas on the surface;
- eggs — for carving and decoration.

Hens lay about 12 large eggs per year. Emus can be run in conjunction with ostriches. They can be susceptible to influenza, but are generally hardy and very adaptable.

ALPACAS AND LLAMAS

Alpacas

Alpacas are hardy and adaptable to a wide range of Australian conditions, being found in the tropics of North Queensland, as well as in Tasmania and across the continent in Western Australia. In 1998 there were approximately 14–15 000 alpacas in Australia.

Alpacas are bred primarily for their superb silky, fine fleece which is strong and warm. The fibre comes in some 12 different colours. Breeding is

Alpacas are grown for their quality fleece. Alpaca farmers are then able to value add by producing spun yarn or garments from the fleece.

at present being directed to produce strong, uniform and fine fleece (recommended 25 microns). The main uses of the fleece in Australia include clothing and doona filling. Alpacas are also popular in farm tourism enterprises.

Australia is strategically placed to supply the Japanese market, which is the world's largest.

They can be farmed on small acreages with low establishment costs, and there is no requirement for special facilities and elaborate fencing as they do not 'work' fence lines, nor do they jump or push fences. They have padded feet, and tend to be light grazers, making them less likely to damage pasture and soils than traditional grazing animals such as sheep and cattle. They do well on lower quality hay and pasture than traditional grazers in Australia.

Although infrastructure costs are low, the initial set up stocking rates may be considerable in order to acquire good breeding stock.

Alpacas are easy to care for as they are generally disease-resistant (only known to get Johne's disease and facial eczema), and generally do not suffer from fly-strike and foot rot. In cold rainy areas they do require shelter.

Females are joined at 15 months old. Gestation period is 11 months, and rejoining can be within two weeks. Alpacas can live 15–25 years and can weigh up to 70 kg (150 lb).

Llamas

Llamas are closely related to alpacas, but larger, and do not have the same quality of fibre. Llamas are more commonly kept for meat or as a pack animal (the males can carry weights up to 25 per cent of their body weight). Like alpacas, they are very gentle, intelligent and easily trained animals. They require similar conditions to alpacas.

There are two types of llamas. Most are non-woolly, having a coarse, short fibre. The others (woolly llamas) have a long fibre, which is generally soft but coarser than alpaca fibre. The females can give birth to one cria (baby llama) per year. Llamas have a life span of 20–25 years.

More information can be obtained from:

Alpacas Australia (Magazine)
381 Tooronga Rd, Hawthorn East, Victoria, 3123

Australian Alpaca Association Inc.
Suite 1, 818 Whitehorse Rd, Box Hill, Victoria, 3128
Postal address: Private Bag 4200, Box Hill, Victoria, 3128
Ph: (03) 9899 1099, Fax: (03) 9899 1055

Llama Association of Australia Inc.
RSD E1328 McFarlanes Lane, Mt Egerton, Victoria, 3352
Phone/Fax: (03) 5368 9616

DEER

Although it is still considered a 'new' industry, deer farming has been developing in Australia for nearly two decades.

Deer have potential markets in meat (venison), antlers and their velvet (for uses ranging from oriental medicines to textiles), sale of breeding stock, and in tourism operations. There are well-established markets both within and outside Australia, usually to the extent where demand outstrips supply.

Deer slaughtering at 15–24 months will yield carcass weights from 28 kg (62 lb) for fallow deer up to 55 kg (120 lb) for red deer and higher for wapiti hybrids.

Land for deer farming should ideally have no steep slopes or water courses. Access to good quality drinking water is important, as is sun protection in summer and winter protection for fawns. Deer are adapted to a wide range of climatic conditions and soil fertility, although good quality grazing land that can sustain a good pasture is recommended. Stocking rates will vary depending on season and yield capacity of the land.

Good quality fencing is very important, as deer are capable of jumping 2-metre high fences. Most states have regulations regarding fencing of deer.

Farm layouts must allow for easy movement of deer from paddock to paddock, preferably via lanes. Crushes are used to carry out vaccination and de-antlering.

In 1997, deer meat (venison) could fetch $6–$40/kg for Australian farmers, depending on the cut of meat. 'Dried' velvet was fetching up to $750/kg. Velvet prices may vary from year to year depending on market demand and the stability of the Asian market. Velvet yield from breeds are: fallow cutting about 700 g (1.5 lb); red 3–5 kg (6.5–11 lb), elk hybrids 5–9 kg (11–20 lb) and elk 5–15 kg (11–33 lb). Velvet harvesting is normally carried out in November. Training in velvet removal is recommended.

Deer are relatively easy to handle, although a few basic mustering skills are beneficial. Handling males during the rut period is not advised due to their temperament. Additional feeding can aid in keeping deer quiet and non-aggressive. Feeding is particularly important for males during the pre-rut period, and females during lactation.

GOATS

Goats are farmed for meat, milk or fibre. Goat meat production in Australia was valued at about $20 million per annum in 1997, and goat milk at $1 million. The mohair industry was valued at about $2 million per annum, the cashmere industry at about $0.5 million per annum.

MEAT

There is at present a major under-supply of goat meat in Australia to satisfy

domestic and export demands. The limited number of feral goats being captured and sold, and low numbers of farmed stocks, indicates that more suppliers of good quality meat are needed. Meat prices can vary throughout the year.

Identification of specific cuts and market needs (i.e. carcass or live goats), combined with the co-ordination of suppliers, wholesalers and retailers will maximise client satisfaction. Younger goats, although lighter in weight, can bring a higher price as the meat is much more tender. Older goats often contain too much fat for the market. Meat can be obtained from all breeds of fibre, dairy, feral and improved Boer goats.

DAIRY

Goat milk is used for specialised cheese making and the supply is much less than the demand, indicating a need for industry expansion to satisfy domestic and export markets.

Dairy goats need improved pastures in good rainfall areas. A good knowledge of animal nutrition, lactation and disease control is essential for milk production. Additional knowledge of pasture management will aid in increased productivity.

The main dairy breeds include Saanen, British Alpine and Toggenburg. Crossbreeds of these have been used in recent years in Australia. Milking sheds are set up like cow dairies. Infrastructure and machines may be expensive to set up, but are easily run. Lactation lasts for 300 days, with an average 2–3 litres (4–6 pints)/doe/day.

Use of all chemicals should be monitored. The withholding period of chemicals should be strictly adhered to for meat and dairy goats.

FIBRE

Mohair and cashmere is one sector of the goat industry that has internationally established markets for the fibres. The demand for quality fibre is beyond the present Australian supply capacity. Prices for fleece may vary considerably from year to year, due to fashion trends and market economies.

Mohair fibre is regarded as high quality and frequently used in luxury clothing. Fibre price is dependent on fibre diameter, length and occurrence of colour. Kid mohair generally receives a higher price compared to the coarser adult fibre. Shearing is carried out twice a year when length exceeds 10 cm (4 in).

Cashmere goats produce a coarse, low-value fleece but have an undercoat of fine, high-quality down — it is this down that is called cashmere. Price obtained is governed by colour and fibre diameter. Shearing is carried out once a year.

Mohair fibre is normally sold overseas in the greasy state, with Australia buying back yarns, rugs, knitwear and velours. Australian producers have recently been processing more of their fibre to reduce imports and to benefit from value adding. Vegetable matter (VM) content in the fibre will lower the value of the mohair.

HUSBANDRY

All goats have the benefit of consuming weeds, and the ability to utilise steep slopes where other animals are less likely to graze. Goats are best in dry to semi-arid districts where winter rainfall is not high — high winter rainfall tends to increase problems of parasites. Goats are susceptible to soil trace-element deficiencies and a range of diseases, including Johne's disease and caprine retrovirus (CAE).

Goats need strong fencing, so initial fencing costs may be high; electrified fences tend to be cheaper in set-up and more effective in goat control.

Before entering into goat production, it is advisable to fully research the topic. Try to observe other goat farm operations, ensure suitable fencing is constructed, start with a small flock before expanding to full production, and purchase the right equipment (drenches, shears, castration equipment, etc.). Stocking rates are similar to that of sheep, and good pasture husbandry will increase productivity. Goats have been successfully incorporated with other grazing animals.

HORSE INDUSTRY APPLICATIONS

The horse industry is a very large and sometimes (if not often) profitable business. Opportunities to develop business ventures could occur in any of the following areas:

- racing;
- harness racing;
- competition in events (one-, two- or three-day);
- dressage (physically demanding on the horse);
- show jumping;
- competition driving;
- long distance competition;
- show horse/pony;
- serious transportation: riding on rural properties (particularly in less accessible areas), jackaroo/jillaroo;
- recreational uses: trail riding, riding schools, pulling wagons (gipsy wagons, hay rides), children's pony rides;
- sport: polo pony;
- stud farms: breeding of thoroughbreds, stock horses, polo/polocrosse horses, children's ponies, etc. There is also a niche for breeding for colouration and markings;
- stables: rent out with agistment, or to horse trainers;
- tourist/holiday resort: riding lessons, trail rides, camping out, mustering cattle/sheep. Could expand to 'live in' courses/holidays for various periods (e.g. 2 weeks during school holidays) and incorporate leather work, working cattle/sheep in yards for marking, dipping, dehorning, etc;
- basic training of the above horse types. There is a ready and lucrative market for 'horses to go';

- special horse training: re-educating problem horses, with the emphasis on mouthing, standing to be shod, standing to be caught, and not to bite;
- saddlery: It is important to keep overheads down and the best way to do this is by making only to order, and carrying out only simple repairs. Follow polocrosse carnivals, gymkhanas, rodeos, etc. Carry products for sale, such as emergency tack items like girths, reins, sets of horse shoes and nails, bandages, bell boots, etc;
- making videos: different aspects of horse breeding and horse management. Professional standard of camerawork is important. Possible sales outlets may include pony clubs, schools, TAFE colleges, fellow horse enthusiasts;
- writing books/handbooks on various aspects of horse husbandry.

THE RACING INDUSTRY

Racehorses are a risky business. Many people own racehorses as much for the status and fun they get as for the possibility of making money.

Racehorses need more attention than other horses, and this can be costly, with no guarantee of a return. A good racehorse, though, can be extremely profitable, generating money from winnings and, later in life, from stud fees.

While cheaper horses are advertised through the media, racehorses are not. If you are planning to buy a racehorse, it is wise to select a trainer first and then buy your horse in collaboration with the trainer.

HORSE RIDING

Horse riding can be a viable additional venture alone, or may be a complementary service.

