KO MAHINGA O TŌKU MĀRA KAI

ESTABLISHING MĀRA KAI

A Resource Kit for the Establishment and Management of Māra Kai Aligned to Marae and Communities

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Ka nui mihi ki ngā kaitautoko mō tēnei pukapuka.

Tēnei te mihi nui mō koutou katoa.

TRADITIONAL MĀRA

OVERVIEW

AHUMĀRA – MĀORI HORTICULTURE

1769 is accepted by Europeans as their first contact with Māori (not including Abel Tasman) although- tangata whenua have many other stories of early contact. Agricultural and horticulture were essentially the same thing however the uniqueness of land use in Aotearoa was the subsistence farming of crops and no grazing animals.

Activity surrounding food production was structured with a strong relationship to the gods and reliance for some crops. Tools were almost exclusively wooden with a wide range of specialist implements for various aspects of production. Bartering was common, especially between tribes who lived among various resources e.g. inland and coastal tribes bartering forest foods for seafoods.

The primary cultivated foods were kūmera, hue or (bottle) gourd, taro, uwhi or yams and aruhe or fern-root. All these foods except the fern-root, which is in fact the rhizome of the braken fern, are considered to have been brought to this country during the migrations of Māori over 700 years ago. Other introduced crops that did not succeed in this new environment included: coconuts, sweet and plantain bananas, breadfruit and sugar cane. The climate would have been the key factor in the environmental loss of these tropical crops.

Some important agricultural practices developed and used by Māori included:

- Improvement of soil through:
    - Application of wood-ash/plant material as fertiliser.
    - Placement of stones around crops to increase soil temperatures by improving heat retention.
    - Addition of sand or gravel to improve soil structure by “lightening” heavy clay soil.
- Crop rotation.
- Controlled burning of fern lands to control overcrowding and encourage vigorous regrowth and therefore edible fern-root production.
- Pest control (i.e. caterpillers) through fumigation by burning kauri gum or dried kawakawa.
- Crop storage mechanisms (both storage houses above ground and insulated storage pits below ground).
- Processes were developed to transform poisonous or otherwise inedible plants in order to make them edible (e.g. tutu [Coriaria arborea] juice had to be strained through finely woven bags in order to separate it from the highly toxic seeds and stems).

SITE SELECTION

Site selection was important for a successful crop season and the selection process was adapted to the locality under consideration. Hill soils were believed to be favoured because they gave better frost protection (especially on north facing slopes), were in abundance and were easier to clear by burning. Alluvial or river valley soils generally have better natural fertility, better water holding capacity, were easy to clear and could be gardened with more intensity.

Other aspects of the pre-European horticulture system include the use of a ‘slash and burn’ technique of clearing ground for planting, terrace gardening on slopes and foothill areas, abstract

fencing around gardens and several labour-intensive practices such as mounding of production plots for kumara and yams, and weeding.

SEASON APPROACH

Crops were planted and grown according to their natural season and the calender of events is well known prior to any activity taking place. To support this Māori utilised the maramataka or Māori calender which is based on indigenous knowledge of astronomy cosmology and the seasons, effectively ‘indigenous lunar science’ and substantiated by observation of the environment. Other tohu or signs were utilised in determining horticultural activities e.eg., the arrival of the shining cuckoo and it’s shrill call koia, koia, koia (dig!, dig!, dig!) in spring- was seen as the calling of man to work the tilling of the ground for crops similarly the arrival of the star Poutū-te-rangi or flowering of certain trees or shrubs such as the kōwhai also signified the arrival of spring and the start of a new planting season. These tohu would differ between regions, iwi and hapū.

SEED SELECTION

Based on experience, the tikanga associated with seed selection for crops is based on keeping the best for planting (regeneration) so that the traits help within the seed are transferred between generations. This was metaphorically aligned to the process of whakapapa within tribal communities and strongly adhered to as it ultimately contributed to the survival of the people. Spoilt or undesirable crop produce was eaten straight away or at least stored temporarily for use before the next season.

PLANTING

Planting any crop was a major activity in Māori society and the gardens were known for their meticulous appearance and fastidious workers. Aspects of production would include pest and disease control, weed management, nutrition and fencing to keep out animals. It should be noted that the majority of the pest and disease pathogens seen today were not present in pre-European Māori society and hence no management approach exists for many of the current plant health issues surrounding the traditional crops.

HAUHAKE / HARVEST

Again, an activity which was based on tikanga and involved the whole community with each having their own task. Young women did not carry heavy loads so would be involved in grading the produce with the older relatives.

The activity was supported by karakia and chants throughout the process and undertaken based on the maramataka.

STORAGE

Another process that required skill and was based on tikanga specific to each tribe. The reliance of stored produce to maintain the community through the winter months or during periods of drought,

war, etc., highlights the importance of this activity. The traditional rua or storage pit was considered to be the most successful method of storage of root crops based on excluding any moisture from the storage environment and the maintenance of a moderate and even temperature.

With the introduction of feral animals such as pigs, storage facilities were adapted for crops including potatoes and kumara. The timanga was an elevated platform, 2-3 metres high with sides that enclosed the platform but no cover. The enclosure was lined with fern and the crop stored within it. Pātaka and whata are other well known raised structures used as storehouses.

Subterranean storage pits or rua kumara are the most obvious evidence of both gardening practice and settlement in many old pa sites. There are types of Rua: rectangular pits, generally accepted as being for storage of kumara and the bell-shaped ones for fruits and other foods preserved where they were harvested. Essentially rua were wholly or semi-subterranean and the sides were strengthened by the use of tree fern trunks and then lined with rushes and the floor covered with dried manuka and fern fronds. A roof (kōpani) was placed over the rua after the kūmara or other produce was put inside (generally stacked loose) and often soil was then placed over the roof. The choice of storage option was primarily aligned to local conditions.

OTHER STORAGE METHODS INCLUDE

- Whakatoke – or simple pits for shorter-term storage of a lesser quantity of kūmera or other root produce.
- Timanga – which are essentially open tiers on raised platforms to protect from browsing animals.
- Whata – similar to timanga.
- Pātaka – or raised storehouses on legs at least one metre above ground level and sealed against rats and other pests.
- Preserving – preserving food products was a common practice to extend the storage life of the food. Examples of traditionally preserved foods are:
    - Smoked fruits of forest trees – stored in a rua and ‘smoked’ by burning brush wood such as manuka and sealing the rua before the burning process was complete.
    - Foods fermented in running water such as with kanga (corn) and taewa (potato).
    - Dried and cooked foods such as kumara kao (steamed and dried).
    - Foods preserved in hinu or animal (bird or fish) fat.

There are many other preparation and processing methods continue to be used in this time as a specifically Māori process and some are re-gaining favour as potential commercial opportunities in New Zealand and abroad.

MARAMATANGA MĀORI

Māori Calendar for Fishing and Horticulture

Hei whaka Māori I tēnei e mau ake nei; No 1 (whiro) – ko te ra I muri iho o ta to pakeha new moon (the day the new moon on the calendar); No 15 (Rakaunui) – ko te ra I muri iho o ta te pakeha full moon (the day after the full moon on the calendar).

