Managing Your Weeds Organically

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Sustainable Living in the Suburbs

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1.0 Introduction - What? Why?

I guess the start of a conversation around weed management should cover what a weed actually is, some form of definition. Many years ago an old mate gave me his definition of a weed and he had an interesting take on things:

“You pull a plant and toss it onto your compost heap, if it dies it was just a plant, but if it survives it is a weed!” – Tim

Personally this seems a bit too much like the witch trials for me but Tim did have some interesting ideas! Looking a bit further afield, here are some definitions provided to me by my good friend Uncle Google –

- **Oxford Languages Dictionary** - "a wild plant growing where it is not wanted and in competition with cultivated plants".
- **Merriam-Webster** - "a plant that is not valued where it is growing and is usually of vigorous growth"
- **Cambridge Dictionary** - "any wild plant that grows in an unwanted place, especially in a garden or field where it prevents the cultivated plants from growing freely"
- **Collins Dictionary** - "a wild plant that grows in gardens or fields of crops and prevents the plants that you want from growing properly".
- Or my favourite from **Wikipedia** - "a plant considered undesirable in a particular situation, growing where it is not wanted".

Putting that in simple parlance: a weed is a plant out of place. It does not have to be a wild plant to cause problems, as anyone who has done battle with the rootstock of a Nelly Kelly passionfruit can attest!

So, having seen that the general characteristics of a weed are that it is just a plant growing in an area where you don’t want it to be, why is that a problem? There may be any one of a number of problems associated with that plant out of place –

1. Competition – weeds will compete with the plants which you are trying to grow to a greater or lesser extent. They will compete for light, water, nutrients and/or space all depending on what your main crop is and how invasive the weed is. With the wet weather we had around here over the past couple of years, I found that *commelina cyanea* (scurvy weed) moved in and took over a number of our patches. It was fast growing and was physically able to outcompete a number of veggies for light. At the least a bad weed infestation can result in reduced yields, with death of crop plants as a worst case scenario.

Weeds can develop into a mass of foliage, competing with crop plants for nutrients, water, space and light

2. Hosts for Pests – Weeds can act as hosts for pests of crop plants providing a place where they can feed and reproduce, camouflaged in amongst all the weedy growth. Also, pests can overwinter on weeds so they are ready to start up the following spring. Some examples include thrips on a number of weedy species, aphids on sow thistle (*sonchus* species) and harlequin bugs on long grass and herbaceous weeds.

3. Host for Diseases - Weeds can also act as host for crop plant diseases such as viruses that can then be transmitted to crop plants by sucking insects like aphids, whitefly, leafhoppers and thrips. Some diseases such as the tomato spotted wilt virus and Cucumber mosaic virus are hosted by a wide number of weed species. Shepherds Purse (*capsella Bursa-pastoris*) can also host a wide number of insect, nematode, viral and bacterial pests that may damage crop species.

Jasmine - an invasive weed with associated allergy problems

4. Allergies – the pollen produced by many plants, including weeds, can cause human allergies. My daughter is very allergic to jasmine (*jasminium species*) when it flowers. Other common weeds that can cause allergies include – amaranth *(amaranthus species*), dandelion (*taraxacum officinale*), dock (*rumex species)*, fathen (*chenopodium album*), nettle (*urtica species*), plantain *(plantago species*), red sorrel (*rumex acetosella*) and rye grass (*lolium rigidum*).

5. Physical injury – Caused the pointy bits (technical term) of weeds such as stinging nettles also giant, scrub and dwarf nettle *(urtica species*), thistles, like spear thistle (*Cirsium vulgare*) or scotch thistle (*Onopordum acanthium*), or bindii (*Tribulus terrestris*). There is nothing quite like leaning down to grab some tomatoes and getting a handful of stinging nettle, it certainly presents an opportunity for the neighbours kids to learn some new words!

6. Dermatitis - Some weeds can also cause dermatitis on skin contact, either immediately or after repeated contact such as parthenium weed *(parthenium hysterophorus*), petty spurge (*euphorbia peplus*) or cotton bush (*Gomphocarpus fruticosus*).

Petty Spurge (euphorbia peplus), a common weed around here, has a number of hazards associated with it

7. Poisoning – Some weeds are poisonous and can cause problems if harvested as with vegetables, eaten by children, or eaten by pets such as chooks or rabbits. Some poisonous weeds include include apple of Sodom (*Calotropis procera*), cotton bush (*Gomphocarpus fruticosus*), blackberry nightshade (green berries) (*solanum nigrum*), Deadly nightshade (*Atropa belladonna*), green cestrum (*Cestrum parqui*), pellitory (*Parietaria Judaica*), petty spurge (*euphorbia peplus*) and thornapple (*Datura stramonium*).

8. Allelopathy – This is a property of some weeds where they produce on or more chemicals that can inhibit the germination of seeds and/or growth of the crop plants surrounding them. Some examples of weeds that can have this effect are - variegated thistle (*Silybum marianum*), purslane (*Portulaca oleracea*) , fathen (*chenopodium album*), white clover (*trifolium repens*) and red clover (*trifolium pratense*) and garlic mustard weed (*Alliaria petiolate*).