Horses used as hacks need to be properly trained. Clientele need to be assessed and matched with appropriate animals — a novice rider needs and will be happy with a quiet, well-behaved horse, while an experienced rider may find such an animal boring. The conditions for using the horses need to be clearly indicated, as do the areas where clients can ride. A trail ride (on or off the farm property), may be guided by a member of staff. Riding in open paddocks that can be seen clearly may not require such close supervision.

Farms might also offer hay rides, horse and cart rides, etc., perhaps as a means of touring the farm, or perhaps as an experience in its own right.

Competition Horses

Preparing and/or breeding competition horses is another sector of the industry that could provide an alternative to farmers. There are many different types of competitions, and different horses are bred and prepared in different ways for each type of competition. Some of the differences are shown below.

THE EVENT HORSE

- To prepare a horse for a program of events, a schedule should be prepared in chart form to suit that individual horse's needs.
- Include in the schedule competition dates, diet, exercise, shoeing and medical treatments (e.g. veterinary inspection, worming, etc.).
- Generally allow around 3 months for preparation for an events program.
- Extra conditioning is required for longer events (e.g. 2–3 days).
- Adequate attention must be paid to endurance as well as muscle fitness.

THE DRESSAGE HORSE

- Dressage is very demanding upon a horse.
- The horse must maintain a high level of fitness at all times.
- The dressage horse is not normally rested for prolonged periods.
- The horse's mental attitude is critical and it must always be treated as an individual.
- Muscle fitness is usually more critical than endurance.
- Daily grooming is necessary.

THE SHOW JUMPER

- Though show jumping is an all-year sport, horses do not compete continuously.
- Horses are usually rested for 2–3 months; they then go through a 2-month conditioning program before competing.
- After a major event the horse is usually rested at least a few days.
- During competition, feeding is designed to maximise energy but minimise weight.
- In dry weather the ground can be hard and cause shock to the jumper's legs. This must be taken into consideration.

THE DRIVING HORSE

- Though driving can occur all year round, the competition season is often limited.

THE LONG-DISTANCE HORSE

- Horses are prepared by a few weeks of long walks followed by slow trots, building to faster trots to develop muscular and cardiorespiratory fitness.
- Conditioning for endurance is important.

Educating Horses

A horse doesn't automatically become suitable to ride. It needs to be educated or trained and, as with any animal, the earlier the training begins the easier it is. The following information will give you an idea of what is involved.

GETTING USED TO HANDLING

A foal should be handled as soon as possible after birth, so that it becomes

comfortable with humans from early in its life. Place a mare and foal in a small yard (don't separate them) and approach the foal slowly. Be calm and pat the foal gently. Lift the legs slowly and place your hand on different parts of the body gently. Spend no more than a few minutes doing this. Repeat the process frequently in the foal's early days (if you leave these lessons for several months, the job will need to be handled differently as the animal will be much stronger).

LEARNING TO BE LED

The foal must next be taught to be led in a headstall. The foal and mother should be moved into a restricted area, perhaps using a crush to separate them. The foal should be allowed to relax before any head collar is put on it. When relaxed, it will sigh and chew; if tense, it will hold its breath and clench its teeth.

It's normally best to secure the neck strap first, then put on a nose band. Place this gear on very gently. Once the headcollar is attached, the mother can be led out. The foal will follow, being led by a handler. When it feels the collar the foal will create a fuss. The handler must hold the rope, but not restrict the foal too much. It usually only takes a matter of minutes for the foal to get used to being led. The process is repeated every day for at least 3 days, for 10 minutes at a time. Gradually the foal is taught to be led away from the mother.

OTHER LESSONS AND PROCEDURES

Foals must be taught a variety of other things, including being tied up, having their legs handled, and to eat solid food (weaning). As the foal develops, other procedures may be necessary, including castration, branding, vaccination (e.g. tetanus and strangulation) as well as keeping official records. As the horse continues to grow the training will continue, with the horse being taught:

- to wear a rug;
- to handle a long rein;
- breaking (usually at around 18 months).

Breaking in a horse is an expert job and must be done properly. It requires an experienced handler, the right equipment, short effective lessons and a sensitive but firm attitude.

CHAPTER 11

Animals II: Aquaculture

The vast majority of the world's aquaculturists are agriculturists. This is not surprising because aquaculture requires land and water — and farmers, worldwide, control most of the area suitable for aquaculture.

The first need for fish farming is land that can be used for ponds. This land should preferably have a high clay content to hold the water efficiently. Secondly, a reliable source of water is needed — this can be from a storage dam, river or borehole. Thirdly, an inexpensive source of fish feed is a must. This can range from plant growth in a pond to fishmeal products produced on the same farm or bought in as rough or processed feed.

In some cases fish production has to compete directly for land, water, feed and labour with beef, pork, poultry and other animals. However, fish are far more efficient at converting feed into meat than any of those animals.

Aquaculture enterprises can increase productivity on farms, giving increased return from under-utilised resources. Such resources include farm dams, crop wastes, marginal land unsuitable for crops or pastures, effluent water, etc. Fish production can use many of these efficiently. A prime example is the use of piggery and poultry wastes for fertilisation of fish ponds. In addition, wastes from fish processing can be utilised as stock feed, or as fertiliser.

Most farms have some form of water storage necessary for the watering of animals and the irrigation of pastures and crops. The many hectares of water that stand idle all over our country can be used more efficiently by producing fish in it before it is used for irrigation. The integration of fish farming in an established farming system can be beneficial to the latter. The organic enrichment of the water will benefit any crops being irrigated with this water.

The aims of modern aquaculture are similar to those of other forms of agriculture say Paul Bryant, Kim Jauncey and Tim Atack in their book *Backyard Fish Farming* (Prism Press, UK, 1980). However, there are some differences.

Firstly, impounding water for aquaculture constitutes the creation of a new environment, whereas agriculture makes use of existing environments. Secondly, aquaculture uses three-dimensional space (volume) and thus is considered more productive than conventional livestock rearing on the same area of land. Bryant et al. liken it to farming sheep in a multi-storeyed building.

THE ADVANTAGES OF AQUACULTURE

- Aquaculture is known to produce more animal protein per hectare than most other kinds of livestock farming.
- Aquaculture can often make good use of marginal land unsuitable for other forms of agriculture.
- Fish contain a greater percentage of edible flesh than most other farmable animals.
- Fish also require less feed to produce this flesh. The feed conversion efficiency is partly due to fish being cold-blooded and not having to expend energy to keep warm or cool. This energy remains stored as flesh and fat. Also, the buoyancy of the water in which fish live means they have to use less energy for movement and support than do land animals.

THE DISADVANTAGES

- The commercial production of fish requires high-quality, high-protein feed. The proportion of protein in most livestock diets is lower than that required for fish.
- Setting up an intensive fish farm is far more expensive than enclosing land with conventional or electric fencing and establishing grazing for livestock.
- The constant nature of aquatic environments means that fish are prone to a wide variety of sicknesses, diseases, parasites and predators. They can tolerate only small changes in their environment and these must not be too sudden or drastic.
- Aquaculture requires a reliable supply of clean water, free of excess nutrients or pollutants.

The advantages certainly outweigh the disadvantages under most circumstances. It is up to each individual farmer to determine if farming with fish can be accommodated by existing farming facilities and plans and if it will be profitable to add fish to the farming operation, or even change completely to fish production.

AQUACULTURE SYSTEMS

Two kinds of aquaculture are generally practised — extensive and intensive production. Both have their place; both have advantages and disadvantages. It is up to you to decide which of the two systems you prefer for the organisms you are culturing.

Extensive Production (EP)

An extensive production system involves the use of natural waters (i.e. rivers, dams, lakes and various other impoundments). It is a system whereby animals are stocked, allowed to spawn and increase in number and size, with little input from the farmer or manager. Sometimes there will be some

input in terms of water, fertilisation, feeding and/or protection. Usually a simple stocking and harvesting routine is followed.

Extensive culture systems have been employed throughout the world, particularly when impoundments have been stocked for angling recreation. This system is also employed for casual harvesting (i.e. non-commercial) by rural communities.

It is generally accepted that it is less expensive to produce a harvestable crop from an EP system than that from an intensive production (IP) system. Water is available at little cost, manpower needs are lower and the degree of expertise required from both the farmer and farm workers is considerably less for extensive than for intensive fish production.

The lakes, dams and ponds used for extensive production are usually large and have sufficient food and cover to support a large number of fish and allow them to grow reasonably quickly to a marketable size. However, these fish will grow more slowly than fish that are force-fed under intensive conditions. The mass of fish harvested is considerably less on a per hectare rating than under intensive production.

It is a simple matter to stock a dam, leave it for two or three years, and then begin cropping on a regular (or irregular) basis. The extent of harvesting must be judiciously determined so it does not negatively affect the spawning population — sufficient numbers of adult and sub-adult fish must be left to ensure efficient spawning and enough new recruit fish for the future. However, the actual point of maximum sustained yield (MSY) is something very difficult to determine.

Intensive Production (IP)

An intensive production system (IP) is managed to ensure optimum water conditions, feeding regimes and production of marketable flesh at all times. This is important for high production. It requires a well-designed and managed production unit so water flow, water quality, light intensity, oxygenation, waste build-up, feed, predation, competition and most other factors affecting or limiting production are efficiently controlled, improved or otherwise manipulated. Reproduction can sometimes be initiated slightly out of season by manipulating water temperatures, oxygen and light intensity.

Pools, raceways or dams are typical units for intensive production. They are designed and constructed to offer the farmer as much control as possible, to circumvent problems and to improve any natural limitations. They also enable the farmer to determine exactly his or her marketable stocks and have them available whenever they are needed.

Intensive aquaculture, for example, may involve artificial spawning by means of hand stripping, with or without hormone stimulation. The ova (eggs) are hatched, and the young raised under protected and controlled conditions. They are regularly sorted and those of the same size are kept together. The weaker fish — those that would normally have died had they

been in a natural habitat — are now a useable and marketable additional percentage.

In a hatchery, diseases that are often dormant in wild fish populations may suddenly develop and spread quickly because of the large number of fish contained in a small amount of water. Treatment is imperative to ensure a suitable harvest, and is often costly. However, most sicknesses can be quickly and efficiently treated.

Observation, experimentation and selection for improved breeding are usually extremely difficult where extensive production is practised, but relatively easy in a hatchery or intensive farm. Selection for fast growth, good feed conversion, marketable characteristics and many other factors is usually done over a long period of time.

WATER CONTAINMENT

Water for aquaculture purposes may be contained in a number of ways:

CONCRETE

This may be either a prefabricated construction (suitable for breeding tanks, but often uneconomical for large ponds) or constructed on site. On-site construction is very solid and there is a great flexibility available to the designer in the way the pool is shaped, however costs can be high. Concrete must have a waterproofing additive (available from building or hardware supplies) mixed in to prevent loss of water. Lime from the cement may harm the animals, hence it requires a period of curing before use.

