CHAPTER 1 INTRODUCTION

For decades farmers have relied upon chemicals to control pests and diseases in order to produce saleable crops. In the ornamental, vegetable and fruit gardens reliance on chemical controls has also been the mainstay for many gardeners. Unfortunately it is only recently that we have become aware that many of these chemicals are dangerous to humans, let alone the environment. Natural gardening has however increased in popularity in recent years due to the conscious awareness of safety in the garden, the protection of the environment, plus the desire to produce uncontaminated crops that are healthy to eat.

The renewed interest in natural gardening means that many people are seeking information that will direct them towards sustainable gardening techniques. Natural gardening should have an environmentally sound approach that helps people work in and enjoy their gardens but also protects the birds, insects, animals, plants, soils and water that are part of the natural environment. This book will lead you through these practices and guide you to naturally maintain your garden and develop it into a slice of Eden!

DIFFERENT WAYS TO GARDEN NATURALLY

Natural gardening works with nature, rather than against it. It recognises the fact that nature has many complex processes which interact to control pests, diseases, and weeds, and to regulate the growth of plants.

Chemicals, such as pesticides and artificial fertilisers can reduce both the overall health of the environment and the quality of garden produce. Undesirable long-term effects such as soil degradation and imbalances in pest-predator populations also tend to occur. As public concern grows, these issues are becoming increasingly important. Natural gardening techniques aim to maintain the quality and integrity of the environment, as well as the produce we grow in our gardens and farms.

There are a variety of ways of growing plants that work with nature rather than against it. Some are techniques that have been used for centuries. Some of the most effective and widely used methods are outlined here.

ORGANIC GARDENING

Organic plant growing is the production of plants without the addition of artificial inputs such as chemicals that have been artificially manufactured or processed. This includes herbicides, pesticides and fertilisers.

Organic growing has increased in popularity over the past ten years due to the increasing awareness of safety in the garden and on the farm and the desire to produce food that is free from chemical inputs. For decades, farmers and growers have relied upon chemicals to control pests and diseases in order to produce crops for sale. Unfortunately it is only recently that we have become aware that many of those chemicals can sometimes cause health problems to humans, as well as long-term damage to the environment such as soil degradation, imbalances in pest-predator populations can also sometimes occur. As public concern grows, these issues are becoming increasingly important. However the organic grower or gardener should understand that not all organic practices always guarantee a healthy environment, over-cultivation for example can also lead to soil damage. Organic growing practices should aim to ensure quality of both the environment in which we live and of the produce we grow in our gardens and on our farms.

A growing interest in more environmentally sustainable gardening methods offers the chance to provide the general public the quickest, safest and most enjoyable organic garden practices. This course will lead you through these practices and guide you to develop and maintain your plot, large or small.

Organic Garden

Organic growing of plants works with nature, rather than against it. It recognises the fact that nature is complex and accordingly endeavours to understand interactions between plants, animals and insects. It therefore encourages the gardener for example to learn about the life-cycle of pests and to use this knowledge to control them. It also recognises that the use of chemicals has to be replaced with labour and management. Organic gardeners/growers have to manage pests rather than eliminate them. They need to be vigilant and have the ability to recognise problems and act quickly to minimise the spread of both pests and disease. They may also need to accept some insect damage to the plants they grow as inevitable. How to manage pest and disease

problems in an organic system is covered in detail later in the course.

Organic gardening and farming have been given a variety of names over the years - biological farming, sustainable agriculture, alternative agriculture, to name a few. Definitions of what is and isn't 'organic' are also extremely varied. 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.

Practices which are typical for organic systems are composting, intercropping, crop rotation and mechanical or heat-based weed control. Pests and diseases are tackled with naturally-produced sprays and biological controls (e.g. predatory mites).

One of the foundations of organic gardening and farming, linking many other principles together, is composting. By combining different materials, balancing carbon and nitrogen levels, coarse and fine ingredients, bacteria and worms act to break down the waste products. Composting produces a valuable fertiliser that can be returned to improve the soil. Natural biological cycles are promoted, 'wastes' are re-used and the need for external supplies of fertiliser are reduced or cut altogether.