9. Cross pollination – while this will not be a problem unless you want to save your own seed, in some cases wild plants (weeds) can cross pollinate with vegetables of the same species, resulting in lower quality vegetables when those seeds are planted. Examples are Queen Anne's lace (*daucus carota*) and carrots; wild turnips (*brassica rapa*) with other brassica rapa species such as pak choi, mizuna and mibuna

10. Aesthetics – depending on your point of view, a weedy place may look natural and attractive, or they may look messy and untidy, particularly if they are growing in amongst your prized rock garden or flower bed. In that case you may want to look at some weed control strategies.

Natural and attractive or messy and untidy? Your call!

So there are a whole stack of reasons why you might want to control weeds on your property. Clearly before you can do that, you need understand what weeds you have to deal with. So the next part of the process is how to identify and record which weeds are weeds to you!

2.0 Knowing Your Weeds

Trail of various weeds between veggie patches

The first activity in working out a cohesive weed management strategy is to understand exactly what it is we are dealing with here. In other words, conduct a weed Inspection of the appropriate areas of the garden. What are the appropriate areas? Well that depends on you.

For me the appropriate areas are the veggie growing areas of the back yard and productive perennial growing areas of the front yard. I divided up the veggie growing areas into south, central, west and north. Because surprisingly there are differences. The handy bit of this approach is that I didn't have one vast area, I had a number of smaller areas which I could review as I got the time.

Identifying the weeds

There are a number of ways to identify the weeds in the area of review, but for me the two main ones were using my collection of weed identification books and using a plant identification app on my phone. Some of the books I use to identify weeds can be found in Section 8 of this eBook, and the app that I use is the free Plantnet app.

When identifying the weeds it is important to use the Latin/scientific rather than just the common name. This is important for a number of reasons –

What I would call 'oxalis' is actually oxalis latifolia AKA fishtail wood sorrel

1. Common names can vary from place to place but the scientific name is very specific and refers to one plant only. On Facebook I see a common 'You Can Eat These Weeds' poster come up on people's pages regularly. Unfortunately, even though there is a small and difficult to make out picture, they only use common names and it originates in the US. One of the weeds listed as edible is fireweed, which in the US is *Chamerion angustifolium*, but here in Aus, the plant we refer to as fireweed is *Senecio madagascariensis*, a totally different plant, and toxic.

2. I can identify a fair number of edible weeds, and I found that a weed which I was confident was mallow. After some work with the plant identification app it turned out that I had not only common mallow (*malva neglecta*), but also Egyptian mallow (*malva parviflora*) and red flowered mallow (*modiola caroliniana*) which is also referred to as American mallow. This sort of distinction may prove important as research continues because they will have their own separate characteristics and may require different management techniques.

3. There is a weed that I had been told (by no less an authority than my father) was wandering Jew. One of the books I have refers to the name 'scurvy weed' (which is edible) as an alternative name for wandering Jew, hence I thought they were the same plant. In my researches it turns out that:

Commelina Cyanea

a) Wandering Jew is in fact *tradescantia albiflora* and is toxic.

b) The plant I had known as wandering Jew was *commelina cyanea*, also known as scurvy weed and is edible.

c) Just in case I thought things were too easy, there is a plant called hairy wandering Jew which is also a member of the commelinaceae family with a Latin name of *commelina benghalensis* which seems to be edible.

Needless to say, knowing the Latin names of plants being identified and subsequently managed is important!

Carrying out the review

Once I had divided the site up into areas that made sense to me, it was just a case of spending a lovely half an hour, maybe a bit more, wandering around and looking at the abundant crop of weeds in each area. I would move through reasonably systematically, looking at each area. I would pick out a weed, bring it up on the app on my phone and then write it down, both the common and scientific name, then move on until I had recorded all the weeds in that particular area. I could then move on to the next.

Stinging nettle (Urtica Urens) - called stinging for a reason!

What I found worked was to have the phone app as the front line of identification and then use the books in my library to clear up any concerns on any identification that did not seem right and to provide more information about a particular weed once I had the name.

Back in the day, I did weeds as a subject in the Farm Technology Certificate at TAFE. There were no mobile phones in those days let alone apps, so I had a feel for what would be required when identifying weeds, as that was part of the course. While I am usually a fairly analogue bloke, the phone app saved me HOURS of time looking up the books, although the books were invaluable in their own right.

Recording

I put together an Excel spreadsheet (a copy of which is available in the Resources section) to be able to record and keep track of my weeds in some sort of systematic fashion. In the first column I record the date the inspection was carried out. This is important because different weeds grow at different times of the year, so I intend on doing at least a summer and winter inspection. It remains to be seen if it is worthwhile also doing a spring and autumn one.

The second column is the common name, closely followed by a column for the scientific name. The fourth column records the particular area where the weed was located. The Fifth column provides a place to record the PITA score (check out the next article in this series, coming soon). The sixth column is to be filled out with the preferred conditions for each weed, this will be the result of some research, hitting the books and the 'net and the final column provides a a place to record the weed management strategy(ies) once decided upon.