BRICK OR STONE

Raised pools or ponds can be constructed with brick or stone and lined with either concrete or a pool liner fabric.

FIBREGLASS

The cost of constructing an original fibreglass mould is high, after which it is relatively cheap per unit to produce duplicates of that construction. However, prefabricated pools in standard shapes are usually used. Installation is easy and inexpensive, however the design is limited to shapes and sizes of pools that are commercially available.

EARTH CONSTRUCTION

Lakes, dams and ponds can be constructed in soils that are not too porous. The bottom and walls may need to be treated prior to filling to enable them to hold water. In recent times bentonite, a naturally occurring clay product, has been used to seal earthen dams and lakes. When bentonite is wet it can swell up to 15 times its dry volume, and yields an impervious gel-like substance that is not harmful to aquatic organisms.

LINERS

A depression is formed in the ground and a waterproof sheet (i.e. material/fabric) is laid over the bottom and sides of the depression. A common

lining material that is tough and long-lasting is butyl rubber. Commercial suppliers of butyl rubber liners use the following equation to calculate the lengths of butyl required:

Length Measurement (A): Length of pond + twice depth + twice side overlap.

Width Measurement (B): Width of pond + twice depth + twice side overlap.

(side overlap is usually 20 to 50 cm (8–20 in).

One of these measurements (A or B) is aligned to match the nearest roll width (for example, if measurement B is, say, 2.8 m, then the 3 m roll is used). This minimises wastage. The other measurement (A) is then cut to the length of the roll.

Rolls come in widths of 2, 3, 4, 5, 6, or 8 m (6, 10, 13, 16, 20, 26 ft).

Rolls come in the thicknesses of 0.5 or 0.8 mm for most domestic or small commercial jobs. Greater thicknesses can be obtained for larger scale use.

WHAT SPECIES TO FARM

Native freshwater creatures commonly aquacultured in Australia are marron *(Cherax tenuimanus)*, yabbies *(Cherax* sp.), the Australian bass *(Percalates novemaculeatus* also known as *Macquaria novemaculeata)*, and barramundi *(Lates calcarifer)*.

Some of the other species suitable for stocking dams are:

eel-tailed catfish *(Tandanus tandanus)*;
straight-backed catfish *(Neosilurus* spp.);
silver perch *(Bidyanus bidyanus)*;
sooty grunter *(Hephaestus fuliginosus)*;
murray cod *(Maccullachella peeli)*;
mary river cod *(Maccullochella* sp.);
archer fish *(Toxotes chatareus)*;
saratoga *(Scleropages* spp.);
golden perch *(Macquaria ambigua)*;

Exotic species commonly cultivated in Australia include various species of trout and salmon, and redfin (English perch).

Advice should be sought from relevant authorities (e.g. Departments of Agriculture, or Fisheries) before releasing any aquatic organisms (i.e. fish, crayfish, etc.). Some species are banned in certain states (e.g. marron in Victoria) and some, such as European carp, are considered noxious pests everywhere in Australia. Permits may be required for the release of other aquatic organisms.

Trout

Present production is mainly for fresh consumption (e.g. hotels, restaurants and supermarkets), and for recreational fishing. The fish are grown out for

9–12 months and harvested at 250–350 g (8–12 oz) or larger, depending on market requirements. Where fish are produced for stocking private and public angling waters they are grown for 3–9 months, with the marketed size depending on the needs of the client and the water being stocked with fish. Where production is for ova (local or export) no growing on is done. The export ova market is a new one which holds much promise.

Mullet

Various mullet species are used successfully in Israel under intensive polyculture conditions. For many years some farmers have netted large numbers of small mullet in streams alongside their farms and stocked them in freshwater dams, with good production results. This is a mass culture fish species for the future.

Murray cod

Australia's largest and most prized freshwater fish, it grows best in dams larger than 0.2 of a hectare (½ acre), but does not breed in farm dams. It takes 2–3 years for fish to reach table size.

Pet and fancy fish

Large numbers of tropical and subtropical fish are imported into Australia every year. There is a great demand for pet fish and a relatively large market is already available.

Marron

Although there are necessary permits for the production and sale of this freshwater crayfish from Australia, the marron industry holds a good potential for growth and expansion and seems to be quite attractive economically. Export markets are already well developed. Local acceptability is seemingly high. Establishment costs are reasonable and running costs low. Marron populations are self-perpetuating, if given the correct living and feed conditions. (Note: It is illegal to grow marron in Victoria; however, yabbies are farmed in that state).

RECREATIONAL FACILITIES

Recreation in the form of freshwater fishing is increasingly in demand. Where suitable waters can be developed and made available to the public, there is a good potential return from relatively low inputs. Such activities could be readily incorporated as part of other farm tourism activities.

CHAPTER 12

Farm Tourism

Combining tourism and the unique character of the farm can generate an income that is not only profitable, but can provide cash flow during adverse times (e.g. drought, low market prices).

Farms have a unique opportunity to provide services to tourists, for two reasons:

1. Farms are mostly located in country areas, where facilities for tourists are more limited than they are in city areas.
2. Farms can offer tourists opportunities to experience things which are different to their normal way of life.

A farm that carries on a range of tasks (animal husbandry, crop production) can have the advantage of enticing a larger number of tourists. Those farms that delve into more 'exotic' lines such as alpacas, herbs, or aquaculture will have further attractions for people who wish to experience a 'real farm'.

Most evidence indicates that the majority of tourists are looking for quality and difference in their experiences rather than the same type of facilities and attractions repeated over and over. The most successful tourist facility is generally the quality facility offering something different, something special, or something better than other places.

Basic Requirements

The services required will depend upon what type of visitor is most likely to be visiting your farm — long stay or short stay — but all farm tourism enterprises will require car parking and toilet facilities.

People who stay for any period of time (i.e. more than 1 hour) will appreciate:

- a place to rest (e.g. some seating, shelter from the weather, a fire or air conditioning, a shady tree);
- something to drink (e.g. complimentary water, a drink-vending machine);
- something to eat (a tea room or cafe).

Obviously, people who stay overnight will require sleeping accommodation and meals or cooking facilities.

Legal Requirements

You will also need to check out what is required by law — some services are subject to legal restrictions. These might include:

- liquor licensing;

- car parking;
- town planning regulations — are farm tourism activities or tourist accommodation facilities allowed on your property? Do you need to apply for permits, or perhaps for rezoning to occur?
- signage (sometimes you need permits to put up signs ... there may be restrictions in terms of sign size, location, information details, etc.);
- health regulations — toilet provisions, food handling, disposal of wastes, etc.;
- noise restrictions;
- hours of operation.

What insurance policies will you need? Talk to an insurance broker, or a specialist small business advice bureau (most state governments operate such bodies).

WHAT YOU COULD OFFER

A farm could consider offering services to tourists in one, or several, of the following areas:

FOOD

Selling food and drinks to farm visitors can generate extra income. The simplest service might be vending machines which dispense soft drinks or snack foods; the most complex would be a restaurant that serves a variety of meals. The type of food service offered should complement other farm enterprises (e.g. a farm that offers wine tastings or an open garden might provide light lunches or Devonshire teas on a terrace or in a small room).

A farm restaurant can involve a great deal of work and a significant investment in time and money; but it can also be a stand-alone business with the potential to be as profitable as the rest of the farm, and not affected as much by drought or flood.

Food produced from crops or animals grown on the farm and/or other locally produced food could be a real attraction. This could include dairy products from goats, sheep, or cattle, local wines, locally grown meats (including more exotic meats such as ostrich, emu, kangaroo, rabbit, venison, or goat) herbs, fruit and vegetables, bush tucker or breads, cakes, damper, etc. processed from local grains.

ACCOMMODATION

This can be as diverse as hotel-style facilities — bed and breakfast accommodation, self-catering cabins, camping facilities, or a combination of various types. Obviously, different levels of investment will be required according to the type of accommodation and number of people provided for.

While some farms operate independently, others become affiliated with organisations which assist with the co-ordination and marketing of farm accommodation. An example of such an organisation is:

Australian Farmhost Holidays P/L
PO Box 41, Walla Walla, NSW, 2659
Phone: (02) 6029 8621
Email: farmhost@albury.net.au
URL: www.travelaus.com.au/farmhost

Some farms focus on catering for their guests from late afternoon to early morning, leaving them to fill their day with activities away from the farm. Others offer a total holiday package, including various activities during the day.

In Australia in 1998 there were at least 1300 holiday farms. Some of these specialise in a particular type of clientele (e.g. health farm, coach tours for international clientele, etc.).

The main reason people choose to stay on a farm rather than other accommodation is because of the 'uniqueness' of the experience. The physical surroundings *and* the people who interact with clientele need to be appropriate to the farm experience. People who choose a farm holiday like to experience a contrast to their normal urban lifestyle, including the smells and sights of a farm, the spaciousness, the friendly people, etc.

TASTINGS

Wineries have developed tastings to a fine art, offering visitors the opportunity to sample their product and then purchase. This can be an excellent marketing tool. Many people feel an obligation to buy a bottle of wine after receiving a free tasting.

The same principle can be applied with other types of farm produce. Cheese, fruit, preserves and other types of farm produce can be offered as tastings to entice visitors to first stop and later buy from a farm.

FARM PRODUCE AND/OR GIFT SHOP

Products grown or processed on the farm are generally fresher, and often unique when compared with the supermarket option. This is a strong selling point, and provided an ample and appropriate range of product at realistic prices is offered, a farm shop can be very profitable. Produce can include fruit, vegetables, herbs, crafts, cheese, wines, preserves, confectionery, nuts, fabric, yarn, clothing, etc.

A gift shop is something different to a produce shop (although you can have both). Whereas a produce shop will probably sell its goods to those who live, or have self-catering accommodation, within a reasonable distance of the farm, a gift shop aims to sell tourists souvenirs or gifts to take home, which is often interstate or overseas. This can be a lucrative market. The culture of some travellers (e.g. Americans, Japanese) is to spend a lot on gifts and souvenirs. If you have tourists visiting your locality, and if you can attract them to your farm, then a gift shop could generate significant income ... if not, it could be a costly drain on resources.

Be careful about buying in goods to sell. Larger retailers can generally

Horse-and-cart rides can be an attraction for farm tourism operations.