DAY	NAME	NOTES
1	Whiro	He rā kino tēnei mō te ono kai mō te hī ika, hoki. A bad day for fishing or planting, the moon is out of sight.
2	Tirea	He pō ahau pai t`nei mō te hī koura, tuna mō te ono kai. A good day for planting, fishing, torching eels and crayfishing.
3	Haohaoata	He rā tino pai tēnei, mō te hī tuna, koura ono kumara ono hoki I ētahi atu kākano. A very good day for planting kumara or any seed, also crayfishing or tourching eels, especially if the moon is out of sight.
4	Ōuenuku	He rā pai mō te ono kai, he rā pai mō te hī ika. A good day for planting and fishing, from dawn to midday.
5	Ōkoro	He rā pai ano tēnei mō te ono kai hī ika hoki. A reasonable day for fishing, good day for planting from midday to sunset.
6	Tamatea- kai ariki	He rā pai mō te ono kai mō te hī ika, he rā hau, he kaha te ia tērā pea e marangai. Fair day for planting and fishing. It is windy and the sea currents are strong, expect a change in weather.
7	Tamatea angaanga	He rā pai mō te hī ika, kia tupato te haere ki te hī ika I ngā ngaru pua I ngā kohu. He rā pai ki te ono kai. A very good day for fishing, watch out for the weather. It is either a big heave or misty day. A good for cropping also.
8	Tamatea āio	He rikiriki te tuna, te ika me te kumara I tēnei ra engari he nui tupato te hunga ehi moana. Eels, fish, kumara etc. are plentiful but small in size. If boating, keep an eye on the weather.
9	Tamatea whakapau	He pai mō te ono kai I te ata ki te rā-tu. Kaore I tino pai mō te hī ika pou ngā Tamatea. Fair for planting from morning to midday only. Only fair for any sort of fishing.
10	Ari	He rā kino tēnei. A bad day. OK for crayfish only.

11	Huna	E hara I te rā pai ki te ono kai ki te hī ranei he noho mohoao te noho a te tuna, a te koura. Not a good day for planting or fishing. Flounders, eels, and crayfish will get very timid.
12	Māwharu	He rā tino pai tēnei me te ono kai, he nunui te kumara engari kaore e roa ka pirau he rā pai ki te hī ika. A very good day for planting but the produce does not keep for long. A good day for fishing.
13	Atua	E hara I te rā pai mō te ono kai, mō te hī ika rānei. It is not a good day for planting or fishing.
14	Turu	He pai tono mō te hī ika mō te ono kai, I muri ō te rā tu, ki te rā to. A fair day for fishing, especially on the incoming tide, and for planting from midday to sunset.
15	Rākaunui	He rā tino pai mō te ono kai, ahakoa he aha taua kai rā pai mō te hī ika kaore e tino pai mō te hī tuna. A very good day for planting and general gardening, not so good for eeling but good for other fish.
16	Rākaumatohi	He rā tino pai mō te ono kai, mō te hī ika, kaore mō te tuna. As for Rākaunui, a very good day for planting and fishing but not eeling.
17	Takirau- māheahea	Takirau māheahea, kua makoha te marama te rikiki te kumara, te koura, te tuna. The moon is losing its brightness. Kūmara planted on this day are small, also crayfish and eels. Best from dan until midday.
18	Oike	E hara i te tino rā pai, mō te ono kai mō te hī ika rānei. It is only another day, not the best for palnting or fishing.
19	Korekore te whiwhia	E hara I te rā pai, mō te ono kai, mō te hi ika rānei. It is only another ordinary day for either planting or fishing.
20	Korekore te rawea	E hara I te pō pai tēnei. Not a very good day at all.
21	Korekore tūroa	He pai tēnei rā atu I te rā-tu, ki te rā-tō. Koia nei ētahi rā pai ki te patu tuna, koura, ika me ngā momo kai katoa. A very good day from midday until sunset for both planting and fishing.
22	Korekore piri ki ngā Tangaroa	He rā pai ki te hī ika, koura, tuna. A very good day for planting, fishing, crayfish and eels.
23	Tangaroa piri a mua	He rā pai tēnei ki te ono kai, ki ngā mahi hī ika koura.

		A very good day for planting, fishing, crayfish and eels, especially from noon until sunset.
24	Tangaroa piri ā roto	He rā pai tēnei ki te ono kai, ki ngā mahi hī ika koura. A very good day for fishing, crayfish and eels. This is the best day for planting kumara, taewa and other root crops, in general the best day for any planting in the garden. Also excellent for deep-sea fishing.
25	Tangaroa ā kiokio	He rā pai tēnei ki te ono kai, ki te hī ika, koura, tuna. A very good day for planting, fishing, crayfish and eels.
26	Ao tāne	He rā pai tēnei ki te ono kai, ki te hī ika, koura, tuna. A very good day for planting, fishing, crayfish and eels. Also excellent for deep sea fishing.
27	Ōrongonui	He rā tino pai tēnei mō te ono kai hī ika, koura, tuna. He pai mō te waihanga whakaaio. A very good day for planting, fishing, crayfish and eels. Also a good day for business.
28	Mauri	E hara I te rā pai tēnei he oro mauri te kai ka amo. Not a very good day for planting or fishing. Fish, eels and crayfish are very elusive.
29	Ōmutu	E hara I te rā pai tēnei. It is not a good day at all.
30	Mutuwhenua	E hara I te rā pō pai tēnei kua hinapouri te ao e ai ki ngā kōrero ō neke rā. It is not a good day at all: the world is in darkness.

MATARIKI AND PUANGA

Matariki is a well-known reference to a constellation of stars known in European terms as the Pleiades. In the Western regions of the North Island, they use the star Puanga (Rigel) to the same effect. The rising of matariki or puanga signalled the end of a cycle of seasons and a time to consider and prepare for the new cycle of seasons. All crops which were the basis of the food chain were harvested, graded, and stored.

It was heading into mid-winter and a time to rest, to enjoy the fruits of their labours and to socialise through festivals and celebrations. A poroporoaki to the old year was undertaken recognising those who had passed on and this was succeeded by a whakatau to the new season and newborn infants since the last season. These celebrations would not generally include physically working towards the next years' activities, but a period of stocktake, deserved rest during the coolest months and planning for the new season.

Ngā kai o Matariki, nanā I ao ake ki runga – The foods of Matariki, that have risen.

CONTEMPORARY MĀRA

A CONTEMPORARY MĀRA

1. Firstly, for most people the ability to contribute to the kitchen and meals is imperative.
2. The ability to contribute to the act of manākitanga, providing hospitality for others either through gifting produce for individuals, groups, hui etc., or through contributing to the table when hosting visitors.
3. Aesthetically, through something which is both practical and pleasant to participate with.
4. Be a diverse enterprise and include fruit, vegetables, flowers and utility plants.
5. Be a learning environment where information, mātauranga and experience can be shared and learnt by all generations.
6. Be a contributor to community health; the produce and the activities around gardening canh be direct contributors to a healthy quality of life for all involved and their dependants.

It is important that the garden is viewed as an indigenous garden rather than under a contemporary banner such as organic, biodynamic, and so on. This is because you need to retain the freedom to make the choices for inputs and expectations in your garden to reflect your whānau, hapū and iwi rather than external rules.