A	B	C	D	E	F	G
Date	Common name	Scientific Name	Location	PITA Score	Preferred conditions	Management Strategy

It is a bit of work, but as the saying goes, knowledge is power, and if you want to avoid reaching for the herbicide, even an organic herbicide, it is worth doing the work that will give you an edge over your weeds. If a new weed turns up, you already have a process to follow help you manage it!

Summary of the process

- Divide your weedy spaces up into manageable areas.
- Download a plant identification app if you are going to use one
- Go out into your weedy area and systematically identify all weeds in the area using your app and/or weed identification books
- Record all information (common and scientific names) on all weeds present
- Once the area is complete, transfer the information to weed spreadsheet

3.0 Rating Your Weeds on the PITA Scale

It may be that after you've been out and had a look at the weeds in the places that you don't want them that you only find a couple of species, but that was not my experience. On looking at a place overrun by weeds the response it can engender is "Aaarrge, pass me the sprayer!". This is, however, only a short term solution, and counterproductive in the longer term. So it is much better to understand what you are up against so you can develop a longer term, and more effective, weed management strategy. If you have a lot of weeds to manage, it can be helpful to be able to decide which weeds to attack first, that is to say: prioritise them. The trouble is how do you work that out?

The PITA weed scale

That is why I developed the PITA (Pain In The A$$) scale that helps you look at each weed in turn and rate them in terms of invasiveness and persistence, assigning a number for each, the combining the two numbers to give you a figure out of 25. The higher the number the more of a PITA the weed is and the higher up the list for managing it should be.

There are a couple of other factors that may affect the score, which you can use if you want, but otherwise it is a fairly simple system allowing you to divide your weed list into weeds which are minor, moderate or major PITAs. Then off you go!

As mentioned above, the PITA scale takes into account the invasiveness of a weed, ie how quickly and effectively it can move into an area and take over, and persistence of a weed, being how difficult is it to get rid of. A slowly growing weed that stays in one place and is easy to pull out without leaving material behind that will re-sprout will have a low PITA score whereas a weed that goes rampant overnight and leaves seeds or runners in the ground which are difficult to dig out will be pegging the PITA meter!

Scurvy weed - it spreads via stolons and can be quite invasive

Invasiveness

This is the property of a weed to be able to move into an area and outcompete plants already there such as fruit, veggies and herbs etc.
5 Plant spreads by a combination of rhizomes/stolons/vegetatively and by seeding prolifically eg creeping oxalis
4 Plant spreads by rhizomes (underground runners) eg kikuyu grass or stolons (aboveground runners) eg Scurvy weed
3 seeds are spread by wind or people eg dandelion, cobbler's pegs
2 seed are spread spread by explosive seed dispersal eg flickweed
1 Seeds are spread primarily by water movement ie they fall close to the plant and only disperse in heavy rain eg amaranth

Scurvy weed also can leave roots behind when it is pulled out - allowing it to regrow

Persistence

This is the property of a weed that enables it to remain in place despite concerted actions to remove it.
5 The weed has underground rhizome, corms, bulbs that come up again when leaves pulled out eg onion weed, nutgrass
4 The weed regrows from broken stems & roots which occur as a result of attempts to remove it eg scurvy weed
3 The weed has a taproot which breaks off when pulled, allowing the weed to regrow eg dandelion
2 fibrous root system that does not regrow when pulled out eg paspalum
1 single stem, simple root system easily pulled out, does not regrow eg petty spurge

Other considerations

There are several other considerations which may modify the original PITA score which are not taken into account by the invasiveness/persistence weed criteria. It is up to you if you want to include these considerations in your calculations.

Is the weed useful in some way? Or, more importantly, is the weed useful in a way which you are likely to take advantage of? For example, dandelion is useful in that the whole plant is edible, it may have medicinal properties, the roots are used to make a coffee substitute and the flowers used to make a honey substitute. Of course, if you have no intention of using dandelion in any of these ways the PITA score would remain unaltered and it would be just another weed. However, if you do intent to take advantage of a weeds useful qualities (ie the weed is edible, dye, medicinal, a nitrogen fixer, a dynamic accumulator), this could be taken into account by taking 5 points off the PITA score.

On the plus side: scurvy weed is edible

Are you, or any of your family, allergic to this weed? Allergy, depending on how severe it is, could be pivotal factor on how important the weed is to prioritise for management, so the PITA score could be doubled to bring this point home.

The PITA Score Matrix

Invasiveness	1	2	3	4	5
Persistence					
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	14	16	20
5	5	10	15	20	25

= Minor PITA

= Moderate PITA

= Severe PITA

So, the idea is, now that the weeds of concern have been identified, and then assessed as to their level of being a PITA, then next thing will be to research these priority weeds and decide on which management techniques will be used to reduce their impact.

4.0 Prevention is Better than Cure

4.1 Importing weeds

One way to manage a potential problem is to put strategies in place to prevent the problem before it occurs. To be sure, this does not help with problems already in place, but it prevents you having to deal with new ones cropping up, and so it is with weeds! Plus, of course, if you are just starting out these strategies can save you a lot of trouble down the track by keeping your weed problems to a minimum.