Farm tourism involves providing services and experiences rather than products. If you have a cliff on the farm, you might provide visitors with instruction and the experience of abseiling.

operate on much smaller profit margins than a farm shop. If it is your own produce, you can make a profit by avoiding expenses involved in marketing it by other means. If you buy produce in, the margin you need to add to make a profit may make the item relatively expensive compared with its price in a large retail store, therefore try to avoid stocking items that can be offered more cheaply by your larger competitors (a 'scouting' trip to shops in adjoining towns or tourist attractions can be worthwhile in this regard). Another option is to accept goods on consignment (e.g. from local artists), paying the supplier only after the item has been sold.

OPEN GARDEN

The world is full of garden lovers, and many farms in places like New Zealand, America and Britain have capitalised on this fact by developing unique gardens and charging an entry fee to visitors who like to look them over. However, if this is to work, the garden needs to be special in some way. This might be achieved by filling the garden with artistic features (e.g. statuary); by creating a garden designed to a theme (e.g. a rainforest garden, a herb garden, a cactus garden); by developing a specialised plant collection (e.g. displaying dozens of different types of lavender); or by incorporating some other offbeat, unique feature (e.g. a maze, topiary or a tree-top walkway).

RIDES

Horse riding can be a viable venture alone, or may be a complementary service — see Chapter 10 for more information. Other animals (e.g. camels) could also be used, or perhaps cart or buggy rides drawn by a horse, or even bullocks.

PICK-YOUR-OWN OPERATIONS

Various crops lend themselves to this type of operation. Allowing customers to pick their own can significantly reduce your harvesting costs, allow customers to pick what they feel is the best quality fruit, and at the same time they have fun (and usually a good feed).

An area of berries, tree fruits, vines, etc. can be allocated for visitor picking. To ensure the quality and quantity of produce available to clients, the 'pick-your-own' areas of a farm could be divided into sections, and the use of these sections could be rotated.

For example, strawberries can be picked from one paddock for a few days, then clients are directed to a different paddock for a while, allowing new fruit to ripen in the first paddock.

It is common for produce to be weighed after picking, and a charge made according to that weight, or a container of a certain size is filled. A fee can be factored into the price charged to cover the amount of produce eaten during picking. One problem with this type of activity is that, depending on how many customers you get, not all of the harvestable produce is picked. This may require you to do follow-up picking to minimise wastage or, alternatively, a certain amount of wastage can also be factored into the price you charge.

FISHING AND HUNTING

A fee might be charged for individuals or groups to hunt or fish on your property. This type of operation is particularly appropriate to aquaculture, because it offers families an opportunity to take children fishing with a very high probability of catching a fish. Natural or man-made water bodies might be stocked with fish in order to ensure good fishing. The fish caught are then weighed and paid for as the customer leaves the property, or a set price is paid per fish caught. Fees can also be charged for the hire of fishing equipment.

Hunting is an activity on which people have conflicting opinions, but the farmer whose property is plagued with rabbits, foxes, feral pigs or feral cats is likely to take a pragmatic view about hunting these introduced animals that are degrading our countryside, and would welcome culling by paying guests.

The first move for an Australian farmer considering this option would be to become fully conversant with Australian firearms regulations regarding hunting of feral or game species. (This, of course, applies to overseas readers as well.) Clients offered this activity would need to be versed in the safe handling of firearms. Bow hunting might be an alternative option.

Careful management would be needed to ensure that hunters go only where they are supposed to, and shoot only what they are supposed to hunt. If somebody is available to act as a guide, so much the better, as appropriate shooting practices in suitable areas can be ensured, customer satisfaction is more likely because they can be guided to areas where their prey is likely to be found, and it is reasonable to charge an extra fee for this service.

CHARGING ENTRY FEES

If you have, or develop, worthwhile attractions, it may be appropriate to charge an entry fee to anyone visiting your farm. If you are going to charge an entry fee to come onto the farm, the potential clientele need to have a reason to pay it. People will pay an entry fee to see such things as a show (series of demonstrations), be taken on a guided tour, have unrestricted use of certain facilities (e.g. water sports, barbecues, bushwalking, fishing rights, etc.), or to see displays (e.g. a museum, labelled displays of animals or plants).

Many people like to see how farmers do things, so conducting demonstrations of any farm skills can attract a fee (e.g. branding, sheep dogs working, horse riding, shearing, whip cracking, etc.).

ECOTOURISM

Ecotourism activities are generally considered to be those that are based around some aspect of nature, and that have minimal impact on the natural systems in which the activities are taking place. Examples of ecotourism activities might be white water rafting, wildflower walks, bird watching, nature photography and low-impact bushwalking.

You might, for example, conserve part of your farm in its natural state for tourists to visit and experience, or you might provide a base for people involved in activities in nearby areas where accommodation is not available (e.g. national parks, state forests, coastal regions).

Anyone interested in being involved in an ecotourism enterprise would find it worthwhile to contact the Ecotourism Association of Australia for information. They have developed a code of practice to provide guidelines for people who operate within the industry. Essentially it is designed to take heed of existing government regulations, but also addresses sensible work practices in order to maintain the integrity of the industry.

The Ecotourism Association of Australia can be contacted at:
PO Box 26, Red Hill, Queensland, 4509. Ph: (07) 3352 7220
URL: www.lorenz.mur.csu.edu.au/ecotour/EAAHome.htm

Promoting a Farm Tourism Operation

It is one thing to offer a service; it is another thing for tourists to know about what you are offering and to feel encouraged to come and visit you.

One body worth contacting for information is Australian Farm and

Farm Tourism. The Ploughman Garden, a rural property south of Auckland, NZ, displays its gardens to the public, sells herb plants grown by the wife and sculptures made by the husband.

A topiary garden at Levens Hall in England. The novelty of trees and bushes cut into weird and wonderful shapes attracts thousands of tourists who pay to stroll around this rural garden. Further income is derived from afternoon teas and souvenirs at a small shop.

Tourism Inc. They are the top national body for farm and country tourism, and can be contacted at:

Level 6, 230 Collins St, Melbourne, Victoria, 3000.
Ph: (03) 9650 2922.

Most state and regional tourism agencies/bodies have an extensive range of brochures available relating to farm tourism. It is a good idea to get hold of some of these to look at the types of facilities and activities being offered, the prices charged for these, and how the brochures are put together to promote such information. Such tourism bodies are also a very valuable means of marketing your own farm tourism activities, and are well worth contacting for this purpose.

The first essential for any farm tour operation is a good brochure. This brochure should be distributed to all places where tourists are likely to look for information on your local area, including:

- the local tourist office;
- capital and regional city tourist offices;
- accommodation facilities (e.g. motels, hotels, caravan parks);
- complementary tourist attractions — you could display brochures from other local facilities, and they could display brochures of yours;
- travel agents, local restaurants, some types of retailers, etc.

It is important to keep brochures up to date and to keep distribution points well supplied with this valuable advertising medium.

Brochures need to include clear directions on how to get to your property (preferably including a map).

Other ways of promoting:

- **Signs**. Local government may signpost the route, or you might arrange for signs on nearby properties or at road intersections.
- **Internet Web Site**. This is not to be underestimated. It is a cheap way of reaching literally tens of thousands of potential customers. An increasing amount of tourism business is being done over the internet. A large proportion of people who can afford to travel are also people who use the internet.
- **Paid advertising**. Be careful! This can be a good way to get the word out, but advertising can be very expensive and risky ... you can easily spend more than you get back. Start with only a couple of small, inexpensive ads, and *do not* spend more until you have assessed their worth.
- **Press releases**. A clever campaign of press releases can result in free promotion (articles in newspapers or magazines, or mentions on radio).

GUEST HOUSES AND BED & BREAKFASTS

A guest house is a private house offering paid accommodation. A bed and breakfast is generally a private house offering accommodation and breakfast

in a package deal. These are very general definitions, and could relate to any size of accommodation, and any standard of facility or service, although in Australia guest houses are often larger facilities than bed and breakfast operations.

Guesthouses and B & Bs appeal to many people because, as distinct from hotel accommodation with its hustle and bustle, they are able to provide a simpler form of accommodation, catering to smaller numbers of guests, and providing a more informal or even personal interaction between guests and staff/owners.

Is it Worthwhile?

Before deciding whether to embark on operating a guesthouse or bed and breakfast operation, thorough research should be undertaken. You should consider not only the suitability of your premises, but what your personal reaction is likely to be to having strangers in your surroundings.

FIRST CONSIDERATIONS

- Do you think you have the right temperament to run the business?
- Have you approached suitable organisations (e.g. tourism bodies) for relevant information?
- Have you carefully considered the cost of getting established?
- Will you feel comfortable admitting paying guests into your home?
- Have you done calculations of expenditure versus potential income?
- Are skilled staff readily available?
- Will the additional tasks involved in running the enterprise become burdensome to you?
- Have you considered zoning, health and any other regulations which might affect the way the establishment could be developed and/or operated?
- Do similar facilities exist in the vicinity?
- If so, where are they found and what are their occupancy levels?
- At which markets are they targeted?
- Could there be a market overlap with your proposed venture?
- Is there a need in the market for your proposed venture?
- What percentage of the overall market would the new venture be expected to draw?
- What markets should you target?

Structural Considerations

It is often easier to start with a new building, but this might not always be the case. Existing buildings do have their advantages — they may be more difficult to fit out than a new structure, but old buildings may offer character or history which will attract guests.

The amount of redevelopment required before opening for business can vary greatly. It really depends upon what you want to offer guests, and how

easily you want the facility to operate. Things you do at this stage can make it easier later to service guests and maintain the facility.

LAYOUT AND DECOR

Apart from bedrooms, bathing and toilet facilities, the following amenities are generally required:

- a reception area;
- a dining area;
- a food preparation area;
- a parking area;
- telephones;
- utilities.

The decor should be in keeping with the surroundings and the environment. The whole purpose of a guesthouse or B & B is to create an environment where visitors can have a restful and relaxing stay. Various things can make this difficult to achieve, such as smoke-filled rooms, garish colours or loud music.

Management

Operating a guest house or B & B involves more than just providing accommodation, cooking food and serving it to customers. It also involves such things as logistics, planning, coordination of staff and public relations, and providing an experience of a different (rural) lifestyle. This may require you to give up time to socialise with the guests. Knowledge and application of these requirements are important if the guest house or B & B is going to be successful.

Your capabilities should also include such things as:

- buying;
- inventory control;
- staffing, including employment of cooks, etc. if required;
- catering;
- the procedures for providing accommodation;
- simple accounting and recording procedures;
- organising skills.

The size of the establishment will determine the number of staff. For instance, in a small establishment with perhaps three bedrooms to let, there may be one part-time cook and a waitress/cleaner. In a larger establishment, more staff may be needed. Remember, if staff are to have days off, you may require a couple of other people rostered at different times to do their job. When a business is just starting, staff will most likely do several different jobs.