Produce from an Organic Farm

Organic gardeners should avoid the use of inorganic (soluble) fertilisers, super-phosphate for example should not be used because it contains sulphuric acid, rock phosphate however is the acceptable alternative. Synthetic chemical herbicides, growth hormones and pesticides should also be avoided.

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Influential People in the Organic Movement

Lady Eve Balfour – farmer and organic farming pioneer. Born in the U.K. in 1899 she was one of the first women to study agriculture and at the age of 21 started farming in Suffolk England. For the next 70 years she worked as an educator, researcher (The Haughley Experiment – scientific experiment into organics) promoted organic farming, and published books, such as 'The Living Soil' in 1942. She co-founded the Soil Association in 1946 – an organisation that promoted sustainable agriculture and organic methods. This organisation still flourishes today and is one of the principle bodies dealing with inspections of, and awarding certificates to, organic farms and small-holdings in the UK.

Sir Albert Howard – Born in the U.K. in 1873 studied botany and became a principle figure in the organic movement. He is often referred to as the 'father of modern organic agriculture'. He worked in Asia and India as an agriculture consultant and also developed and documented organic techniques that he also promoted throughout Europe. He wrote An Agricultural Testament – a classic organic farming text and published in 1940.

Jerome Irving Rodale – Born in 1878 in the USA was one of the first advocates of organic and sustainable farming in that country. Initially an accountant who set up an electrical firm, Rodale was later so influenced by the work of Sir Albert Howard that he bought a farm to test Sir Albert's ideas. From then on he actively promoted an 'organic life-style' and also popularised the term 'Organic Farming'.

With Sir Albert as associate editor JI Rodale published (by Rodale Press, Inc.) the first edition of Organic Farming and Gardening in 1942 in order, to promote organic approaches to agriculture.

Rodale believed that the health of the soil and the plants living in it depended on introduction of organic matter in the form of de-composed animal and plant waste. He was also convinced that the use of chemical pesticides destroyed soil micro-organisms. These are the very organisms that are needed to breakdown plant and animal waste into useable nutrients, that promotes healthy plant growth. Rodale too is still flourishing today in the USA.

PERMACULTURE

In its strictest sense, permaculture is a system of production based on perennial, or selfperpetuating, plant and animal species, which is useful to people. In a broader context, permaculture is a philosophy which encompasses the establishment of environments which are highly productive and stable, and which provide food, shelter, energy, etc., as well as supportive social and economic infrastructures. In comparison to modern farming techniques practised in Western civilisations, the key elements of permaculture

are low energy and high diversity inputs. The design of the landscape, whether on a suburban block or a large farm, is based on these elements.

A permaculture system can be developed on virtually any type of site, though the plants selected and used will be restricted by the site's suitability to the needs of the varieties used. Establishing a permaculture system requires a reasonable amount of pre-planning and designing. Factors such as climate, landform, soils, existing vegetation and water availability need to be considered. Observing patterns in the natural environment can give clues to matters which may become a problem later or which may be beneficial.

A well designed permaculture garden will fulfil the following criteria:

- Upon maturity it forms a balanced, self-sustaining ecosystem where the relationships between the different plants and animals do not compete strongly to the detriment of each other. The garden only undergoes subtle changes from year to year.
- It replenishes itself: The plants and animals in the garden feed each other, with only minimal (if any) input (e.g. natural fertilisers, feed) introduced from the outside.
- Minimal work is required to maintain the garden once it is established: weeds, diseases and pests are kept to a minimum through bio-diversity (of plant insect and animal life). Companion planting and insect attraction are an integral part of this ecosystem for the beneficial effect they have on each other.
- It is productive: food or other useful produce can be harvested from the garden continually.

Intensive land **Use:** a lot is achieved from a small area. A common design format used is the 'Mandala Garden' based on a series of circles within each other, with very few pathways and easy, efficient watering.