There is no harm in learning from other production systems and to selectively apply tools they offer, but it is important to acknowledge the system as Māori, recognising this means the resources will be managed and looked after in a way acceptable to the iwi and contributing to iwi health and well-being for many generations.

UNDERSTANDING PLANTS

WHAT ARE VEGETABLES

Vegetables are those plants we grow to utilise in a culinary way as savoury and primary foods in our diet. They can include a range of different types of crops from roots and tubers of plants to some leaves or fruits. We tend to differentiate vegetables from other plants based on their endues but also include some sweet produce such as strawberries and cape gooseberries because their growing systems are more in line with the main vegetables than ‘fruit’.

WHAT ARE FRUITS

Fruits are the sweet produce of our garden; they are invariably perennial plants and trees which produce edible fruits seasonally. Our primary fruits are classified as pip fruit (apples, pears, nashi, quince), kiwifruit, grapes, stone fruit (apricot, plum, nectarine, peach, cherry) berry fruit and brambles (raspberries, blackberries, loganberries, black/red/white currents), citrus (lemon, orange< tangerine, mandarin, lime, grapefruit, kumquat) and tropical- fruits (passionfruit, avocado, guava, tamarillo, pomegranates, olives). Nut crops are also classified as dry fruits; these include walnuts, macadamia, hazelnuts, pinenuts and pecans.

WHAT ARE HERBS

Herbs are practical plants with a variety of uses such as culinary, medicinal, aromatic, a base for drinks and fuctional. Herbs compliment vegetables and are as diverse in their plant type and suitability as any garden can be. Culinary herbs are often harvested as-needed and grown as perennial plants. Good examples are common herbs such as rosemary, sage, thyme, bay, dill and fennel.

Medicinal herbs cover a range of plants and uses across cultures and continents. Suffice to say almost all plants will be of interest to herbalists for their medicinal qualities. Aromatic herbs are used in several ways, as culinary additions such as mint and thyme, as companion plants in a garden to help manage pests such as pyrethrum and mint and plants such as lavender for potpourri. Herbs that are the basis for those with all sorts of other uses; chicory as a root crop for mining soil nutrients, wormwood as a fly repellent in the house- and comfrey to aid composting in compost heaps.

WHAT ARE PERENNIALS AND ANNUALS?

It is important to understand the basic plant biology in food production to better grow and manage crops and plants throughout the year. The first point to note is the difference between perennial and annual plants:

- Perennials are those plants which produce seed on a regular basis over several years, sometimes (almost) permanently. Good examples are all of our fruit and berries such as apples, apricots and blackberries. In the case of vegetables, runner beans, rhubarb, asparagus and strawberries are perennial crops. The alternative are annuals.
- Annuals are plants that complete their life cycle within a 12-month period and are actually three categories of plants; short-term annuals (such as lettuce) which can complete their life cycle twice or more in an annual period; long-term annuals that will produce only one crop cycle a year (such as potatoes) and biennials that would naturally take up to two years to

complete their life cycle in normal conditions (such as carrots). Biennials ordinarily have a dormant phase in their cycle before extending to flowering and setting seed. Carrots and parsnips are good examples of biennial crops.

Our garden will contain a mix of all these types of plants.

The next thing we need to know is what are we harvesting?

What plant parts are we targeting for the table?

This impacts on how we manage our crops both in the garden and beyond. Think of where in the life cycle of the plant we target the harvest, and you will get an idea of the age and vulnerability of that harvest part.

Vegetables, where we harvest the leaves and stems, are generally immature and require good cool storage to keep their quality before eating. Lettuce, watercress, silverbeet, spinach, asparagus, parsley and celery are examples of leafy vegetables.

Fruits are the culmination of the plants growing season and carry the seeds which, if used, initiate the same crop sometime in the future: they are therefore mature plant parts. Vegetables which are actually fruits are tomatoes, capsicums or peppers, strawberries, watermelon, pumpkins, kamokamo and cucumbers. Other fruits are from orchards such as apples and olives.

There are also seed vegetables, different to fruits because they do not have a fleshy component where the seeds are contained. Peas, beans, sweetcorn, peanuts and broad beans are good examples of seed crops.

Roots, tubers and bulbs form another mature plant grouping and are generally specialised storage vegetables capable of long-term- storage off the garden.

There are also some vegetables harvested as flowers (cauliflowers, broccoli and nasturtiums), stems only (rhubarb), seedlings (sprouts of various beans), grasses (lemon grass), and as fungus (mushroom and truffles).

NATIVE PLANTS

Natives are those plants whose origins and where the environment for which they are best adapted are in Aotearoa / New Zealand. In a perfect world native plants would be the base of our ecosystem and the natural factors that impact on them such as pest and diseases, weed associations and so on would not impede their growth in a strongly native way. Instead we now have an ecosystem which is inclusive of native and exotic plants, some introduced purposefully and others that have found their own way here.

Some of our most popular plants, and almost all vegetables, are exotics in the Aotearoa / New Zealand landscape. Only the kokihi or New Zealand spinach is the true native vegetable, all others are late arrivals including pūhā, kumara and taewa / Māori potatoes. So, wee need to keep our plants in perspective and recognise the value all plants we have at our disposal can offer. Aside from the plants, the pests and diseases as well as weeds in our gardens are mixture of native and introduced species, all adapted to the local environment and plant species they take advantage of.

Plants are often identified in three categories:

NATIVE: Belonging to a place, in our case belonging to Aotearoa / New Zealand.

ENDEMIC: Only found among a certain region or people (not necessarily native).

EXOTIC: Introduced or originating from another country.

ESTABLISHING CONTEMPORARY MĀRA

There are many approaches that can be taken to establish gardens. Primarily you should consider the whole site of a 'garden' and within it establish some different features to meet your needs. These features can include raised garden beds for vegetables, fruit and orchard plantations, flowering plants, a specialist seed and transplant raising area, composting heap, water saving facilities and good access around the whole garden. It should be a place that is pleasant to work in so some shade needs to be available as well as chairs and tables. You will also want to encourage children to the garden so ensure it is safe, all tools are put away after use and garden products are locked up on site.

The following information will introduce some of the key activities around establishing these gardens with an emphasis on vegetable gardens. These are:

● Site selection and design	● Educational gardens.
● Low input gardening	● Salad gardens.
● Pest, disease and weed management.	● In-ground gardens.
● Soil and soil management.	● Composting and fertilisers.
● Sowing your own seeds.	● Garden accessories.
● Raised gardens.	● Companion planting.

SITE SELECTION AND DESIGN

The most important task in deciding a garden is site selection. This is a decision that will affect the ability to create a garden capable of providing produce for many seasons and years ahead. Some of the key points to consider are given below. No particular point ranks higher than others but collectively you should be satisfied the site chosen is the best possible mix of factors as possible.

1. In a general sense identify a site you want to consider.
2. Determine the aspect; where is north, south, east and west?
3. What are the prevailing winds?
4. What is the slope, if any?
5. Is your site sheltered, especially from winds? Does the shelter cause long shadows over the garden during the day? Alternatively, is shelter needed?
6. Is the site large enough to create the garden with rotation practices in mind, a place for composting and seedling production and perhaps a shed?