Keeping the establishment clean in all respects is essential, not only because of health regulations, but also because a clean, well-cared-for presentation is essential for customer satisfaction.

WILLING WORKERS ON ORGANIC FARMS

WWOOF is an international organisation which operates in more than 50 countries, with the aims of providing people with the opportunity to learn about organic farming and rural living by staying and working for a period on an organic farm. The farmer will provide food, accommodation and an opportunity to learn, while the guest provides labour helping out with the farm work. At the time of writing this book, Australia had about half of the world's WWOOF hosts (i.e. 700). For more information:

WWOOF Australia
Buchan, Victoria, 3885. Ph/fax (03) 5155 0218.

WWOOF New Zealand
Jane and Andrew Strange, PO Box 1172, Nelson, NZ

WWOOF UK
19 Bradford Rd, Lewes, East Sussex, BN7 1RB, UK

CHAPTER 13

Towards Better Planning

A modern farmer needs to think laterally, plan long-term, and minimise business spending on non-essentials. If farmers are to deal with problems better in the future, like the Boy Scouts they need to 'Be Prepared'.

Planning involves preparing for problems before they happen. To plan successfully, you need to be able to see what is *likely* to happen before it happens. In a rapidly changing world, this is an increasingly difficult task — often we can't be certain of what will happen until it is about to occur. However, that is no excuse to avoid planning.

Despite the uncertainty of the future, it is possible to make a relatively educated guess at what is likely to happen. Sometimes you don't know *when* something will happen, but you *do* know it will happen sooner or later (e.g. drought, cash flow problems, etc.). At other times you may not be certain of market changes (e.g. growth or reduction) but you have a basis upon which to guess the future, although of course the distant future is always harder to predict than things that are likely to happen soon.

Planning is all based on probability. You need to try to determine the likely outcomes of alternative actions and then select the course which is most 'probable' to give you the best results. If you are going to plan the future of a farm or hobby farm, you need to try to foresee the future.

New Ways of Thinking

For centuries, farming has been a very traditional and predetermined way of life. Consequently, most farmers have been relatively conservative/safe in their thought processes.

To be successful today, farmers need to be not just prepared to change, they must be more innovative than in the past — they need to actively chase new ideas and continually introduce improvements.

A successful modern farmer will probably:

- always try to be different;
- try to determine what the competition is likely to do, and introduce innovations before everyone else;
- be a lateral thinker (i.e. be able to perceive a problem from a range of different perspectives in order to devise original and innovative solutions).

ONE WAY OF THINKING A LITTLE DIFFERENTLY

Farms have always been product-based industries in that they make their money out of producing a commodity such as milk, fruit, meat, vegetables

or grain. They have sometimes partially processed their products (e.g. a dairy farm separating cream from milk), but rarely to a stage where the product is ready for retailing. Some farmers do go the extra value added step (e.g. a butcher using his own stock).

A financially struggling operation may be able to increase their economic viability by processing their produce, or by providing income-generating services such as farm tours or accommodation (see Chapter 12).

ANALYSE THE MARKETPLACE AND THE INDUSTRY

If planning is to be effective, it is essential that you be familiar with changes and trends in any relevant areas of the industry. This calls for continual vigilance and awareness of what's going on around you and in other parts of the world.

- **Be aware of your own property.** In particular keep good records (e.g. records from the past on weather for a local area). If you know what has happened in the past, you have a basis upon which to predict what is likely to happen in the future.
- **Be aware of your industry.** Developments in your industry are beyond your control, but knowing about them early will enable you to adapt faster and reduce any negative financial impact (or optimise any financial gain). You will help yourself in this respect by subscribing to trade magazines, attending shows, field days, associations/societies/clubs, searching the internet, listening to relevant radio/TV shows, keeping in touch with the local branch of the Department of Agriculture, etc.
- **Be aware of wider global developments.** Farming today is affected by industries beyond agriculture. Decisions and developments in politics, science or economics, amongst others, can result in rapid and dramatic changes to the viability of agricultural enterprises.

It is imperative to stay abreast of local, national and international news. Listen to the news daily on radio or TV, buy and read at least weekend newspapers, and perhaps follow developments on the internet. Some trade or professional associations are also good at monitoring and informing farmers of potential future impacts of developments on areas of their special interest.

Remember ... you need to have several information sources to get a balanced perspective. One source alone can often be biased, or miss out on certain information.

ECONOMIC PRINCIPLES

A basic understanding of economics should be applied to farm planning in order to ensure that financial viability is sustained.

LAW OF DEMAND

A fall in price usually creates an increase in demand, while a price rise generally causes a decrease in demand. If a greater quantity of a product is

put on the market then, other things being equal, it will be sold at a lower price.

Example: An increased supply of beef in the market results in lower prices of the commodity and therefore more people are likely to buy the beef. If supply is reduced as a result of drought, etc. then the small quantity available will fetch a greater price, which tends to reduce the overall demand by consumers but may give a higher total return to the farmer who can provide even limited supplies of beef.

LAW OF SUBSTITUTION

The demand for luxuries is elastic; the demand for necessities is inelastic.

Example: Where an item is limited in availability (such as venison) people may buy beef as a substitute if they feel the two meats are similar and one can be substituted for the other. For a luxury item such as cashmere, the demand in the textile industry may be volatile (or elastic), whereas the demand for cotton (a more basic and essential item) will be more stable (inelastic).

LAW OF DIMINISHING RETURNS

As extra resources are put into production, a point arrives where the successive extra units produced decrease.

Example: It is well known that as you increase input to a farm, you tend to obtain an increase in yield or productivity. However, a point of equilibrium is eventually reached, when input is equal to yield. Surpassing that point with additional input (labour, fertilisers, etc.) may, in fact, result in a reduced return as yield becomes less than input. In other words, if you put twice as much material and labour into producing something, and get less than twice as much product yield, your profit is reduced due to increased costs.

LAW OF DIMINISHING MARGINAL UTILITY

The more of anything you consume, the less satisfaction is experienced and, in some cases, the less of it you want.

The first hemp socks you buy may be worth a lot to you in terms of satisfaction. The second pair may still be worth a lot but the third and fourth may have lost their uniqueness and value in your eyes.

This phenomenon can have an effect on the farmer, as the 'worth' of an item to the customer may reduce if product is oversupplied. This is one of the important reasons for being early into the market with a new product or service.

Economies of Scale

More business does not necessarily mean more profit and unfortunately there is no single formula to arrive at economies of scale, because each farmer will have different variables (e.g. costs, production potential, etc.) This is where accountants and economists can be helpful; so can an experienced adviser from your local Department of Agriculture.

Often when a business expands to produce more, it will find that the amount of profit per unit produced will decrease. There are usually a series of barriers which need to be broken through before moving on to greater profit. It can work something like this:

- A farm sells $200 000 of produce and has a profit of $35 000.
- When the sales increase to $210 000, there is more cost involved in production (e.g. more fertiliser, labour and marketing costs) and the profit drops to $34 000.
- When the farm sells $250 000 of produce, though, the profit increases to $40 000.

Change, But Slowly ...

No business, farms included, can afford to remain stagnant in the modern world. If you do not manage the farm to achieve continual change, your business will probably shrink. The trick is to achieve a *manageable* growth in appropriate areas. Excessive growth is risky, not just because it involves greater uncertainty; but also because it requires a much greater increase in management effort and skills, especially in the expertise required.

If a farm business is to be sustained, you must know everything that is happening in order to maintain control.

A PLANNING PROCEDURE

Every farm needs a different type of plan: different in emphasis, different in content and different in structure. Given that each farm has different priorities and operates under a different set of circumstances, it is impossible to follow a 'generic' or standard approach to planning.

You do need to plan all aspects that are important to your operation, including production, finance, land care, facility and equipment management, marketing, product processing (if relevant), and physical layout (i.e. design of the farm).

Planning in each of these areas will involve:

- determining decisions which need to be made in order to prepare for the future;
- gathering information upon which to base those decisions;
- analysing that information;
- considering the options, and the likely outcome of each option;
- selecting the most appropriate option, based upon the information available;
- acting on the selected option;
- reviewing the situation periodically and, if necessary, modifying the action being taken.

A well-organised and experienced farmer might not need to be too rigid in adhering to a procedure like this; however, many farmers will find a real

benefit in working through such a systematic procedure 'on paper'.

The surest way to succeed is to move through this procedure step by step; writing down everything as you go. This give you a chance to ponder over what you have written, add new thoughts, or make alterations.

OTHER APPROACHES TO PLANNING

There are many different ways to approach planning on a farm. Commencing with a drawn plan of the farm, with all assets and land features illustrated, lets the farmer plan other land management strategies.

Often a farmer will be encouraged to follow a particular procedure or model that has been established by so-called 'experts'. From time to time, such new 'models' emerge and become popular or trendy — generally they emphasise one aspect or another in response to deficiencies perceived in other approaches to planning.

'Whole Farm Planning', for example, emphasises a holistic approach, where consideration is given to everything (i.e. not just the economics, but also conservation, health and wellbeing of the farmer, family, staff, etc.).

A 'Business Plan', in contrast, concentrates on the 'business' and is not particularly concerned with the social impacts involved.

The *approach* you take to planning is not as important as the fact that you *do* plan. Different things are of different significance on different farms; so whatever procedure you follow, you will probably need to modify it according to where you put your emphasis and what is important to you.

Just keep it logical, and think things through before making decisions.

DECISIONS

The farmer needs to make decisions every day, but each decision varies in terms of:

- **Significance.** Some decisions will have a greater impact than others (e.g. buying new land or changing agents). Obviously more significant decisions warrant more careful planning.
- **Timing.** Some decisions need to be made frequently (e.g. buying fertiliser or stock food). Good planning may involve establishing a procedure to help with such decisions (e.g. re-order when the quantity in stock drops to a certain level). Some decisions need to be made straight away (e.g. treatment of a serious disease), while others might not matter if they are delayed (e.g. replacing a fence).
- **Permanence.** Some decisions are permanent (e.g. planting an orchard), while others are easier to change (e.g. the amount of water applied each week).

WHAT TO PLAN FOR

There are many different things which might require planning decisions on a farm, and each decision needs to be based upon sound information. The decisions and corresponding information requirements which follow are typically dealt with in farm planning. The relative emphasis given to

different aspects (e.g. production, finance, marketing, welfare, etc.) will vary depending upon what is more important to a particular farmer, and to his/her particular circumstances.