- There is a diversity of plant varieties; this spreads cropping over the whole year so that there is no time when a "lot" is being taken out of the system. This also means that the nutrients extracted (which differ according to each type of plant or animal) are "evened out". For example, iron-hungry plants are grown next to plants requiring little iron, in order that the soil does not become iron-deficient. . The diversity of species acts as a buffer.
- It can adapt to different slopes, soil types and microclimates.
- It develops through an evolutionary process changing rapidly at first, but this becomes more gradual over a long period perhaps never becoming totally stable. The biggest challenge for the designer is to foresee these on-going long term changes.

Structure of a Permaculture System

Large trees dominate the system. The trees used will affect everything else they create shade; reduce temperature fluctuations below (create insulation); reduce light intensities below; reduce water loss from the ground surface; act as a wind barrier, etc.

In any system, there should also be areas without large trees, but will include shrubs and lower growing plants.

The "edge" between a treed and non-treed area will have a different environment to the areas with and without trees. These "edges" provide conditions for growing things which won't grow fully in the open or in the treed area. The north edge of a treed area (in the southern hemisphere) is sunny but sheltered while the south edge is cold but still sheltered more than in the open. This is reversed in the northern hemisphere. "Edges' are an example of microclimates: small areas within a larger site that have special conditions which favour certain species which will also grow well elsewhere.

Pioneer plants are used initially in a permaculture system to provide vegetation and aid the development of other plants which take much longer to establish. For example, many legumes grow fast and fix nitrogen (raise nitrogen levels in the soil) and thus increase nutrients available to nut trees growing beside them. Over time the nuts will become firmly established and the legumes will die out. Pioneer plants are frequently short lived (but not always).

The Development of Permaculture

Bill Mollison

The concept of 'Permaculture' was developed by Bill Mollison, Australia.

Born in 1928 Mollison is often called the 'Father of Permaculture'. With David Holmgren he co-developed an integrated system of design. This encompasses agriculture, horticulture, ecology, strategies on land access, architecture, as well as financial and legal management of businesses and communities.

Masanobu Fukuoka

Sustainable agriculture was a concept that was developed before it became associated with the term 'permaculture'.

Masanobu Fukuoka, a microbiologist, left his career as a scientist to develop a sustainable organic farming system that replicates nature as closely as possible. The ground isn't ploughed – seeds germinate on the soil surface, species are chosen to out-compete weeds, and cover crops are slashed and left on the soil surface to break down. Straw from the previous season's crops is slashed and used as mulch: ducks are used to clean up unwanted pests and so on. Fukuoka's system is also remarkably low in labour inputs.

NO DIG GARDENING

Cultivation of soil is often used extensively in organic growing, particularly to control weed growth. Where chemical weedicides are not used, ploughing or hoeing can be extremely effective methods of controlling weeds. These techniques also help to open up soils which have become compacted, allowing water and air to penetrate more readily into the soil. Cultivation has been shown (by ADAS research, U.K.) to help reduce plant disease by destroying plants which might harbour those diseases.

There are problems with cultivation however, as outlined below:

- It can destroy the soil profile, the natural gradation from one type of soil at the surface (usually high organic and very fertile) through layers of other soil types as you go deeper in the soil. When soil profile is interfered with, pans can be created. A pan is a layer beneath the surface of the soil where water and root penetration becomes difficult. Water can build up over a pan creating an area of waterlogged soil.
- Drainage patterns can be changed.
- Plant roots can be damaged.
- Heavy machinery can cause compaction.
- Shallow cultivation can encourage weed seed germination. Cultivation can also bury seed and protect it from foraging birds and rodents. It may also help keep it moist and warm enough to germinate.
- Loosened soil can be more subject to erosion (e.g. from wind, rain, irrigation).

No Dig Techniques

There are obvious advantages to be had by using techniques which do not dig or cultivate the soil. Some of the techniques are pest, disease and weed control with fire, mulching for weed control and water retention and raised organic beds.

No Dig Garden

No Dig Raised Beds - One Method

Although timber edges can be used to construct no-dig beds and may help to keep beds intact, this is not really necessary. Beds can be layered straight on top of the soil, without the use of edging. Straw can also be placed between the beds to create weed free pathways. Over time the straw in the paths will decompose, this can then be removed and replaced with new straw the decomposed material is then used to top up the beds.