7. What is the history of the site, especially in land-use as this may affect factors such as fertility, toxic residues and so on?
8. What environmental factors need to be thought through – potential to flooding, frosts, erosion and/or drought? Will there be problems from stock or possums etc.?
9. What is the soil type – this will help you determine some of the management factors around soil structure etc.?
10. Are there soil tests available or does one need to be taken?
11. Where is the available water – or do you need to create water storage facilities?
12. Will there be a need for garden security so your produce is not destroyed or stolen?
13. What additions will the garden require; paths, seating, raised beds and so on?
14. What is the access to the site for cars, trucks, bikes etc. And is it accessible in all seasons?
15. Make the site and garden a safe place for all generations – no surprises!

Once these factors have been considered, discuss the outcomes with the whole group and future users of the garden and make a decision. It is useful to consider establishing the garden in three or four phases based on the following process.

1. Break open the vegetable garden in late winter so the first planting will harvest prior to Christmas the first season.
2. Plant and begin to establish the backbone to the garden for strategic effect – fruit trees, shelter, location for perennial plants or crops- such as asparagus.
3. Establish routine for the seedling house and compost heaps.
4. Don't expect to have the garden in full production from year one, learn from the first season and develop the rotation of crops as well. Introduce new crops in years 2, 3 and so on.
5. Create a trial space in the garden for new crops, varieties and activities.
6. Begin a diary to record your activities and what is happening in the garden for future use.

LOW INPUT GARDENING

Some of the best management techniques you can apply to your garden system are based on diversity and the establishment of more complex ecosystems that encourage natural elements to assist in creating a healthy balance in the garden. Birds and some insects such as ladybirds are useful to the garden. Your garden should be a mix of fruit, vegetables and flowers to achieve a good natural diversity and produce year-round. Some of the things you can do to minimise the costs of gardening and reliance on manufactured products include:

- **Make compost.** Collect vegetable and fruit scraps, tea leaves, coffee grinds, grass clippings, fallen leaves, dead flowers etc.. Dead flowers etc. Make a moist pile from these, layering with different ingredients. Let it rot for at least six months.
  The resulting finished product should be dark, earthy and sweet smelling. Cover compost-heaps in the hot months to retain moisture.

- **Feed your soil.** Use natural products that add organic matter such as compost, rotted manure, lucerne, hay or other natural mulch and blood and bone. Apply these to the soil in layers and reapply as it starts to break down and disappear into the soil.

- **Do some homework on your plants.** Understand their natural environment and physiological processes e.g. plants that have underground storage organs such as potatoes or carrots are often representative of originating in cold winter climates as the underground organ is a means of overwintering.

- **Get to know you garden.** Inspect the garden more often, at least twie a week. If you see pest insects, then squash or destroy them straight away. If you see weeds coming through, pull them straight away. Any other signs of health problems are better remedied if you deal with them early before they do major damage to your plants.

- **Be tough.** If plants begin to suffer repeated attacks from pests and diseases, assess their worth and remove them, if possible, to get rid of the problem. Replace them with something more suited to the season and environment.

- **Encourage nature to participate**. In vegetable gardens especially birds can be in valuable to help cleaning up some of the more common pests such as caterpillars and snails or weed seeds. Allowing birds to use the garden will have benefits that outweigh te negatives. However, make sure you cover fruiting plants to keep the birds from destroying the crops before harvest.

- Practice crop rotation. Follow some simple rules such as not planting the same vegetable or its relatives in the same patch of ground each year. This way you minimise the build-up of pest and diseases and also make better use of the natural nutrient levels in the soil.

- Companion planting. Learn the relationships between plants and plant families. Companion planting can be useful tool to ward off pests and assist the soil to do its job of feeding plants.

- Minimise the chemical additives you use in your garden. Both synthetic and natural products represent a wide range of chemical structures, and some can be very persistent in the soil or plants. Most will break down naturally. However, it is good practise not to overload your garden with chemicals and let nature take its course with some guidance through all the above tips.

- Be “Bee” safe. Choose your management inputs wisely to ensure you are not impacting on the honey bee or bumblebee activity in a negative way.

PEST, DISEASE AND WEED MANAGEMENT

No matter what you grow, you are bound to have problems at some point relating to pests and diseases and weeds. There is often a relationship between these as weeds can be hosts for plant

health problems, but they can also host beneficial insects so don't write them off straight away. In many natural gardens a weed bank is allowed on the perimeter of the garden to encourage beneficial insects to help manage the destructive ones!

Your choices for pest and disease management can be complex. The following points are introduced to give you tools to consider as garden managers and also as producers of an indigenous garden where you have the flexibility to create your own set of production criteria:

- Under low-input gardening, attempts are made to create a balance in the garden. The balance in natural life – insects, larger animals and plants will settle itself and you learn to accept certain issues that may arise.
- It is useful to recognise that a percentage of the garden will be lost to nature. Generally, 10% is an acceptable level; this is what the birds might eat, pests might render unremarkable and so on and it is pertinent to support the whole ecosystem in some way so your gardens support the environment as a whole.
- Opossums and rabbits can be a major pests in māra and need a proactive approach e.g. traps and bait stations. Local regional councils all have pest control officers who can advise on management strategies.
- Familiarise yourself with the pest, disease, and weeds likely to be a problem. Know their lifecycle, when they are damaging and what threshold is acceptable and what is not. As an example, the late Blight disease for potatoes and taewa is correctly called phytophthora infestans (every plant or living organism has a Latin name) and it occurs at the end of summer in high humidity and high temperatures. In commercial management It requires a fungicide such as copper oxychloride (both organic and conventional sector approved) for protection of the crop before the problem happens rather than as a response to the disease infestation. Find a visual reference so you know what the symptoms on the plant will look like.
    - Familiarise yourself with the options for pest and disease control. Ensure you are aware of the problems that might arise, ability to identify the problems and respond in a timely way. An early response will save you much heartache later on.
    - Don't write off new technology (including chemical options as each needs to be considered for its merits or otherwise over the whole garden. Some of the natural toxins can also be problems in the gardens so consider them in the same light as the manufactured products.
    - Hygiene in the garden is imperative. Clean your hands and tools when dealing with disease problems. Destroy plant waste properly, either in composting or burning and so on. Do not allow volunteer plants to take over the garden as they may harbour diseases out of season.
    - Understand the family groupings of plants, especially with weeds and crops. As an example, nightshade and potatoes, tomatoes and eggplants are all related so any controls on nightshade in a potato crop will affect the crop equally.
    - Be prepared for some physical work, keeping weeds managed before they grow too big will save a lot of work in the long-term. Be regular in your management approaches.

TE ONEONE SOIL AND SOIL MANAGEMENT

The soils are the best materials for any garden and without them nothing would grow. Consider them as the supermarket for the plants that we grow. Soils provide nutrition, water, gaseous environment and stability for the plant as an anchor. In natural environment soils are fed by a

constant supply of falling leaves and other plant matter, bird and animal droppings. These materials create a resource that has existed for eternity and supports biological life within it (earthworms, microbes etc.) and on it. The following key points are worth knowing about soils and should be considered whenever you want to work this resource to grow crops.