Production

A production plan is a strategy for growing or processing a particular product. It might begin with a statement of what you aim to produce, followed by an analysis of relevant information, and then a determination of decisions and actions based upon the information analysed.

An approach that can sometimes be appropriate might be to simply prepare a production schedule or timetable (i.e. a statement of the tasks that need to be undertaken, step by step, in order to produce a particular product). An example is given in Table 13.1.

Table 13.1. A simple production plan for growing a carnation cut flower crop

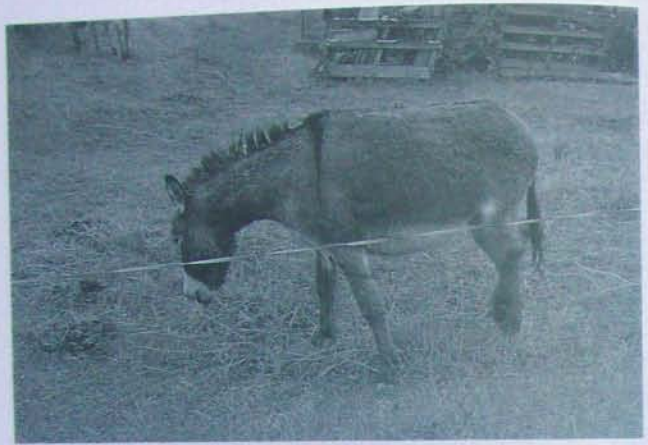
Week	Action
1	Sow seed in 75 per cent sand and 25 per cent peat and place in greenhouse.
2	Check for germination. Keep well watered.
3	Check for damping off, thin out if necessary. Spray fungicide if necessary.
4	Plant seedlings into rockwool slabs. Spray with insecticide (Malathion) for caterpillars, etc. Feed with high-nitrogen fertiliser.
6	Check for insect and fungal problems. Remove affected leaves and plants, or spray.
8	Treat with fungicide.
10	Check for disease, insect damage and nutrient deficiencies.
12	Harvest.

(NB This is only one of many possible ways to grow carnations.)

INFORMATION

The following are examples of information that might be collected and analysed:

- **Climate.** (average rainfall per month, number of rainy days, minimum and maximum temperatures, evaporation, etc.). Preferably collect 'actual' climate details from the closest relevant location, keeping in mind that each part of a farm is different, with its own microclimate (e.g. rain shadow, extra shade, more wind, steep slope, facing north).
- **Public demand for products/services.** The first person to produce a new product or service has to spend a lot of time and money 'selling' it. The next group of producers can cash in on the initial selling, and so get the sales before the market becomes saturated. They may concentrate on a part of the market in which you developed a niche.



Good planning involves consideration of all the options, and modern farming offers more options than ever before. Fencing, for instance used to be timber or wire, but today (as seen with this donkey) a single electrified strand can be just as effective.

- **General health of animals and crops.** Information is generally readily available for traditional products grown locally, but it may be more difficult to learn about those not yet established with local farms. Often, looking to similar climates in other countries where the same product is grown can turn up useful advice.
- **Period till harvest/selling of crop/animals.** This varies greatly according to the produce being considered and can depend on the time of year when production is started. (Note: Demand or growth might slow down in very hot or cold weather.)
- **Business finances.** Traditional sources are banks, but there are other options (e.g. taking in a partner or buying franchises with extended payments).
- **Average value of crop/stock over several years** (5 years would be appropriate). The seasonal price fluctuations should be obtained, if possible, from an appropriate authority (e.g. the Australian Wheat Board, Department of Agriculture, trade organisation). Remember that some products are subject to greater-than-normal price fluctuations.

STRATEGIES

Having gathered and analysed the necessary information, some of the decisions that might need to be made are:

- *what* you will produce in the future (varieties), *quantities* (how much), *when* (production timetable);

- preferred cultural technique; which machines are preferred for production;
- how best to control pests, diseases, etc.;
- timing of harvesting, method of harvesting, processing techniques;
- mixed row cropping or monoculture;
- stocking rate on land;
- breeding, weaning and growing of stock animals;
- fencing construction costs;
- use, cleaning and maintenance of buildings and equipment (e.g. servicing of farm machinery);
- establishment of markets and buyers;
- ensuring that different enterprises are compatible with each other.

Finance

A financial plan is a type of budget, usually revised every 12 months. It requires the same processes of information collection and analysis, and subsequent decisions, as are needed for production planning.

INFORMATION

Examples of information that might be collected and analysed are:

- What have you been spending money on? You need a breakdown of expenditure over the past few years.
- Current liquidity — what can you afford to invest, or what do you need to borrow?
- growth and profit results;
- total labour costs, including your own and your family's replacement cost (e.g. if your 20-year-old son left home);
- product details (costs and specifications of any possible capital expenditure).

DECISIONS

You will probably need to explore and make plans for at least some of the following:

- cutting costs without impacting on the farm outcomes;
- speeding up harvesting with improved technology;
- off-farm investment options (e.g. investment accommodation at a tourist resort, or the stock market);
- maintenance or replacement of machines;
- identification of point of diminished returns (i.e. the point at which further significant investment may increase production without increasing profit). There is no point in having a bigger farm and working more, unless there is a greater profit.
- assumptions of yields and prices;
- target profit margins;

EXAMPLE: STRUCTURE OF A FINANCIAL PLAN

1. Financial objectives

This should describe what the short- and long-term financial aims are. These might be, for example, to obtain an income, service loans and, in addition, make a profit that reflects a return on investment. Determine the short- and long-term financial objectives. Short-term goals may be top produce, an income to live on, service loans, and a cash flow to carry over low-income periods (e.g. between woolclips). Long-term objectives may be to conserve the soil by introducing organic farming methods paddock by paddock, or to gradually increase the production of a stud while converting from a traditional farming operation.

2. Financial forecasts and assumptions (educated guesses)

- **Cash flow.** This needs to be based upon assumptions not only about the amount of money that will be moving in and out of the business, but also when cash will move. Cash flow needs to cover the low income and/or high expenditure periods of the year (e.g. shearing costs before wool sale proceeds arrive, or cost of building accommodation in preparation for home-stay guests).
- **Profit and loss.** This will involve estimated income from sales, expenditure on operating costs (e.g. materials) and a consideration of any depreciation of assets.
- **Balance sheet.**

3. Financial analysis

- **Statistical analysis** of past and projected figures can help determine trends, and in turn give an indication of the likely future of the business.
- **Ratio analysis** involves determining the ratios of two different figures (e.g. return on investment compares the amount of profit over a 12-month period with the total amount of money invested in the farm).
- **Break-even analysis** considers costs and income, to determine the quantity of business required to break even (any business above that point will then be profit).
- **Sensitivity analysis** considers the factors to which profit is most sensitive (e.g. selling price and exchange rate) and analyses the business to determine the level (quantity of business) at which the business will be vulnerable.

4. Budget plan

There are many different ways of going about preparing a budget. Whatever approach is used, the budget is normally prepared following a series of systematic steps like the following:

Step 1. Gather all information you can to help with preparing the budget, such as:

- financial records from the previous year;

- estimated income (i.e. money available). In some circumstances your accountant may tell you this, otherwise you may need to make the estimate. The Bureau of Statistics can be helpful, as well as various agricultural, rural, retail and service organisations.
- List all the areas on which you need to spend money and beside each make notes about what needs to be spent, what could be purchased, what time of year spending is heavier (there might be more overtime paid to staff at one time), etc. The list should include such things as wages, insurance, rent, repairs, hire of equipment, materials, advertising, telephone, water, electricity, fuel, etc.

Step 2. Draw up a chart with 12 columns across the top (one for each month of the year) and list down the side each category on which you plan to spend money. You can then begin filling in the chart.

Land Management

A well-conceived plan for the way in which the land is managed will ensure long-term farm sustainability and minimise the risk of land degradation.

INFORMATION

Examples of information to be collected and analysed are:

- **Land contour maps.** Check with your local Agriculture Department or equivalent. In or near populated areas there are often aerial photos available to provide details of roads, hills, buildings, trees, etc. These are particularly useful when in colour.
- **Location of established fodder trees.**
- **Environmental waste management procedures.** Government authorities often have a lot of written material available on waste management, as well as advisers for specific requirements. Wherever there is a suspected contaminated land area (e.g. disused cattle dip) then a 'waste consultant' should be engaged to investigate the potential pollution and advise on possible remedies. Such consultants are generally listed in the telephone Yellow Pages.
- **Land conservation reports and departments.**
- **Easements or other restrictions on land use.** Check the title deed for easements and other restrictions (e.g. power line access, easement for national horse trail). Check for possible future use of the land (e.g. widening of roadways, power line construction). Check that all fences, including boundary fences, are in the correct position and in good condition.

DECISIONS

Examples of decisions that might need to be made:

- how to ensure survival of stock through periods of drought or flood;

- how to ensure that the fertility of soil does not degrade;
- how to dispose of potentially harmful waste products. The local council or government authority will often advise where and how to dispose of these products. For instance, in Australia a licensed carrier must be used for transport of dangerous goods weighing more than 250 kg (550 lb).
- how to prevent erosion. Advice is available from government authorities (e.g. Soil Conservation Service). A major method of erosion control is to attempt to slow the speed and volume of water flowing over areas of concern. Grassing and contouring slopes will usually achieve these objectives.
- how to manage the farm so that it does not harm native species. The National Parks and Wildlife Service (or equivalent) will advise on this. There are also local wildlife preservation societies which can be helpful. A local veterinarian may also be able to advise.
- how to prevent contamination of waterways by chemicals and effluent. Contamination can originate on your property or neighbouring properties (e.g. a local sewage plant can give elevated levels of copper, selenium and zinc in downstream water). Dumping empty pesticide containers in a gully can also lead to problems downstream.
- how to divide the property (e.g. into paddocks, what different areas will be used for, what areas will be for conservation and what will be farmed, etc.).
- how to manage irrigation to minimise waste water and prevent leaching excess minerals from soils.

Check the type of soil, especially subsoil, on the property. Check particularly for acid sulphate soil.

Marketing

INFORMATION

Examples of information to be collected and analysed:

- market research and an independent consultant's advice;
- data from Bureau of Statistics could be very helpful.

DECISIONS

Examples of decisions that you might need to make are:

- What contingency arrangements do I have to locate alternative markets if a usual market fails?
- Is it worth producing add-on marketing and/or value added products? (Once you have a customer for one product, it may be possible to produce further items that are attractive to the same customer, thus increasing the total sales each time you sell to them.)
- Shall I market my products at the top quality range or middle price range?
- Do I deal directly with the buyers or do I use a trader?