A typical no dig garden could be made as follows:

1. Weeds are removed first by mowing, physically removing by hoeing off, burning or some other method.
2. Wet the area thoroughly.
3. Very thick layers of newspaper (uncoloured) is laid on the surface to inhibit further weed growth (up to 50 sheets thick is not uncommon).
4. Again wet this layer.
5. A layer of straw or hay (weed seed free) is placed on top of the newspaper (at least 10 cm thick). Other materials such as weed-free compost or grass clippings.
6. The straw or hay is covered with rotted manure to a thickness where the straw or hay can barely be seen.
7. A further 812 cm of hay is placed on top.
8. At this stage, depending on your location, soils and intention for using no dig, the surface may be sprinkled with blood and bone fertilizer or chicken manure pellets. Small quantities of these materials may also be mixed with the hay or other materials. Whether or not you choose to do this will depend upon the soil quality. For example some Australian soils are very ancient and poor and need the added ingredients; however locations with younger and/or richer soils will not require this.
9. Growing through the Mulch
10. Depending on your purpose, you may either transplant directly into the top layer with a few handfuls of good quality compost around the roots of each transplant.

Or:

If you are essentially using this method to clear the site, you may also plant through the mulch in the first year. Do this by cutting holes in the mulch and planting through it. Typical plants to use would be tomatoes, courgettes, seed potatoes, runner beans. Once the area is free of unwanted growth, then seeds can be sown as usual in shallow drills. Holes can be made for transplants. In colder climates you will need to consider the depth of the mulch and which vegetables are suitable.

No Till Planting in Turf

Seedlings or established container plants can be planted directly into a lawn or grassed area. No digging is done prior to planting. The roots of the plants tend to go deeper because they are in competition with shallow rooted turf grass species on the surface. The base of plants can be mulched and unplanted areas continue to be mown as a lawn. Drainage, soil compaction and water retention generally remain very good for plants grown this way in undisturbed soil. Research has shown excellent results for tomatoes, beans, corn and squash grown this way. *(Ref: Advanced Organic Gardening by Carr, published by Rodale).*

The technique can also be used for other types of plants.

A similar technique is called “Vegetable-Sod Inter-planting”, where growing strips 20-40cm wide are mulched and planted as rows over an existing lawn or mowed turf. A narrow line may be cultivated sometimes down the centre of each row to sow seed into, if growing by seed, to hasten germination. Mulch mats, black plastic, paper or organic mulches can be used to contribute to weed control in the rows. Crop rotation is usually practiced between the strips. This contributes towards better weed control. Clover is often encouraged in the strips of turf between rows to help improve nitrogen supplies in the soil.

BIODYNAMICS

Biodynamic farming and gardening is a natural practice which developed from a series of lectures given by Rudolf Steiner in 1924. It has many things in common with other forms of natural growing, but it also has a number of characteristics which are unique.

It views the farm or garden as a "total" organism and attempts to develop a sustainable system, where all of the components of the living system have a respected and proper place.

There is a limited amount of scientific evidence available which relates to biodynamics. Some of what is available suggests biodynamic methods do in fact work! It will, however, take a great deal more research for mainstream farmers to become convinced widely of the effectiveness of these techniques; or in fact for the relative effectiveness of different biodynamic techniques to be properly identified.

Principles of Biodynamics

Biodynamics involves a different way of looking at growing plants and animals. Plant and animal production interrelate. Manure from animals feeds plants. Plant growth feeds the animals.Biodynamics considers the underlying cause of problems and attempts to deal with those causes rather than dealing with superficial ways of treating problems. Instead of seeing poor growth in leaves and adding nutrients; biodynamics considers what is causing the poor growth -perhaps soil degradation, wrong plant varieties - or whatever? It then deals with the bigger question.

Produce is a better quality when it is "in touch" with all aspects of a natural ecosystem. Produce which is produced artificially (e.g. battery hens or hydroponic lettuces) will lack this contact with "all parts of nature", and as such the harvest may lack flavour, nutrients, etc., and not be healthy food.