- Every soil has ‘structure’ generally determined by the aggregation of soil particles and how well it all holds together and allows for drainage. Pure sand is structureless whilst dominant clay soils are almost solid and too structured. Organic matter and biological residues such as worm exudates help improve structure. Our main priority for any soil management is to maintain and improve soil structure for future use.
- Organic matter refers to carbon-based additions to a soil and this is often plant based crop residues, compost, manures and so on. Organic matter helps hold soil particles together thus improving structure and provides nutrient inputs for crop use.
- Every soil has ‘texture’, generally determined by the composition and ratio of sand, silt and clay particles. Soil texture is important in determining the best way to manage the resource e.g. what are the drainage characteristics likely to be?
- It can be inexpensive to feed soils as they don’t have to be fed constantly with bought fertilizer products. Home-made composts provide a valuable source of organic matter and nutrients. Animal manures that have been composted and thus kill off weed seeds are also OK for vegetable plots. Liquid fertilisers such as seaweed or animal manures soaked in water until the smell has gone (generally 4-6 weeks) are good additions to soil when the crops are in the ground. Green additions such as crop residues, leaves and grass clippings are also good additions to the soil.
- Mulching is good practice to minimise weed growth, feed crops, and protect soils. Mulches will also help minimise water loss in hot summer days and heat loss at night. An organic mulch is commonly compost, lucerne hay, manure, newspaper, or grass clippings. These materials were all once living organisms and become food for worms and other soil organisms that digest and excrete them making humus, a highly nutritious, moisture retentive substance and soil addition.
- Inorganic mulches are based on non-living ground covers such as rocks, gravel, scoria, pebbles, tumbled glass etc. and can be great weed suppressants but don’t break down easily and can be expensive to establish In the garden.
- Soil pH is a measure of acidity or alkalinity and scored on a scale of 1 – 14; 1 is most acid and 14 most alkaline with pH 7 being neutral. Most New Zealand soils are naturally acidic and a pH somewhere between 5 and 7. Most of the crops we grow (but not all) prefer a soil pH around 5.5-6.5; brassicas are a good exception where pH 6-7 is preferred. Lime products help raise soil pH and acidic fertilisers such as sulphate of ammonia or elemental sulphur will lower pH.
- Worms feed on plant debris (dead roots, leaves, grasses, manure) and soil. They offer many benefits, increased nutrient availability, better drainage, and a more stable soil structure, all of which help improve productivity.

WHĀNGAITANGA KINO NUTRIENT DISORDERS

To obtain good yields it is important to ensure plants or crops have adequate nutrition at the right stages of growth. The most common problem in crops arise from an under-supply of key nutrients or

nutrient deficiency presented in various ways as plant responses; occasionally an over-supply of nutrient excesses. The most common minerals required by plants are classified as macro-nutrients supported by those with minor amounts required by plants and known as micro-nutrients.

The soil pH (acidity or alkalinity level) can affect the availability of nutrients (e.g. aluminium) to plants so sometimes the problem will lie in the soil environment rather than in a lack of nutrient supply.

The following tables identify the main nutrient deficiencies and excesses found in crops. In all cases, soil and / or leaf analysis is the best way to determine specific nutrient levels and design responses for crops to improve production and yield.

TAIORA NUI

MACRO-NUTRIENTS (GENERIC PLANT RESPONSES)

Nitrogen (N) Hauota	Deficiency: slow growing plants, leaves become uniformly light green and plant growth is poor. Older leaves turn red at the margins then whole leaf developing a reddish tint eventually turn into brown. Excess: produce a lot of plant green growth at the expense of other growth.
Phosphorus (P) Pūtūtaewhetū	Deficiency: red-brown or purple pigmentation on the older leaves. Both vine and leaf growth are restricted with older leaves falling off.
Potassium (K) Konurehu	Deficiency: restricted plant growth, shortened internode and smaller leaves are easiest symptoms. Older leaf blades are darker green at the midribs with short petioles and less pigmentation. Small shiny brown patches may occur on the underside of the leaves.
Sulphur (S) Pungawerewere / Pungatara	Deficiency: leaves become pale green to yellow. Younger leaves show deficiency symptoms ahead of the older leaves. Extensive fibrous root development and in kūmera or taewa storage roots are round. Deficiency and excess of sulphur show similar symptoms.
Calcium (Ca) Konupūmā	Deficiency: the plant shows retarded growth. Small chlorotic patches appear on the surfaces of leaves and eventually develop a leathery texture. New leaves become light green and reddish and the ones near the base of the plant turn brown. Older leaves fall off.

TAIORA ITI

MICRO-NUTRIENTS

Boron (Bn) Pūtiwha	Deficiency: mostly occurs in coarse-textured soils. Terminal growth of the plant is distorted and restricted, and internodes are shorter. Kūmara will a bitter taste.
Iron (Fe) Rino	Deficiency: lamina of young leaves turned very pale yellow to almost white in the very early development of leaves with veins sharply contrasting. Plants are markedly stunted, and plants may totally fail to mature properly.
Sodium (Na) Konutai	Excess: presents itself as a soil salinity problem and with serious impact on crop establishment and growth. Plants appear stressed and leaves may develop brown necrotic spots, turn yellow and fall off.
Aluminium (Al) Konumohe	Excess: most common in acid soils and plants appear stressed. Fibrous roots become thickened, stunted and fail to branch properly or normally. With excess aluminium, leaf, petiole size and overall top growth is reduced.
Manganese (Mn) Konupango	Deficiency: young leaves turn pale yellow. Internodes are smaller and leaves are smaller. Excess: interveinal yellowing.

SOWING YOUR OWN SEEDS

Sow seeds and produce your own seedlings or transplants for the garden. This activity should take place separate from the garden and can continue all year to provide replacement plants as the garden produce is harvested. Seedling production needn't be an expensive activity and it is very useful to get into the habit of recycling materials; pots, potting mix, labels etc.

Some important factors around growing seedlings are as follows:

- For many plants you can save your own seed at a cool temperature to hold its quality until sowing. For seed purchased from a shop, try to buy as required and sow immediately rather than holding it over for any length of time.
- Dust seeds, especially cucurbits that get planted directly in the garden, with powdered sulphur or another suitable fungicide before planting. This helps control damping-off disease of seedlings.
- Maintain good hygiene in work space and with materials. Always wash and disinfect tools used. Ensure all plant waste is destroyed and diseased seedlings taken away from the facility for destruction. Recycled trays need to be properly cleaned and dried.
- Label all trays are generally plastic and reusable. It is also possible to use egg containers, milk or drink cartons (cut down to their bases) paper roll tubes or general plastic containers such as margarine containers for sowing seeds. Ensure drainage holes are made before sowing.
- Use seed-raising mix to sow your seeds. This is the best material available and ensures good germination and seedling growth.
- Water regularly with a fine misting spray. Do not over water seedlings as this encourages diseases.