EXAMPLE: STRUCTURE FOR A MARKETING PLAN

1. Marketing objectives

Both short- and long-term objectives need to be determined in terms of what is to be sold, how much is to be sold, and into what markets it is to be sold.

Short-term objectives, for instance, might be to establish and maintain regular local customers (e.g. sale of sweet corn to a local fruit and vegetable shop, if near an outlet and visited frequently already); a long-term objective might be to extend into interstate or international markets.

2. Market analysis

This involves evaluating the farm's past performance, identifying and analysing competing suppliers, and evaluating the likelihood of changes in costs and/or prices, in the short and long term.

3. Sales predictions

Determine the most likely short- and long-term sales, price and volume based upon trends and any other available information.

4. Develop strategies

A series of marketing strategies should be established, and regularly reviewed and updated.

Product strategies specify what the product is — how it will be prepared for market, whether there will be a selection or grading process to ensure a uniform quality to certain markets, or certification for entry into the organically grown produce market.

The **pricing strategy** specifies how prices should be established based on production costs and yields, and the possible influence of local and world price trends and demands. As an individual, the farmer has very little control over pricing, but if he/she is part of a co-operative then it is possible that some control might be achieved. For example, by differentiating their product (let's say 'Farmer's Valley Cheese) from other similar products, they may market the cheese as a better product (for any number of reasons) and therefore sell it at a higher price.

A **promotion strategy** will involve maintaining a good relationship with established customers, as well as seeking out and encouraging new customers.

A **distribution strategy** involves planning and preparing for the way the produce reaches the customers, from transport (your own or by contract carrier), in bulk or packaged form, refrigerated or not, etc.

Personal Welfare

This involves planning to ensure the personal wellbeing of the people who work on (or are affected by) the farming operation. It involves giving due

consideration to Workplace Health and Safety issues (e.g. training and instruction for safe use of equipment, staff accommodation, lunch room, etc.), psychology, financial planning, superannuation, accident insurance, etc.

INFORMATION

The following information should be collected and analysed:

- Copies of laws applying to the health, safety and wellbeing of staff (e.g. Workplace Health and Safety legislation, Employee Benefits legislation, PAYE taxation, superannuation).
- Accountant's report.
- What is the health status of staff? Does anyone suffer a condition (even minor) which may affect their work (e.g. asthma, allergies, susceptibility to back complaints, etc.).

DECISIONS

The following situations may call for decisions:

- Are employees (including family) stressed physically or mentally by work?
- What award wage rates and consultancy rates apply?
- What farm insurances should be taken out?
- Are work and handling conditions appropriate to minimise risk to fitness or health?
- Are amenities adequate to cater to the wellbeing of staff?
- Are personal commitments, including family, appropriately catered for?
- Are appropriate work practices already in place, or do existing practices need to be modified to enhance the health status of workers?

EXAMPLE: A SIMPLE PLAN FOR FAMILY WELLBEING ON A FAMILY FARM

Aim:

To minimise risk of on-farm accidents and avoidable deterioration of the physical or mental health of all members of the family who live and work on the farm.

Analysis:

Situation:

A poultry farm. There are four family members:
Father (48 yrs old) and son (23 yrs old) work 12-hour days on the farm.
Mother (47 yrs old) splits her time between the farm and a part-time secretarial job.
Daughter (13 yrs old) performs some daily chores. All are healthy and fit.

Problems identified:

No one knows how to apply cardiopulmonary resuscitation (CPR).
No family member has had a holiday for several years.

Tractor accidents are not uncommon on farms, but with appropriate planning and adherence to workplace health and safety regulations their likelihood is minimal.

Action:

Mother and son will do a St Johns Ambulance First Aid Course. Son will take a holiday at a quieter time when daughter is on school holidays and is able to help; then, at another off-peak time, parents and daughter will take a holiday, leaving the son to run the place.

PLAN DRAWING OF THE FARM

The first step towards arriving at a property development strategy is to draw a plan of the farm. Drawn to scale and illustrating important attributes such as contours, creeks, hills, cliffs, etc. this map of your property will aid in the appropriate exploitation of useable land and the most economic land use. Details such as existing trees, river banks, fences, soil types, direction of summer and winter winds, will all aid future planning processes. If you have recently purchased the property, some of this information may be available from previous farm owners, local council departments and even Lands Departments.

The inclusion in the map of existing building structures and knowledge of work patterns and access routes can will allow efficient time management and will also enable optimum siting of future buildings.

If sheds and the farm residence are placed close together it will reduce time to get from work to home, aid in better husbandry of animals and crops, improve security around the farm and reduce transportation between various components of the farm. If it is a new farm location, careful placement of the buildings may even reduce costs. For instance, a house built close to

the road will reduce connection costs of electricity, phone and other services).

The siting of the house and farm buildings should take into account the agricultural value of the land, central location of the house to all useable land, flood levels, etc. Good land should not be built on — it should be reserved for agricultural use — but if the property is flood prone, then a compromise needs to be made. Check how often the land, or any part of it, has been flooded.

The location of farm buildings may also be determined by their use and function in the running of the farm. For instance, hay sheds should be downwind to residences in case of fire; piggeries, poultry sheds, etc. should also be placed downwind to any farm residences due to dust and odour. Consider the downwind land uses in neighbouring parcels of land.

Always remember to allow appropriate thoroughfare for machinery. Ensure safety when driving machinery in terms of overhead powerlines, steep slopes and edges of access tracks (weak road shoulders and gullies).

Having a natural source of water on the land is every farmer's dream. Considering it is actually a resource, many districts require registration for tapping that resource. Extra care is needed when looking at the potential of pollution into the waterways by others upstream of your farm. Water problems can relate to underground water movement as well as more obvious surface water. Both types of water can bring pollutants from outside of the property.

Note that a licence is usually required to sink a bore or to install a pump from a surface water supply (e.g. river or lake), with the volume controlled by the licence requirements.

Water quality is important for crops, animals and humans and a water purity and quality assessment is therefore recommended. In remote districts, it is crucial to employ water conservation techniques such as water harvesting, selection of dryland species, etc.

Fencing is placed to maximise land use, assist ease of access through the property, mark off damaged areas (e.g. unstable ground, erosion-prone soil) and to restrict animal grazing.

Efficient farming depends a great deal on getting your priorities right, identifying those tasks on the farm which need to be done before other jobs are undertaken. For example, this may mean finishing the fencing on the deer farm before the shed extension is started. In another situation it may be as simple as fixing up the house so that you can safely live in it before you tackle other farm buildings.

Money is one of the biggest burdens for the farmer and anybody considering alternative or new farming practices must identify their present financial limitations so that they can plan the new enterprise fully aware of financial constraints. These constraints may slow down the full farm operation, but it is a safe management strategy for the farmer to follow. Take one step at a time, do not jump in head first.

RISK

There is always risk involved in any business, and a farm is no exception. Good planning, however, can minimise the risk of calamities occurring.

Spreading the Risk

One of the best ways of reducing risk is to spread your investment. If all your assets are in the farm, and the farm fails to return an income or provide adequate cash flow, you will have no income at all. If you have 'some' of your assets invested outside of the farm, you can continue to receive an income to some degree, even in poor seasons.

For example, a farmer who diversifies into beef and ostriches plus fibre plants will probably still get income from the ostriches in severe drought, when the other two have failed. In another year a disease could break out with the cattle, leaving the farmer to finance the farm on the back of ostriches and plant fibre. This also evens out the short-term cash flow.

Investing some of the yearly profit into a set saving system, e.g. superannuation, is one way to preserve some of the yearly profit. This normally cannot be cashed in and used until the designated time of retirement. Unfortunately this locking away of money has been of no help in the past, but recent alterations to the laws have made access to the money possible in cases of severe financial difficulty.

Another way to spread the risk is with insurance. By investing money into insurance to cover a crop or stock, you basically end up gambling on the event of a disaster. Should this disaster occur, and if it falls within the categories of the insurance, the farmer will be paid out accordingly. Insurances usually only exist for the duration of the particular crops or stock. Although not cheap when first looked at, the financial benefit in the case of a disaster is life-saving for the farmer. Premiums and risk are based on probabilities and as most farms do not insure their commodities/crops/herd, and as disasters do not occur regularly, there are few pay outs. Disasters normally considered for coverage include fire, flood, catastrophe (for crops this would include hail, storm, etc.). Other areas covered by insurance are normal business occurrences such as accident, worker's compensation, loss of income (i.e. if your normal income stops, then you are paid a specified amount for a stated period of time).

QUALITY SYSTEMS

Quality assurance or quality systems have become buzz words in many industries in recent years. By implementing a quality system, even a very basic one, a greater control is exercised over procedures, hence risk can be reduced. The concept essentially involves:

- writing down the procedures which are followed when doing various work tasks, e.g. step by step how you milk a cow, harvest vegetables, or process accounts;

- developing a procedure to review and make changes or corrections in response to either a procedure not being followed, or a procedure not working properly.

A quality system, although often considered an additional expense, can be an effective way of improving farming practices, minimising costs, assisting in change and offering a greater range of potential customers.

CONTINGENCY PLANNING

Risk can be reduced by contingency planning, which involves preparing 'escape routes' to use in the event of something going wrong.

1. Identify the areas of greatest risk.
2. Devise procedures to deal with identified problems that might occur.
3. Prepare to implement these procedures if the need arises. This might involve training staff or buying in equipment.

EXAMPLE: A CONTINGENCY PLAN TO DEAL WITH FIRE

1. Identify location of fire and items/persons at risk.
2. Clean combustible materials away from work areas, residences, stables, fence lines and other structures. Clearly mark safe exit zones and keep these as clear thoroughfares. Have a fireproof safe or store unit for business records or other non-replaceable items.
3. Train staff in fire prevention and control measures. Train staff in use of fire control equipment, and fire burn first aid. Maintain operational fire extinguishers that are checked according to specifications.
4. Check all fire-fighting equipment monthly. Start motors weekly.

Liquidity

Risk is greatly reduced if you always maintain adequate liquidity. It is essential that a business always has the ability to pay for the cost of operating itself. This may be achieved by holding adequate cash in reserve or, alternatively, by developing and maintaining a facility by which adequate cash can quickly and easily be raised (e.g. through overdraft facilities, by being able to return unsold goods to the suppliers, or by having assets which are very easily converted into cash). This ability to access funds is referred to as 'liquidity'. A business with good liquidity is able to survive unexpected occurrences; without it, an enterprise could fail if something unexpected happened.

Financial Records

It is extremely important to keep accurate, clear and accessible records of all financial transactions which take place in a business. Different businesses have different types of bookkeeping systems — there are many options. The ideal system for you is the one that gives you the detail you require but doesn't take much time to maintain. Financial records are needed because:

- Financial records help you manage your finances.