Manure on Garden

Economic viability and marketing considerations affect what is grown. Available human skills, manpower and other resources affect what is chosen to be grown. Conservation and environmental awareness are very important. Soil quality is maintained by paying attention to soil life and fertility. Lime, rock dusts and other slow acting soil conditioners may be used occasionally. Maintaining a botanical diversity leads to reduced problems. Rotating crops is important. Farm manures should be carefully handled and stored.

Developing a Biodynamic Farm or Garden

The first step is always to look at the property as a single organism, and to appreciate that whatever changes are made to the property can have implications to many (probably all) of the component parts of that property. There is an obvious (though sometimes subtle) relationship between every plant or animal and its surroundings, both the nearby and the more distant surroundings.

Biodynamic Preparations

These are a particularly unique and important aspect of biodynamics. There are all sorts of biodynamic preparations. There is a wide experience (throughout many countries) which suggests the use of these preparations is beneficial, resulting in both morphological and physiological changes in plants (e.g. better ripening rates, better dry matter, carbohydrate and protein rates).

Some of these special preparations are outlined below:

- In the book "Organic Farming" by Lambkin (Farming Press, U.K.); two different sprays (500 and 501) are mentioned as being commonly used. These are made from a precise formulation of quartz and cow manure and are sprayed on crops at (very) diluted rates. Biodynamic growers in the U.K. and elsewhere also use preparations made from plants to stimulate compost and manure heaps.
- Cow manure is placed in a cow horn and buried over winter, with the intention of maintaining a colony of beneficial organisms in the horn over the cold months which can then recolonise the soil quickly in the spring.
- Insect control sprays are commonly made as follows:
- Catch some of the grubs or insects which are becoming a pest. Mash them to a pulp (perhaps in a food processor), then add water and place in a sealed jar for a few days in a refrigerator. Once fermentation begins, remove and dilute with water (100:1). Spray over affected plants. This is said to repel the insects, though no scientific evidence is known to support the treatment.
- Biodynamic growers use a variety of different preparations to add to compost heaps or spray on paddocks or garden plots to encourage faster decomposition. Preparations have included: yarrow flowers, valerian flowers, oak bark, calendula flowers, comfrey leaves and preparations from Casuarina and Allocasuarina species.

THE NATURAL ORNAMENTAL GARDEN

Broadly speaking, a natural garden is one that appears to be a relatively natural occurrence: not contrived or planned by man, and not maintained with any substantial input by man.

Although natural gardens may, in fact, be planned, and may require routine maintenance; it is just these things are not obvious.

A natural garden frequently makes use of the indigenous flora, or native plants of a particular area. It might make use of other plants as well. Your choice of plants for a natural garden will largely depend upon what affect you are trying to achieve.

To appear informal a natural garden should have curves rather than being angular; is informal rather than formal and tends to incorporate nature rather than manipulate it.

Problems arise with the definitions of 'nature' and 'native'. Native plants have been defined as being anything from local or regional to national and even continental. The terms indigenous or endemic should be used with care, as they are generally regarded as "scientific" terms.

In the United States there is also debate as to what should be deemed native from a historical context. Some would argue that only plants which date back to prior to the original European settlement of 1492 should be labelled native. Others have suggested that any plants that have been there for 200 years should be considered native. The term 'naturalised' may be used for plants which are not truly native, but have been long-established in a country or area: e.g. 70 species of Eucalypt, (native trees from different parts of Australia), are found in Cyprus but only a very few - perhaps 6 species - have recorded there for sufficiently long periods to be regarded as 'naturalised' and thus included in the native flora.

Definitions of terms:

- Native: originating in a specific place – kangaroos are native to Australia (Collins English Dictionary 1979 edition)
- Natural: existing in or produced by nature (Collins English Dictionary 1979 edition)
- Indigenous: originating or occurring naturally, not imported (Collins English Dictionary 1979 edition)
- Endemic: present within a localised area (Collins English Dictionary 1979 edition): a plant that is confined to a certain limited area; for example Cedrus libani subsp. brevifolia is found only on the island of Cyprus – it is endemic to the island.
- The term 'nature' has been applied to natural gardens with no less ambiguity. Given that nature is a construct created by man, what is included within nature is perhaps best considered in relation to social, cultural, political and aesthetic influences of the period in history and the country.