- Do not put trays in the full blazing sun as it is too harsh for the seedlings. Initially put trays in a warm and sheltered area, move to a more exposed space once seedlings are about 5 cm tall to start to acclimatise them for planting out.
- Transplanting. When plants have reached about 10cm tall, plant and water them in their garden. Some plants suffer transplant shock especially parsley and many Asian greens and may take some time to settle and continue growing.
- If something is to be sown 'under glass' this means it needs protection to become established and can be achieved through a glasshouse, plastic house, cloche or possibly a shade house. Early plantings of some crops can be achieved with transplants sown under glass.
- 'Seed tapes' are an easy way to plant some seeds directly in the garden. Seeds are evenly spaced on a biodegradable sticky piece of paper and laid directly in a furrow and covered.

RAISED GARDENS

Raised gardens are useful in a limited space and also for people who cannot bend down to the garden easily. They are also a tidy form of gardening and easy to manage once they are established. Some key principles in raised gardens are:

- Width of each garden needs to meet an average person's reach from all sides, i.e. 2 – 2.5 m width maximum, but any length is fine.
- Use treated pine half rounds available from all timber suppliers.
- Depth will be 2 – 4 half – rounds high- depending on preference.
- Sides should be lined on the inside or painted with a tar-based paint on the inside.
- Garden needs to be divided single plots into four rotations i.e. build atleast 4 gardens or divide single plots into 2, 3 or 4 areas so crops can be rotated each year to minimise pest and disease problems.
- Fill with appropriate media, preferably compost, bark products and topsoil which have been well seasoned and limited. It is important the media is not too fine as it will consolidate.
- Install and irrigation system when establishing the gardens. These are available from hardware stores I kitset form, are cheap and easy to install. They will save a lot of work when the summer season arrives.

EDUCATIONAL GARDENS

Teaching our children to grow vegetables is a great experience for them and excellent life-skill.

An educational garden is one where you give children the space to plant and participate in crop management during the year. It should be a mix of short and long-term crops and include plants which can be picked and eaten fresh as well as others that need to be cooked or preserved. A couple of examples of educational garden ideas below:

CARROTS

Carrots are one of the easiest crops to grow and are an excellent crop to get children experimenting in the garden. Carrots are very easy to establish from seed, can be eaten straight from the garden (maybe after a wash) regardless of appearance, and are very nutritious. Carrots can be sown anytime from about August to March.

- The site should be in a sunny aspect and the ground has to be well prepared and enriched with compost.
- Prepare seedbed to the depth of 30cm, sow seed in accordance with the packet instructions and water in.
- Seedlings take 14 – 21 days days to emerge and need to be thinned to 2 – 3 cm apart.
- Carrots will take 12- 16 weeks before harvest.

POTATOES / TAEWA

Potatoes and taewa are an ideal plant to include in a children's garden. They are seasonal, tolerant most climates and produce a great product for children to cook and eat. There are two approaches that can be taken; plant some directly in the ground and manage them through to maturity or, plant one in a bucket which can be kept at home, watered nurtured and harvested at the end of summer.

PADDOCK TO PLATE INITIATIVES

There are a number of new initiatives available to schools for introducing children to gardening activities. One recent success is around the concept of 'paddock to plate' where the crops grown are chosen specifically because they can be used in a cooking component of the curriculum straight after harvest. Thus, the project has several phases, all useful contributions to the learning outcomes.

ECOSYSTEM LEARNING

Aside from the food component of gardens it is useful to give children an opportunity to see nature at work. Some common pests such as aphids or caterpillars can be fascinating to watch and learn. Predators including lacewing and lady bird nymphs or praying mantis are interesting for people to watch. The biological component of the garden and soils will always be dynamic and never cease to introduce something new for people to learn from.

SALAD GARDENS

Salad gardens are those dedicated to growing a range of herbs and vegetables that are useful for fresh salads in the kitchen or as snacking plants. Different plants will have different requirements in the garden and some salad boosters such as mint, parsley, chives and basil will be longer term residents in the garden and need to be planted where they will not be disturbed. Add compost and lime to the garden before planting in the spring. The main vegetables to consider for a salad garden follow.

LETTUCE

Including cos, loose-leaf and hearting varieties. There are a wide range of varieties of different leaf colour which can be used in different ways. Best established from transplant grow from seed under cover. Can be grown year round. Loose-leaf varieties can have their outer leaves picked about 3 weeks after planting. Plant for morning sun and afternoon shade.

Slow growing lettuce will taste bitter so ensure they are well fed and quick to harvest. Lettuces can be quick to ‘bolt’ in hot, dry weather; the buttercrunch variety is generally slower to bolt.

ROCKET

A green leafy vegetable which can be sown directly every 4 days and can be picked once they are about 10 cm tall – about 4 weeks after sowing.

PARSLEY

Slow growing from seed so best to start plants early or purchase seedlings. Plants will survive for a long time and need little in the way of maintenance other than picking.

TOMATOES

There are many varieties and types of tomatoes available. All can be grown from seed purchased or saved from previous season fruit. Choose the preferred type e.g. cherry tomatoes, beefsteak varieties, acid-free varieties, heirloom etc. and plant each seedling with enough room to provide support as required. A tomato ‘wigwam’ or tripod is a useful way of training them and can be made with stake, bamboo sticks or similar tied at the top. Shelter from the wind.

CRESS

Similar to watercress, belongs to the mustard family; grow in a shady place any time of the year, water regularly and once they reach about 5 cm height, start cutting.

PREPARING TOMATO SEEDS

After harvesting the tomatoes seed can be saved from the very ripe fruit. Follow the following steps to save seed for the future crop:

1. Select very ripe fruit of a chosen variety.
2. Cut open and scoop out seed from the cavities of the fruit.
3. Wash excess pulp off the seeds.
4. The next step is called fermenting… this takes off the natural germination and disease inhibitor in the gel around the seeds.
5. Put seeds in a gar of water and cover.
6. Leave for 5 days. The seeds will float then sink to the bottom of the jar separating from the pulp.
7. Strain off dirty water then sieve-wash the seeds.
8. Collect and dry seeds on a paper plate (not paper towels as they will stick).
9. Once air-dried package the seeds in an envelope.
10. Name and date the envelope.
11. Store in a cool place until ready to plant.
12. Seeds are OK to store for around 12 months.

ENDIVE

Grown in much the same way as lettuce but slower to reach maturity. Sown under cover from spring through to autumn and transplanted into the garden.

CAPSICUM / PEPPERS

A summer crop which can be established at the same time as tomatoes.

CUCUMBERS

Including apple cucumbers. A summer crop best sown directly where the plants will establish. Cucumbers also need support for the best quality fruit production.

SPRING ONIONS

Seed sown from autumn to winter and harvested in 3 – 4 months.

RADISH

Fast growing and do best in the cooler seasons, radishes require compost and moisture to achieve their best. Sow directly in the garden and thin to 7 – 8cm apart one they emerge.

ASPARAGUS

This is a perennial plant with varieties that can be cropped for up to 20 years. Sow seed or seedlings in a relatively pH neutral and sandy soil which has been well composted and dug over. Do not harvest and spears in the first season, keep weed free. Subsequent harvests generally last up to 12 weeks annually from late August to late November.

SALAD HERBS

A selection of flavoursome herbs are useful salad plants. Sorrel, mint, basil and chives are all good examples.