Weeds make their way into our landscapes three ways –

1. Weed seeds or runners are imported in things we buy for our garden,
2. Weed seeds are brought onto the property by natural forces such as wind, water or transport by animals or ourselves (think cobblers' pegs in your dog's coat or your socks!), or
3. They are pre-existing.

Acknowledging number one above, that a way of preventing weed infestations is by not importing weeds onto your property in the first place, there are three main ways in which this can happen, ie buying in –

- Seeds,
- Plants,
- Mulches and other soil improvers

Clearly this may be something we do a lot of, particularly in the establishment phase of gardening, so it is important to understand what the risks are and how to address them.

1. Seeds

Problems

There are a couple of potential problems when we buy in seeds. The first one being that the seeds we buy in may contain a proportion of weed seeds which we then sow, thinking we are getting a crop but we are also introducing a weed(s).

The second problem may be associated with the plant themselves. Many years ago I was looking at sowing some grain in the back yard for our consumption, but I had tried our go-to – wheat – without much success due to lack of land. I had subsequently read about a South American grain called amaranth (this was back before the internet, yes I am that old!) and thought it would be worth a go. I got hold of some seed from a seed supplier planted it out and waited for it to do its thing. Well, it turns out that grain amaranth produces huge numbers of tiny (and edible) seeds that get EVERYWHERE! It took me ten years to eradicate the stuff from the back yard, although we still get some weed amaranth cropping up occasionally.

This is weed amaranth, but the theory holds!

The strategies

A. Only buy seed from reputable suppliers – preferably your local seed savers or permaculture group or from the smaller sellers of organic seed available on line, rather than mega-commercial seed suppliers. They should also be open pollinated so you can grow from your own seed, the safest option.

B. Start your seed in punnets rather than direct sowing, that way you can keep an eye out for anomalies. You should only plant out seedlings after they have reached the true leaf (as opposed to seed leaf) stage, where weed leaves should look different from the plants you are wanting to grow.

Our system that uses punnets and newspaper pots gives us plenty of time to spot 'non-standard' seeds!

C. Do your research – before you obtain and start sowing seeds of a plant which you are not familiar with, check out the following questions: Are they easily pollinated? Do they produce copious amounts of seed? Do they reproduce by roots, tubers, corms or runners as well as seeds? Do they grow vigorously and outcompete surrounding species? A yes answer to any of these does not necessarily mean a problem, but if you are committed to the plant then you may need to work out how you are going to control it, before sowing the seeds into your garden.

2. Plants

Problems

New plants being introduced to your garden may bring problems with them or they may be the problem. When you bring plants in pots into your garden, the soil in those pots may contribute weed seeds as well as the plant for which you paid.

Sometimes though, the plant which you have bought may have weed potential. A popular climbing plant people get for their gardens is jasmine, it is easy to grow, attractive and the flower has been used medicinally as well as to extract a material that can be used to encourage plant cuttings to root. It is, however, incredibly invasive and once you have it you've got it for life.

Jasmine - beautiful but dangerous!

Unfortunately, the weed potential may also be from a part of the plant itself. As an example, many years ago we bought a couple of passionfruit vines to go at the back of the house. They were grafted 'Nelly Kelly' variety and while we didn't know it at the time, the rootstock they use is a hugely invasive pest. The leaves look different and while it does produce a fruit of sorts, the fruit isn't edible. It has ensconced itself under the back deck and we are still dealing with it.

Passionfruit 'Nelly Kelly' rootstock, poking its head up to see if the time for takeover has arrived!

The Strategies

A. when buying deciduous shrubs or trees including fruit trees consider buying them bare rooted, while they are dormant. Bare rooted plants do not bring any foreign soil into your garden and so cannot be responsible for bringing in weed seeds.

B. When buying in perennials which are not bare rooted, consider root washing. The process should be carried out when the plants are dormant and during the cooler times of the year to prevent heat stressing the plants involved. As the name implies, remove any pot or plastic bag and place the soil covered roots into a tub or bucket of water, soak for 10 minutes then gently agitate the roots to remove any soil. If the plant is root bound the roots can be teased out to spread them better. Once the soil has been removed, replant into prepared ground, water with Seasol and mulch. Keep the plant

well-watered until it has recovered. The soil and water mix, which will contain any weed seeds, can then be disposed of.

C. Do your research – before bringing any new plants, especially perennials into your garden check with any experienced gardeners you have access to, or gardening groups on the internet to see if there are any undisclosed problems. Also be aware that phrases like 'fast growing' or 'easy to grow' in advertising the plant may mean the plant has weed potential.

3. Mulches and other soil improvers

The problem

We mainly use wheat straw mulch, and as a result there are some wheat seeds that will get through and germinate. This may or may not be a problem, depending on your point of view. You may wish to let the wheat come up and then ripen so you can harvest it, or it may just be another weed for you.