- You can make decisions about what something is likely to cost in the future by seeing what it cost in the past.
- Financial records allow you to see whether your business is making a profit or loss.
- They give you a basis upon which you can calculate what you will charge your customers/buyers.
- They allow you to prepare and submit your tax returns.
- They are legally required by government.
- You can track the fluctuation in cash flow, month by month.

Controlling Growth

It is dangerous for a business to experience too much growth too quickly. Uncontrolled growth can lead to failure of what started out as a booming success. In new agricultural businesses with new crops/animals it would be easy to become disoriented by a fast growth rate. Symptoms of uncontrolled growth might be:

1. excessive increase in farm staff numbers;
2. confusion in lines of authority, with too many staff taking on similar duties;
3. runaway costs (be aware of the law of diminishing returns).
4. lack of overall coordination;
5. improperly trained or inexperienced staff;
6. climbing turnover rate beyond a comfortable restocking rate;
7. general dissatisfaction or even dissension amongst staff.

A farm is ready to expand when most of the following is happening:

- Products or services are being produced at competitive prices.
- The business is taking pride in its work.
- Lines of communication within the business are good.
- Management's attitude is flexible, innovative and growth-oriented.
- Sales are gradually increasing.
- Costs are being controlled closely.
- Employee morale is high.
- There is a lot of talent within the existing staff.
- The business is oriented towards marketing.

Appendix: Courses and Videos

AUSTRALIAN CORRESPONDENCE SCHOOLS

Established by the author of this book, the Australian Correspondence Schools run a wide variety of agricultural and horticultural courses by correspondence (external studies), including a range of Advanced Diplomas, which are government accredited and Austudy approved.

The schools have also produced a range of educational videos.

For a free copy of the schools' handbook and a list of videos, contact:

Australian Correspondence Schools
PO Box 2092 Nerang MDC, Qld, 4211
Ph: (07) 5530 4855, Fax: (07) 5525 1728

or

264 Swansea Rd, Lilydale, Victoria, 3140
Ph: (03) 9736 1882, Fax: (03) 9736 4034
The schools can be e-mailed at admin@acs.edu.au

Further details on the schools' courses, as well as careers advice, and other information, can be found on the internet web sites at:

www.acs.edu.au
www.acs.edu.au/agriculture
www.acs.edu.au/hort

There are more than 270 courses available, including:

- Agricultural Marketing
- Farm Management
- Hydroponics
- Animal Health
- Animal Nutrition
- Ecotourism
- Aquaculture
- Cut Flower Production
- Land Care
- Bed & Breakfast Management
- Horse Care
- Alternative Energy
- Permaculture
- Waste Management ... and many more

AUSTRALIAN ORGANISATIONS

Aquaculture Council of WA
PO Box 55, Mt Hawthorn, WA, 6016
Ph: (08) 9244 2933, Fax: (08) 9244 2934

Australian Alpaca Association Inc.
Private Bag 4200, Box Hill, Vic, 3128
Ph: (03) 9899 1099, Fax: (03) 9899 1055

Australian Conservation Foundation
340 Gore St, Fitzroy, Vic, 3065
Ph: (03) 9416 1455, Fax: (03) 9416 0767

Australian Freshwater Crayfish Farmers Association (National)
RSD 610, Keith, SA, 5267
Ph/fax: (08) 8756 6056

Australian Hydroponics Association
PO Box 823, Murwillumbah, NSW, 2484

Australian Institute of Agricultural Science
Suite 303, Clunies Ross House, 191 Royal Pde, Parkville, Vic, 3052
Ph: (03) 9347 1148, Fax: (03) 9347 1792

Australian Institute of Horticulture Inc.
15 Bowen Cres, West Gosford, NSW, 2250
Ph: (02) 4325 4088, Fax: (02) 4324 2563

Australian Ostrich Association
PO Box 4049, Auburn South, Vic, 3122
Ph: (03) 9819 6822, Fax: (03) 9819 6833

Australian Rare & Minority Breeds Assoc.
PO Box 14, Elphinstone, Vic, 3448

Bio-dynamic Farming & Gardening Assoc.
PO Box 54, Bellingen, NSW, 2454
Ph/Fax: (02) 6655 8551

Biological Farmers of Australia Co-op Ltd
PO Box 3404, Toowoomba Village Fair, Qld, 4350
Ph: (07) 4639 3299, Fax: (07) 4639 3755
Email: bfa@icr.com.au

Commercial and Recreational Fish Hatcheries Association Inc.
MS 379, Albington Rd, Childers, Qld, 4660
Ph: (07) 4126 1844, Fax: (07) 4126 2284

Country Women's Association
1 Benson St, Benalla, Vic, 3672
Ph: (03) 5762 1348

Ecofibre Industries Association of Australia
15 Belmont Crescent, Paddington, Qld, 4065
Ph: (07) 3369 5925, Fax: (07) 3369 1255

Emu Farmers Federation of Australia
PO Box 98, Moonta, SA, 5558
Ph/Fax: (08) 8825 3812

Equestrian Federation of Australia – National Branch
52 Kensington Rd, Rose Park, SA, 5067
Ph: (08) 8331 8411, Fax: (08) 8364 4080

Essential Oil Producers Association of Australia
PO Box 385, Mudgee, NSW, 2850
Ph: (02) 6373 3539, Fax: (02) 6373 3437

Forest Products Association
PO Box 903, Darlinghurst, NSW, 2010
Ph: (02) 9360 4022, Fax: (02) 9361 0374

Greening Australia
GPO Box 9868, Canberra, ACT, 2601
Ph: (02) 6281 8585, Fax: (02) 6281 8590

Llama Association of Australia Inc.
RSD E1328 McFarlanes Lane,
Mt Egerton, Vic, 3352
Ph/Fax: (03) 5368 9616

National Association for Sustainable Agriculture Australia (NASAA)
PO Box 768 Stirling, SA, 5152
Email: nasaa@dove.mtx.net.au

National Landcare Advisory Committee
GPO Box 858, Canberra, ACT, 2601
Ph: (02) 6272 4196, Fax: (02) 6272 5618

National Farmers Federation
PO Box E10, Queen Victoria Tce,
Canberra, ACT, 2600
Ph: (02) 6273 3855, Fax: (02) 6273 2331

Permaculture Institute
PO Box 1, Tyalgum, NSW, 2484
Fax: (02) 6679 3567
Email: perminst@peg.apc.org

Seed Industry Association of Australia
PO Box 276, Blackburn, Vic, 3130
Ph: (03) 9878 0118, Fax: (03) 9878 8426

Warm Water Aquaculture Association
30 Cecil St, Kew, Vic, 3101
Ph: (03) 9817 3043, fax: (03) 9816 9930

Women in Agriculture
Co-ordinator, Department of Natural Resources & Environment
7 Service St, Bairnsdale, Vic, 3875
Ph: (03) 5152 0400, Fax: (03) 5152 0444

World Sustainable Agriculture Association
c/- Communications Co-ordinator,
PO Box 3132, Manuka, ACT, 2603
Email: sanmedia@peg.apc.org

OVERSEAS ORGANISATIONS

Alternative Farming Systems Information Centre
National Agricultural Library, Rm 304
10301 Baltimore Ave
Beltsville, MD 20705-2351, USA
Fax: 301/504-6409
URL: nal.usda.gov/afsic

British Institute of Agricultural Consultants
The Estate Office, Torry Hill, Milstead,
Sittingbourne, Kent, ME9 0SP

Commercial Horticulture Association
CHA Secretariat, PO Box 8, Harrogate,
North Yorkshire, HG2 8XB, UK
Email: 100450.2631compuserve.com
URL: www.ukexnet.co.uk/hort/cha/
(This association links manufacturers, organisations and services together)

Elm Farm Research
Hamstead Marshall, nr. Newbury,
Berkshire, RG15 0HR, UK
Email: 100113.751@compuserve.com
(A research and advisory organisation concerned with organic and sustainable farming)

Henry Doubleday Research Association
Ryton Organic Gardens
Coventry, CV8 3LG, UK
Email: enquiry@hydra.org.uk

International Herb Association
National Office, PO Box 317,
Mundelein, IL, USA 60060-0317

Tropical Agriculture Association
Contact: Peter Brown, 1 Church Lane,
Hellingly, East Sussex, BN27 4HA, UK

Farming on Line
Castle Farm, Main St, Kirby Muxloe,
Leicester, LE9 2AP
Services to farmers on the net
Email: info@farmline.com

CGIAR
(A cooperative association of agricultural organisations co-sponsored by the World Bank and United Nations)
1818 H Street, N.W., Room J-4073,
Washington D.C. 20433, USA
Email: cgiar@cgnet.com
URL: www.cgiar.org

Council for Agricultural Science & Technology
4420 West Lincoln Way, Ames, IA,
50014-3447, USA
Email: cast@cast-science.org
URL: www.cast-science.org

Kerr Centre for Sustainable Agriculture
PO Box 588, Highway 271 South,
Poteau, OK 74953, USA

Institute of Horticulture
General Secretary: Angela Clarke
14/15 Belgrave Square, London, SW1X 8PS, UK
Email: ioh@horticulture.org.uk

Rodale Institute
Kuztown, Penusylvania, USA
URL: www.envirolink.org/seel/rodale/

Manaaki Whenua Landcare Research
New Zealand
URL: www.landcare.cri.nz/

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OTHER AGRICULTURAL BOOKS PUBLISHED BY KANGAROO PRESS

Agricultural Tractors in Australia
Australia's Pest Animals
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Landscape Your Garden
Nursery Management
Pig Keeping
Plants for Sale
Pure Breed Poultry Raising
Successful Gardening in Warm Climates
Sustainable Agriculture
World of Classic Tractors

In a world where markets, technology and climates are changing as never before, it is not enough for today's farmer to do things as they have always been done. But change need not be bad news. *Profitable Farming* shows that for the farmer who is willing to think laterally and has planned ahead, there are many new opportunities for making money from the land — whether by changing the core business of a farm or simply diversifying for extra income and security.

Profitable Farming features a comprehensive survey of new enterprise possibilities, but more importantly, it explains *why* change might be warranted and how to change with the minimum of risk.

Topics covered include:

* specialised crops and livestock;
* farm tourism;
* reducing costs through self-sufficiency and energy conservation;
* long-term planning and management of resources;
* value adding to produce;
* dealing with degraded land;
* working with climate change.

JOHN MASON is a qualified horticulturalist, the founder and principal of the Australian Correspondence Schools and is author of many successful gardening, farming and horticultural books published by Kangaroo Press.

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