STRAWBERRIES

A perennial favourite that can be grown in-ground or in pots or baskets. An excellent snacking plant with the life span of around 2 years (2 seasons).

PEAS / SUGARSNAP / BEANS

Another excellent snacking plant and can be grown easily during the spring and summer months. Plant in accessible areas as they need regular harvests.

BEETROOT

A biennial plant that produces the root in the first year and flowers in the second year. Seed can be sown from spring through to autumn. It emerges within 10 – 14 days, can be thinned a week- or two later. Beetroot can be grown for baby leaves or beets picked at about 6 weeks or classic beetroot harvested around 12 weeks after sowing.

IN GROUND GARDENS

Most of us are familiar with in-ground gardens prepared on a seasonal basis and taking advantage of the soil qualities that exist. These types of gardens are the least expensive to establish. They benefit from additions of composts and manures and will do better if the growing area is raised as this assists drainage for the plants. As with any other gardens it is important to divide the whole garden into at least 4 areas so a full rotation can be practiced which includes a fallow or rest plot.

Rotation is based on a few simple principles and intended to minimise pest and disease issues as well as look after the soil resource in both structure and nutrition. Basic principles include:

- Do not grow the same crop or crops from the same family more than two years in the same plot.
- Shallow rooted crops to follow deep rooted crops (or vice versa).
- Leafy crops to follow long-term annuals such most root crops.
- Cover crops to be grown in fallow or rest periods.
- Do not be shy to include some different crops such as sunflowers in the rotation.

It is also important to encourage the beneficial insects to your garden. Bees are important for assisting pollination of fruit crops and also have the by-product of producing honey. Plant strips of wild flowers on the outside of the vegetable plots to encourage bees in spring and summer. The wildflowers should include easy to raise plants such Californian poppy, aquilegia (Granny Bonnets), alyssum, amaranthus, cornflowers, daisies, salvia, strawflowers and many others.

WATERING

The nursery has a range of tasks which need to be undertaken on a regular basis. **Water is important for plant survival – especially young seedlings.**

There are several ways to water:

- Overhead with sprinkler on a can (for medium to heavy droplets). This method is better for bigger plants and used to saturate the ground.
- Hose for direct watering – outdoors (heavy droplets). Useful for outdoor watering, especially of big plants.
- Misting – best for seedlings and small plants (small droplets). Especially useful for the young seedlings and the trays of seed before they start to emerge.

DAILY

- Water trays and seedlings before 10am.
- If very hot then twice a day, once before 10am and again at the end of the day before nightfall.
- Do not water overhead if too hot as the water will cook the leaves.
- Misting is best for the young seedlings.

2 – 3 TIMES WEEKLY

- Watering of bigger plants and outdoor plantings.

If regular watering is a difficult – put plants in a bath and leave an inch of water under the pots/trays.

FEEDING PLANTS

The nursery has a range of tasks which need to be undertaken on a regular basis. **Food or nutrition is important for plant growth survival.** There are several ways to supply nutrition to the young plants:

LIQUID FERTILIZER

Works faster for the plant and can be applied at different strengths. Fish fertiliser is a common choice or you can buy products which are a concentrate ready to mix with water and then water on the plants. Very good for young plants and leaf growth.

FERTILISER IN THE POTTING MIX

This option is to provide nutrition slowly over the life of the plant while it is in a container. You can buy different fertiliser choices to go with plants depending on their age of growth. In general they all require the basic nutrition called N:P:K:S:Ca (Nitrogen; Phosphorus; Potassium, Sulphur and Calcium)

Look for products that have some of all of these nutrients in their recipe from the factory.

DRY FERTILISER

This is the fertiliser you can buy from the store. Be sure to purchase fertiliser that is appropriate to the crop needing the food! And look for that N:P:K:S:Ca ratio on the packet to match- the plant needs. Dry fertiliser is slow acting compared to liquid fertiliser so needs to be applied ahead of time for the plant to be able to access and use it.

HOW OFTEN SHOULD I FERTILISE THE PLANTS

Plants are like animals, they need support throughout their life.

Small seedling plants will look to the potting mix for the food needed for them to grow. Because of their size they don't need a lot but they do need regular feeding. Larger, older plants have a different demand and it is better to have fertiliser in the mix which they can get when they need it. So – feed young seedlings weekly (once a week) with liquid feed and feed older self-managing plants with a dry fertiliser every 4 weeks maybe.

Strong plants are healthy plants. They can be planted out earlier, out-compete weeds, resist pest problems and disease problems better and give you an early harvest. Good nutrition should help develop the strongest of plants.

GARDENING ACCESSORIES

The following points relate to factors which contribute to a garden's success.

WATER

Every garden needs water. Water is also a good- accessory as it complements the activities of a garden and introduces a diverse range of insects and wildlife to assist the gardener.

- Either have access to water supply or take steps to establish a water storage system that can be accessed in the dry months.
- Use some basic water-wise approaches; collect rainwater, do not fertilise in the dry months, hand water in the rain, water during cooler periods of the day, use soil-wetting agents available from garden shops as appropriate.
- An irrigation system can be cheap to install and save a considerable amount of work.
- Consider drip irrigation for fruit trees and shrubs – it is much more economical.

WINDBREAKS

- If the garden is exposed to predominant winds or icy blasts then the wind break will help to protect it. Natural hedges or women cloth wind breaks are beneficial in filtering the wind as against solid fences which often create wind swirls. Use windbreak cloth to protect hedges as they are growing. Stake vulnerable plants and trees if wind is likely to cause root damage through wind-rock!

TOOL-SHED / CHEMICAL LOCK-UP

- Health and safety is important, especially when children or visitors are likely to be regular visitors to the garden. It is important to have a shed for storing tools and chemicals and other garden aids that can be locked up at all times. Excess or outdated chemicals can be disposed of through the regional council.
- Have an inventory of tools and keep them properly maintained. Better to be ready to us than broken and need fixing before use.

GLASSHOSES / GREENHOUSES

- Glass or greenhouses are structures that allow you to manage environmental factors to produce plants needing controlled inputs. High value crops, seedlings are cuttings are the most common uses. It is important to maintain good hygiene in these houses as any problems can become rampant in a very short time.
- Useful for the establishment and management of seedlings / transplants Specialised houses such as plastic greenhouses have many uses and need to be well maintained all ear round. Power and irrigation options are useful for these houses.

COMPOSTING AND FERTILISERS

In a good garden system, you would know the nutrient values of the soil resource and manage the inputs so the nutrients were maintained at an acceptable threshold level regardless of various crop demands. It is good practise to take regular soil tests at the same time of year annually to determine the main nutrient levels. Test results can allow us to modify nutrient levels and pH values to suit our crop demands. Many fertiliser products are identified with nutrient ratio levels on their packaging e.g. 10:10:12:4 (N:P:K:S) translates as (by weight) 10% nitrogen, 10% phosphorus, 12% potassium and 4% sulphur. Nutrients can be added in several ways; fertilisers both natural and synthetic, compost, manures, liquid feeds, plant residues and atmospherically.