Years ago I used to get a locally grown grass hay to use as mulch, produced by a local farmer. Being produced locally meant fewer kilometres it had to travel, which was a good thing, but it also left me with the gift that keeps on giving – stinging nettle! It appears that stinging nettle was part of the hay and they had viable seeds. I do have uses for stinging nettle but they are still capable of surprising me when I go to harvest a veggie form the patch.

Animal manures are a great source of fertiliser, but depending on the animal and their diet they may contain weed seeds. Also commercial organic fertilisers, soil conditioners and other soil amendments may contain weed seeds, although hopefully not, but anything is possible.

The Strategies

A. Use chooks - We have a separate chook shed for the older birds that do not produce many eggs, we call it the retirement village. All of our straw mulch is put into the retirement village where the chooks dig through it, break down the long stalks, mix it with manure and eat any wheat seed still mixed in with the straw, so this process provides us with a number of advantages.

Wheat straw, worked over by chooks, does the job as weed free mulch for us.

B. Mushroom compost - Another strategy is to use spent mushroom compost. Due to the nature of how it is used (initially sterilised, kept in low light conditions) it is unlikely to hold any viable weed seeds. Also, on the plus side, spent mushroom compost can produce a second flush of mushrooms under the right circumstances. The compost would not produce enough to be economically viable for the mushroom farmer, but can provide a nice side-crop for us amateurs.

C. Composting - take the amendment, particularly if bought in bulk, hill it up and leave it in the rain to compost for a bit. Any weed seeds will germinate during this time and the plants can be removed. This process is also beneficial for cow or horse manure where the animals may have been wormed recently, and the composting allows the wormer to break down, so that there will be no problems with earth worms being affected.

Conclusion

There are quite a number of ways that weeds can get into our gardens, there is no need to make it more difficult by importing them ourselves. Before bringing any seeds plants or other garden related materials, do the research and avoid the weeds where possible, and then select any strategies for treatment which are appropriate to your situation!

4.2 Weeds brought into the garden by other agencies & existing weed seeds

As mentioned at the start of Part A of 'Prevention is better than cure' Weeds make their way into our landscapes three ways –

1. Weed seeds or runners are imported in things we buy for our garden,
2. Weed seeds are brought onto the property by natural forces such as wind, water or transport by animals or ourselves (think cobblers' pegs in your dog's coat or your socks!), or
3. They are pre-existing.

Cobbler's Pegs (bidens pilosa) gotta love 'em!

While the previous section dealt with strategies to prevent (1) bringing weed species into your garden, this one will deal with strategies to prevent problems with (2) weed seeds brought onto the property by other agencies such as wind, water etc. or (3) weed seeds already existing in your soil. The following strategies will impact weed seeds arriving and weed seeds already existing in your soil.

Strategies

1. Avoid cultivation – This means not turning the soil over unless it is absolutely necessary, because this may stimulate existing or blown in weed seeds into germinating. There are times when some tillage is inevitable, like if you want include soil amendments like garden lime if your soil pH is a bit low or add fertiliser's like chook manure.

We use the chook tractor and the chooks will turn the soil over a bit, but will also consume any weed seeds that they find. Occasionally, if we have had wet weather, the chooks can cause some surface compaction of the soil, so I need to go through with a small hoe once the tractor has moved on, and break the surface up a bit before I apply the mulch. Which brings us to our second strategy –

2. Mulch – Think of bare earth as an open wound. If you have been working on your garden and left the soil uncovered, like a bare wound, nature will begin the healing process for you by germinating all those dormant weed seeds present in the soil. If you don't want that then the idea will be to mulch the bare area as soon as possible, with whatever material you have to hand. Even rocks can be used as an inorganic mulch.

We use straw that has been worked over by the chooks in the retirement village, because they break it down a bit, add manure and clean up any residual wheat seeds. The wheat straw goes on our annual vegetable beds and we use wood chip mulch around our trees, shrubs and other perennials. If you know you are going to be doing some gardening work that will expose the soil, having some material which can be used as mulch ready to go will mean the open wound gets a proper dressing as soon as possible.

3. Water – Apart from the fact that it is wasteful and inefficient, watering indiscriminately by hose or sprinkler allows all those dormant weed seeds to come busting thought and give you a hard time. The secret is to put the water where it is needed directly – underground near your crops' roots. While we have tried a number of ways to do this over the years, I have found that I keep coming back to two techniques – ollas for our annual veg and deep pipe waters for our perennials.

Deep pipe waterer for perennials

Ollas are unglazed terracotta pots buried up to the neck in soil in our veggie beds. They can be made from scratch if you are a potter, or made from commercial pots if you are not. They allow water placed inside them to seep out slowly in the root zone of the vegetables. Deep pipe waterers are 50mm PVC tubes, 500mm long with holes down the side, buried upright within the drip zone of perennial plants, again, allowing water to be delivered directly to the plant roots without wasting any water germinating weeds on the soil surface. For more details on both of these irrigation methods check out the links at the end of this article.

Ollas from pots

Of course, we can't control the rain, but in drier seasons watering using ollas and deep pipe waterers can reduce the water you need to irrigate and weeds germinating where you don't want them.