Natural gardens can take on many different forms within the same country since there can be a vast array of flora and fauna and different natural landscapes.

WHAT IS A NATURAL, WILD OR BUSH GARDEN?

The term 'Bush Garden' is widely used in Australia and in Africa; the term 'Wild Garden' is most often used elsewhere in the world.

Essentially a bush garden is a type of natural garden which is informal in style and attempts to recreate the appearance of a natural or bush area. Strictly speaking, a bush garden should use combinations of plants which occur together in the natural landscape. In other areas of the world, the term wild garden will reflect the same concepts.

For example, in Australia a Eucalypt which occurs naturally close to Sydney should not be planted alongside a Banksia which is exclusively native to Western Australia.

In Britain, a *Vaccinium myrtillus* (bilberry or whortleberry), which is common on the northern moors of England, should not be planted alongside *Vaccinium microcarpum* (small cranberry) which is limited to bogs in central Scotland.

In reality, it is common to mix plants which do not come from the same area in natural, bush and wild gardens. For example, *Papaver rhoeas* (field poppy/Flanders poppy) is now naturalised virtually all over the world although it originates from the Central Asia. This will create a wilderness atmosphere. A natural garden can have Chinese, European, American and Australian plants, all together; however, such a garden is more difficult to create than one which copies the plant associations which occur in nature.

Mature Native Bush Garden

When plants are combined in the way in which they occur naturally, it is reasonable to assume that none of them will compete with each other too strongly (i.e. they should grow in harmony and not choke each other out of existence). When plants which do not occur naturally together, are planted together, it is possible that some will be much stronger growing varieties than others, and that some will gradually gain dominance, while others will find it harder to compete and eventually disappear.

In the United States the best example of a naturalistic style is the prairie. Much of the original prairie has disappeared, but now parts of it are being restored to its original beauty. The prairie may be considered to be somewhat similar to the native bush-land in Australia.

Jensen (see next lesson) created naturalistic gardens with a regional mid-western flavour. There are some excellent examples of his work in the book 'Recovering the Prairie: ed. Robert F. Sayre (University of Wisconsin Press).

Planting Design in the Wild/Bush Garden

Planting design, as with any section of landscaping, looks best when it looks natural as if it happened without human intervention in any major way. To achieve a "natural" look in a planting requires the designer to first understand how groups of plants grow together in nature.

In the natural habitat plants tend to grow in the following relationships:

- The "Upper story trees" can grow to over 40 metres tall, though they are often shorter.
- The "Understorey Trees" grow below the branches of the upper story, in some degree of shading, at least during part of the day.
- The "Seedling Tree" protected in its early life by the mature trees.
- The "Shrubs" growing below the trees. This includes vines and climbers that grow up through the vegetation cover in search of light.
- The ground covers, herbaceous perennials, annuals, mosses and other very low plants.

A wild or bush garden will incorporate examples from each of these groups to achieve an overall 'complete picture' that resembles a natural forest or bush scene.

NATURAL GARDENING TECHNIQUES

CROP ROTATION

The likelihood of nutrition or disease problems can be reduced by practicing crop rotation. This involves continually changing the type of vegetable grown in a particular spot. Growing one crop year in, year out will deplete certain soil nutrients and provide a constant home for specific pests, allowing them to build-up to problem levels. Crop rotation principles can be applied to both crop plants and ornamentals, however the most common use for crop rotation is in vegetable production. Look at the list of 'groups' of vegetables outlined below. Don't grow a vegetable in a particular area if another vegetable out of the same group was grown in that spot recently. Keep varying the type of vegetable in a particular spot. Crop rotation can also include a fallow period, when a non-harvested crop is grown. Crop rotation is discussed in more detail in the chapter on vegetable growing.