NATURAL FERTILISERS

Refers to a range of products but includes products that can be purchased at shops such as blood and bone products, phosphate rock, lime, elemental sulphur, copper products and others. Composts

and manures are also natural products that can be used as fertilisers although the nutrient content is unknown.

SYNTHETIC FERTILISERS

Most of the fertilisers that we are familiar with are synthetic or man-made products. This means they have been mixed, combined, transformed with other inert base materials such as clay to contain known levels of key nutrients. This is not necessarily a ba thing and can be useful in returning known levels of nutrient to soils before cropping.

COMPST

Generally made on site using organic waste products from the garden and kitchen. It is useful to have at least two compost areas so one can be left to finish its natural breakdown while another is being built slowly. A good compost system will take around 6 months before it can be taken to the garden either as mulch or fertiliser.

You can do compost by creating a pile in the corner of the garden. This is simple; all you need is the space somewhere where the water will drain well – Do not use a place where puddles will form. The minimum size will be 1m by 3 (1m x 1m x 1m). In dry weather, the outside of the pile will dry out and the compost process will slow down. The compost piles need to be turned and mixed regularly about once every two weeks. It is best to have two piles so that you can be adding new stuff to one while the other is finishing composting completely.

MANURE

Manure is the decomposed waste of animals used as fertilizer to grow crops. Usually from chicken, horse or cow manure however, dung from these animals may contain weed seeds so can be risky for garden use.

To gain a better result soak the manure in water and make a liquid fertiliser. To do so, put the manure in water at a 1:4 ratio (that is, fill a plastic container ¼ with manure in a bag, tied off and the remaining ¾ filled with water). Leave fully immersed for a month and any weeds or grasses will rot away and you will just have manure water. The bag of manure can be used again as many times as you like until he liquid loses its colour.

Another good manure is the fish manure. Fish manure is a green waste option which can be made from the waste materials of fish and other ocean foods – so that a liquid fertiliser can be available for feeding the crops.

Using a large plastic container with a lid – or a made up cover – put the fish waste in and cover with water at least twice the depth of the waste (so 1/3 fish waste and 2/3 water). Stir twice a week until the smell has gone – probably 4-6 weeks. Keep the cover on when not stirring. Mix the watering can – 1 part liquid manure to 2 parts water – and water the ground around the plants. Especially good for young leafy plants.

LIQUID SEEDS

Liquid fertilisers are useful for remedying nutrient imbalances and generally act quicker than solid products. As an example, magnesium sulphate (Epsom salts) for magnesium deficiency is best applied as a liquid fertiliser. Aside from the liquid manure mentioned it is common to see seaweed or fish and shellfish by-products used as a base for liquid fertilisers. Soak these products for several weeks until the smell has gone. The mix needs to be stirred at least weekly. Use as a 1:10 base with water to apply to crops as a foliar feed.

PLANT RESIDUES

It is good practise to return as much plant or crop residue to the soil to add organic matter to the soil profile. Plant residues need to be given sufficient time to rot down and be incorporated before becoming available for future crops.

ATMOSHERICALLY

Some nutrients are sourced involuntarily through the atmosphere including nitrogen which is taken into the soil through legume plants, and sulphur.

COMPANION PLANTING

Companion planting is a relatively natural way to use plants to support each other around pest and disease incidence, assisting pollination, soil quality factors and maximising plant opportunities. Much of the basis of companion planting lays in the scent or aroma of plants acting as attractants or deterrents to insects. The following list identifies some key vegetable crops and the beneficial companion plants followed by plants that would have a negative effect on those vegetables.

VEGETABLE CROP	BENEFICIAL COMPANION PLANT/S	NEGATIVE COMPANION PLANT/S
Potatoes & taewa	Peas, beans, brassicas, con, nasturtiums, marigolds	Pumpkin, onions, garlic, tomatoes, cucumber, sunflower
Corn & kānga	Broad beans, potatoes, melons, sunflowers, tomatoes, cucumbers, pumpkin and kamokamo	Neural
Onions	Lettuce, carrots, beetroot, silverbeet, strawberries and corn	Peas, beans, potatoes
Beans	Brassicas, carrots, cucumber, lettuce, peas, parsley, spinach	Onions, sunflowers, garlic and fennel
Lettuce	Carrots, strawberries, onions, beans, cucumbers, beetroot, turnips, marigold, radish, calendula	Parsley
Beetroot	Beans, brassicas, lettuce, onions, silverbeet	Pole (tall) beans
Tomatoes	Asparagus, gooseberries, chives, onions, parsley, marigolds, nasturtium and carrots	Apricots, broccoli, cabbages, cauliflower
Carrots	Onions, leeks, rosemary, sage, lettuce, tomatoes and marigolds	Dill
Pumpkin	Corn	Potatoes
Kamokamo	Corn, lettuce, potatoes, sunflowers	Unknown
Cauliflower	Celery, beans, tansy, nasturtiums	Tomatoes, strawberries
Peas	Potatoes, taewa, carrots, celery, brassiacs, radish	Onions, garlic, shallots
Silverbeet	Beetroot, onions, lavender	Neutral
Strawberries	Leeks, lettuce, spinach, sage, borage	Brassica
Celery	Cucumber, tomatoes, beans, leeks, brassicas and dill	Neutral
Cabbage	Thyme, mints, onions, sage, potatoes, celery, dill, chamomile, and rosemary	Strawberries, tomatoes, pole beans

Cucumber	Beans, celery, corn lettuce, peas, potatoes, savoy cabbage, sunflowers, radish and nasturtiums	Potatoes
Parsnips	Potatoes, courgettes/zucchini	Carrots, celery, caraway
Leeks	Carrots, celery, strawberries	Potatoes, peas, beans, brassicas
Parsley	Tomatoes, asparagus, carrots, roses	Mint
Garlic	Tomatoes, sage, thyme, nasturtiums	Peas, beans, brassicas
Fruit trees	Mustard, clovers, chives, garlic, onions, nasturtiums, dandelions	Basil, sage and tomatoes

GROWING MĀORI CROPS

These crops are not necessarily 'Māori' but are all traditionally used in the Māori diet and hence have special significance in Māori gardens. The value of many of these crops is their ability to be preserved in some form to extend their availability beyond fresh harvests. These crops are making a comeback to the mainstream markets and seed is relatively easy to access or trade with others.

TAEWA

(Taewa – Māori Potatoes) (RIWAI – Irish Potatoes)

WHAKAPAPA'

There are several different beliefs regarding the origin of the 'Māori' potato (*Solanum tuberosum* subspecies *tuberosum* and *andigena*) in New Zealand and the route taken to get here. It is generally accepted that potatoes were not brought as cargo during the migrations of Māori to New Zealand but how they arrived is an interesting point. Some believe that chance visits by unrecorded trading vessels which may have earlier visited South America are responsible for the introduction of taewa. Other tribes hold beliefs that native potatoes were sourced by their own people from the bush or through other obscure processes. South Taranaki tribes claim the variety Tātairongo was obtained from the underworld by their tupuna (ancestor) Te Reke Tātairongo.

As a cultivated plant taewa enjoy the protection of Rongo. Whilst the crop is not accorded the level of tapu applied to kūmera, ostensibly because of the ease of production and storage and its late arrival into the inventory, it still benefits from the fundamental support