4. Encourage predation of weed seeds – ants of the species Rhytidoponera and Melophorous eat weed seeds and are found widely around Australia. Crickets and ground beetles (specifically Carabid beetles) also consume weed seeds. Clearly this is a behaviour which we should encourage.

Actions to encourage the presence and activities of these insects generally includes: Not using broad spectrum insecticides in your garden and not digging your garden over (see 1. Above). Leaving leaf litter undisturbed and providing a log pile and low growing plants as habitat for ground beetles and crickets is also a good idea.

Bird manure - great for fertility, but not so much when it is on the lettuce, or growing weed seeds

5. Check under bird roosts – Birds are great 'concentrators of fertility' or in other words, they eat elsewhere, then come and crap their extremely fertile manure on your place. This is a good thing and should be encouraged. However, there are some weeds which have evolved seeds that survive the digestive tract of the bird and use birds to extend their range. Such weeds include Privet, Ochna and Asparagus Fern around here and perhaps others or different ones depending on your location. If you do have an

area on your property that birds use as a toilet, that is great, but do keep a check on it and remove any weeds as soon as they germinate.

Conclusion

As mentioned previously, there are quite a number of ways that weeds can get into our gardens, but if we are set up using the above simple strategies we can at least reduce the impact that weeds have on our gardens. This will make the job of maintaining our gardens easier in the long run.

5.0 Weed Control

5.1 General Considerations

Before committing to your weed control strategies, it is worth keeping in mind the following points and considerations –

1. **Be knowledgeable** (see part 2 – Knowing Your Weeds), it critical to distinguish between annual and perennial weeds because weed control practices will, for the most part, be more effective on annual weeds. Perennial weeds will require more effort.

2. **Be safe** – when hand pulling weeds work within your physical limits (ie don't bust a gut!). Also, when treating weeds wear PPE (Personal protective equipment) which is appropriate to the task eg, hat and sunscreen when out in the sun, gloves when pulling irritating weeds, using a heat gun or boiling water (to prevent burns or scalds) or when using chemical controls (to prevent skin irritation). Likewise, wearing eye protection from the sun, heat or chemicals (even vinegar can do bad things to your eyes) is very important.

3. **Be timely** – generally speaking, weed control activities will be more effective if applied early on in the season when weeds are young and small.

4. **Being Timely is still important** – if you miss weeds when they are young and small, at least make sure you control them effectively before they set seed, thus the old proverb – 'one year's seeding equals seven years weeding'.

Once weeds are gone, cover the soil: use a mulch or cover crop

5. **Be vigilant** – keep an eye out for weeds constantly so new ones don't get the jump on you. This can be as simple as casting an eye over the veggie patch a couple of times a week.

6. **Be vigilant, even after the fact** - vigilance is doubly important for areas you have already cleaned of weeds. Depending on the weeds and your chosen control method, perennial weeds may come back, existing weed seeds may be stimulated to germinate or you may have missed taproots, stolons or rhizomes that can re-sprout. Don't make the mistake of assuming the weeds in that area are sorted, keep a weather eye out!

I removed weeds from this area between the fence, greenhouse and compost bin. When I checked back after what felt like a few days (but was probably weeks) this is what greeted me!

7. **Start from an Edge** – Where you have a weed infestation rather than a spotty weed problem, It can be easier if you start controlling the weed patch by working from the outer edges of the infestation where the weed concentration is less in towards the centre where they are more plentiful. This approach will also prevent the weeds from spreading from the area even as you try to control them.

8. **Be realistic** – keep the area of weeds you are working with to a size where you can realistically achieve control. Attacking too large an area, can result in failure, disappointment and frustration causing giving up too early. As I get older I find myself tiring more quickly so I have to be careful not to bite off more than I can chew.

9. **Be thorough** – Do not move on from the weedy area you are concentrating on until it has been thoroughly decontaminated from weeds. Getting the area mostly free of weeds before moving on is setting up for frustration as the bits left regrow and reclaim the area.

10. **Don't let the spaces remain empty** – when you have removed weeds from your beds or patches, replace them with something. Start out with mulch to cover the soil, then replant with seeds or seedlings if that is part of your plan or use a cover crop/green manure.

Dandelions have multiple uses

11. **Are all weeds 'weeds' to you?** – Do you want to eradicate all weeds or are there some you are prepared to accept or even use? We will use dandelion, mallow or sow thistle leaves in our cooking, and feed them to our chooks, so I tend to not be as rigorous with their removal as I might be with others, leaving some growing to use as we need them.

12. **Be responsible** – don't let your weeds become a problem for your neighbours or local bushland, start managing them today!

5.2 Physical Control Techniques

While advertisers would have us believe that the first and best control should be chemical, there are other options, and this section discusses physical rather than chemical options.