- Brassicas (Cruciferae) - broccoli, brussels-sprouts, cabbage, cauliflower, sea kale, kohl rabi, turnip, swede, radish, horseradish etc.
- Cucurbitaceae - cucumber, marrow, pumpkin, squash, cantaloupe (i.e. rock melon), zucchini.
- Liliaceae - onion, leeks, garlic, asparagus, chives.
- Fabaceae (legumes) - peas, beans, clover.
- Poaceae - corn, other grains.
- Apiaceae (Umbelliferae) - celery, carrot, parsnip, fennel.
- Asteraceae (Compositae) - chicory, lettuce, endive, globe artichoke, sunflower.
- Chenopodiaceae - silverbeet, beetroot) and spinach.
- Solanaceae - tomato, capsicum, potato, egg-plant.

Organic Corn

SEED SAVING

When plants are allowed to naturally pollinate each other, produce flowers, fruit and then seed, the local conditions will determine whether the offspring of those plants are suitable for the area. Plant varieties that have been bred in another state or country may not really be suited to your locality without large inputs of fertilisers or pesticides. Growing your own herbs and vegetables, for example, can provide the ideal seed source for your conditions. Only collect seed from healthy plants, preferably with good yields and pleasant tasting produce. Wait until the seeds are ripe before harvesting, although be careful not to let all the seed fall out or blow away. Seeds should usually be stored in paper bags or envelopes, and kept in cool, dry and dark conditions. It is helpful to label your seeds with species, place grown, time harvested, etc.

ENVIRONMENTAL HORTICULTURE

This term was introduced in the early 1980's by John Robin and colleagues from Latrobe University in Australia. They noted the way in which weed species are able to invade a garden, or natural area, and lead to degradation and disappearance of previously present species. Once an imbalance was initiated, a snowballing affect could occur which would lead to disappearance of both plant and animal species; and in the worst scenario resulting in a monoculture (i.e. an area which is covered by basically one species of plant (i.e. a weed).

Environmental horticulture is a technique which bases the growing of plants on an understanding of the environment; trying to foresee and check problems of degradation etc. before they become serious.

Chemicals kill pests and diseases effectively, but there can be problems if you don't use the right chemical or the right method. There are of course other ways to control pests and diseases; but other methods rarely give the complete control that chemicals do. Never the less, the preferred option these days is usually to use a combination of control techniques. The concept is that:

- Nothing is over used to the detriment of the environment; or to the extent that pests "get used to the method", hence build resistance.
- Each different technique weakens the pest or disease that little bit more. The overall affect is a better control.
- Expense controls (e.g. some costly chemicals) are used in limited quantities, keeping costs lower.
- This idea of using a combination of different control techniques which each contribute to the overall control is sometimes called "IPM" or "Integrated Pest Management".

Net to protect vegetables

The different methods of control can be divided into five broad categories listed below.

- Cultural - this involves growing practices that reduce problems, such as reducing humidity to reduce disease, keeping a plant healthy to enable it to problems, etc.
- Biological - this involves using natural mechanisms to control problems, such as pests eating other pests, or plants repelling or deterring development of pests and diseases.
- Physical - this method involves physically interfering with the pest or disease, such as squashing an insect, cutting off diseased tissue, trapping insects, enclosing the plant in a protective cage or net.
- Chemical - using chemicals that kill or interfere with problems. In natural gardens, the use of chemicals is limited to those that are derived from 'natural' sources, such as plant extracts (e.g. pyrethrum, neem oil), or rock dusts (e.g. sulphur).
- Legal - this involves governments making and enforcing laws, such as quarantine, or even banning of specific plants known to increase the spread of harmful pests or diseases.

Biological Control

There are 3 main approaches to biocontrol. These are:

- The introduction of parasites and predators, where natural enemies are introduced to control exotic pests, as in the case of Cottony Cushion Scale, which was introduced to California, from overseas, without its natural predators.
- Conservation of existing natural enemies by changing spraying programs (we can't always just stop spraying. We need to build up the natural enemies to a useful level first) such as using selective chemicals or by changing when we spray, as some insects are active at different times of the day, and by reducing the rates of the chemicals that we use. Another method of conserving natural enemies is to change the way in which you crop your plants. This can be done by such methods as staggering planting times to reduce the impact of having a crop all at one stage when it may be more prone to attack or infestation; by the use of companion plants; by increasing crop diversity, by mixing crop species and by maintaining groundcover in orchards to promote parasite habitats.
- New natural enemies can be developed by scientists growing larger numbers of predators or parasites, or by adding additional numbers of natural enemies collected or purchased from elsewhere. Producing and marketing biological control agents has now become a major business in Europe and the USA, with small scale activity also in Australia, for example Biocontrol (Company name) in Warwick, Queensland, who produce predatory spider mites for control of red spider.