Heat

Sufficient heat or heat applied over a longer term can have a negative effect on plant cells, disrupting them. Heat may be applied in a number of ways to control weeds –

1. Solarisation – This is the process of covering an area in black plastic over summer and allowing the summer heat to kill weeds and weed seeds. Before applying the plastic, mow the weeds or cut them back with a whipper snipper or scythe. Also, ensure the area is damp, this will encourage weed seed germination, which the solar heat and lack of light will then kill. Irrigating the area first will also allow the solarisation to be more effective because damp soil will be more conductive to heat than dry soil. Leave the plastic in place for four to six weeks in the middle of summer to get the most out of the solar heat. It is also important to dig in the edges of the plastic sheet or weigh them down to exclude light as much as possible.

The soil may reach as high as 60C at a depth of 50mm, which will also impact pest insects and soil pathogens. The goal is to achieve a temperature of 45c to 50c in top 150mm of the soil. This is a comparatively cost effective way of dealing with a large area of annual weeds.

The downsides of solarisation are that the soil biota will also suffer as a result of the heating, but this should return to normal after the plastic is removed. Solarisation may also be less effective in controlling perennial weeds that have deeply buried underground vegetative structures such as rhizomes, corms or tubers, which are below the hotter levels in the soil and that may re-sprout once the solarisation is complete.

2. Boiling water – In this weed control method the heat is applied directly by heating water to boiling and then pouring it over the weeds to be controlled. The boiling water acts as a contact herbicide in that it will kill what it comes in contact with, so it will be easier to kill plants with fibrous root systems rather than a long tap root, because the taproot will require more water, going deeper into the soil. This method is ideal for small area surgical strikes on weeds.

Day 0 (prior to boiling water application)

The classic teapot or kettle is ideal for this manoeuvre, fill it with boiling water and put on gloves (just in case, keeping in mind the possibility of burns and scalds)) then transport it to and pour the water on the soil around and over the weeds to be taken out. Keep an eye on the weeds and re-treat after seven to ten days if required.

Day 9 (after application)

This a comparatively cheap method requiring no large investment in equipment, it works well for small patches of weeds. It will require some energy to heat the water in the first place (using a rocket stove will reduce costs) and also the process will also have a deleterious effect on soil biota, but due to its nature of only being used in small areas, the soil biota should recover quickly.

Initially

Two days after application of 3 kettle-loads of boiling water

3. Flame – The easiest and most ergonomic way (you don't need to get down on hands and knees) to control weeds with fire is to use a flame wand. Unfortunately a flame wand will be powered by a fossil fuel, in the old days it was kerosene, I still have an old kero powered heat wand I inherited from my father (see pic below), but these days they are powered by butane or propane. They will also require a small to moderate sized investment in equipment.

Cheaper flame wands (<$40 AUD in 2023) are lighter and have a small attached disposable butane gas bottle and have limited life and limited ability to get to the root of the problem (ie the weeds!). For a small area, small weeds without deep roots and occasional use these may do the trick, but even so you will need to replace the gas bottle, hopefully by recycling rather than landfill.

Cheaper flame wand

Larger flame wands cost more ($250+ AUD in 2023) but have a number of advantages, mainly that they get hot enough to actually give weeds a hard time and a refillable gas bottle is easier, more cost effective and reduces waste, particularly if you have a large area to treat. If possible, get a flame wand that can change from pilot flame to full flame manually (saves gas between weedy areas), that has a tube long enough so you don't need to bend and has the correct connection for your gas tank. Strapping the gas bottle to a trolley will help make the setup more mobile so you don't have to lug the bottle around by hand. A larger wand will despatch newly emerged and shallow rooted weeds with one treatment but deep rooted perennial weeds may still need multiple (3 to 4) treatments to compete the job.

Large Flame Wand

Weeds need less than a second of exposure to the flame to kill them by disrupting their cells, they do not need to be incinerated.

Barriers

Another way to limit the impact of weeds in your growing spaces is to set up a barrier between areas where weeds such as grasses like couch or kikuyu move from the lawn (where they are not weeds) into your flower or veggie beds (where they are!). These barriers can be put together in a number of ways.

1. Plants – Often referred to as competition barriers, these plants can be planted around beneficial species such as fruit trees or vegetable beds to prevent ingress from grass, weeds or other invasive plants. Examples of competition barriers include daffodils, comfrey and perennial alliums (garlic chives, wild leek or Egyptian onions) which are planted around the area requiring protection.

Comfrey - makes a great barrier plant

2. Intentional Soil Compaction – Wait! What? Yup, because soil compaction is bad for plants, the soil and soil biota in general it is something that we as gardeners strenuously avoid, resorting to practices like double digging and raised beds to actually prevent soil compaction. In this case though, the idea is to create an area of compacted soil which becomes a barrier to the infiltration of weeds that spread vegetatively by stolons, runners or the like.

The degree of effectiveness will depend to a certain amount on the level of clay in the soil, the more clay, them more effective the compaction, and around here on good old

Sydney clay, it can be very effective. The idea is to create a 30cm to 60cm barrier either around a weedy area to contain them, or around the area to be protected to keep them out. The tool of choice to achieve this is the imaginatively named 'tamper' which is a flat plate screwed onto a vertical handle of various lengths.