Other approaches, to biocontrol, that are being actively researched are the development of plants with increased resistance to pests and diseases; the use of natural chemicals such as hormones or sex scents to either attract (to a trap or away from plants), repel or kill these types of problems; the use of sterile insects to upset reproductive cycles and the use of plant derivatives, such as pyrethrum, as pesticides.

CHAPTER 2 SOILS AND NUTRITION

There is a direct relationship between plant growth and soil organic matter. It is well known that plants growing in soil with little or no organic matter grow very poorly. The key for any garden, any landscape or any vegetable plot is the organic content of the soil.

SOILS

Plant growth is directly affected by the type of soil the plants are grown in. The majority of plants depend on soil to provide nutrition, physical support (i.e. a place for roots to anchor), water and air. The exceptions to this are those plants that are known as epiphytes. These grow in such places, as tree trunks, on rocks, on or fallen logs.

Soil is made up of:

- Water containing varying amounts and types of nutrients (and other chemicals) in solution.
- Air
- Particles

These “particles” are further divided into:

- Mineral particles of various sizes including clays, silts and sands.
- Organic material in varying states of decomposition.
- Living organisms mostly microscopic, but also including insects, earthworms, nematodes, etc.

These things affect the soil’s ability to grow plants. It is possible to grow some plants in soils without living organisms, organic matter or mineral particles; but plant roots must have air, water and nutrients. Generally, however, you will require some amount of each of the above components to get the best growth from your plant.

Seed bed soil

MAINTENANCE OF SOIL

Soil is constantly affected by all that goes on around it. Its physical properties can be affected by traffic and handling. Its chemical properties can be changed by things added to soil, and by plants removing chemicals. These will in turn affect the biological properties of the soil.

One of the main problems with changing physical properties is the reduction of air in the soil.

There are two basic ways this happens.

1. With changes in drainage patterns by altering the landscape so that water will run to certain areas and sit there.
2. By the soil being compacted by traffic or such practices as cultivating the soil when it is wet.

These problems can be solved by avoiding compaction due to walking on or digging soil in wet conditions, putting drainage pipes in for waterlogging and by aerating the soil by digging it over when reasonably dry and incorporating organic matter. Lawns and similar areas where digging is impracticable can be aerated by removing small cores of soil at regular intervals. Sand can be incorporated into the soil by means of cutting slits in the soil surface, and then adding sand that has pore spaces of around 10-30%.

Gypsum is commonly applied to hard packed or poorly structured clay soils. It has the ability to cause clay particles to aggregate together in small crumbs (or peds), thereby improving structure. It is also used to reclaim saline soils with high sodium levels (known as sodic soils). Gypsum contains around 23-25% calcium and approximately 15% sulphur - it will not affect soil pH to any great extent. However it should not be used on non-sodic soils and soil structure will be compromised as a result.

Nutrient levels can be exhausted with time, as plants take up what they need and by leaching from watering. This can be easily rectified with fertilisers. Additions to the soil in the form of contaminates may take a bit more work. Lighter spills of non-toxic substances can be washed out of the soil by excessive watering, but spills of heavier substances (such as lime, pesticides or petrol) may require the removal of the affected earth before the substance spreads and changes the soils properties (e.g. pH).

IMPROVING SOILS

The type or proportions of soil components can often be readily adjusted, particularly on a small scale (e.g. in a home garden), to improve the soil. This usually involves adding something to the soil. The following are common ways of improving soils using natural materials:

Add Organic Matter

Most soils will benefit from the addition of organic matter, except those that are already high in organic matter such as peaty soils. Soils with good levels of organic matter are generally easily worked (we say they have a good tilth if they are easily worked). If you squeeze a handful of soil into a