Mow the area to be compacted as low as possible, wet it down and then use the tamper to compact the soil, as well as walking on it whenever you get the chance. When any plants try to reclaim the area, mow and re-tamp. You will need to keep an eye on the barrier, but once the tamping has become effective weed regrowth will be much reduced.

3. Mulch – this is a different type of barrier than the previous two, being more a barrier between weeds and the sun, which will settle them down. An organic mulch laid down 75cm to 100mm thick will discourage all but the most invasive and persistent weeds, but if your bed is already a home to an invasive weed like oxalis, a thick layer of newspaper or cardboard under the organic mulch will help in preventing the weeds getting access to the sun and they will die off.

Mechanical removal

1. Manual removal (whole plant) – that is just fancy language for 'pulling 'em out' by hand. This is comparatively easy and quick for small areas of annual weeds, but it is always advisable to wear gloves, especially if you have previously identified weeds that can irritate the skin like stinging nettle or petty spurge. It is more problematic for perennial weeds with tap roots, although deeply irrigating the area can soften the ground to the point where the plant can be removed taproot and all. Also, pulling them early in their life cycle before they have a chance to develop extensive root systems or set seed will ensure a better outcome.

2. Hoeing – If you are of a more mature persuasion or have mobility issues, you may need to remove your weeds while standing and to do this you need a hoe of some description. Generically speaking, a hoe is a piece of metal on the end of a stick used to dig out or cut off weeds, and we have a number of designs which we use. I find the 'Heritage Multi-use Hoe' to be the most useful for weeding although our standard hoe and small hoe also work well, and we have a 'Raymond Wonder Weeder', but I prefer the others. There is also a 'Dutch' hoe or push hoe that is pushed through the soil to cut off weeds just under the surface, I have not tried one but have been told they work well. Hoes are used to cut off annual weeds and dig out the more persistent perennial weeds, but in doing so they may stimulate weed seeds in the soil to germinate. Using a hoe is easier in dry soil rather than wet puggy soil and dry conditions will also cause the weeds to wither once hoed as well.

Raymonds Wonder Weeder and Heritage Multi-use Hoe

Small hoe and Standard Hoe

3. Grow, then mow (AKA chop and drop) – while this tends to work better early in the growing season and much more quickly with annual rather than perennial weeds, if persevered with it will give just about any weed a really hard time! Also pulling out weeds totally (as in 'manual removal' above) can actual act as 'tilling' the soil and result in dormant weed seeds germinating, so it can be better to remove the foliage and allow the roots to die and break down rather than disturbing the soil.

Cut the weed foliage down close to the soil level and keep an eye on the area. While annual, young and shallow rooted weeds will expire quickly, as the more resilient weeds start to re-sprout, hit them again. Eventually even the most committed weed will give up. This technique also has the added advantage that the cut weeds will sit on the soil surface and act as a mulch, eventually breaking down and providing organic matter to the soil.

My Scythe

A number of tools can be used to cut the weeds down and keep them down, and in an open area the first that comes to mind is a lawn mower (hopefully hand or battery powered) on its lowest setting, or a scythe if you want to go for a more 'hands on' approach. There are downsides to these tools in more confined areas like veggie patches and flower beds, so a whipper snipper may be used carefully to keep their heads down. If a whipper snipper is not for you and you want to get more up close and personal with your weeds you might want to consider a sickle, a Japanese Kama, or for smaller areas a Korean Ho Mi.

I bought this from a second hand shop years ago, not sure what it is called, perhaps a sickle scythe?

Conclusion

There are a number of physical means of controlling weeds, but they will need to be tailored to the particular weeds in your circumstances so it is important to identify your weeds and do some research first to ensure the most effective technique is used to control each weed.

5.3 Chemical Control Techniques

Scope

The focus of this article is on weedicides that can be manufactured at home, there are new generation organic herbicides that are becoming available like nonanoic acid also known as pelargonic acid, as present in the commercial herbicide 'slasher'. These are beyond the scope of this article.

Introduction

When the term 'weed management' or 'weed control' is mention, I would bet the majority of gardeners will think first of a spray of some description. This has been due to the impact of advertising by the agricultural chemical industry over many years. Sprays do form a part of weed management, but should not necessarily be the first choice because there are many non-chemical controls that may be more appropriate, depending on the circumstances. (Refer to the previous section)

Non-organic weedicides are plentiful, easily available and to be avoided!

Having said that, if you are one who wants to formulate a spray so you know and understand what goes into it, and what the consequences of its use will be, keep reading.

<u>What we look for in a weed spray</u>
From what I can gather, based on the thoughts of myself and others, what we are looking for in an organic weedicide spray is something that is –

- already on hand in our homes, (Preferably)
- Cheap and easily available,
- Effective,
- Safe for us, non-target organisms (like bees, butterflies and worms) and the soil,
- That doesn't build up and cause problems in the long run, but that will break down quickly and easily in the soil.

Weedicide formulations that are written down in books and available on the internet can be touted as being 'organic' but not necessarily comply with all of the above criteria. It is important to understand the materials we are dealing with, how they work and what downsides they have (if any).

For the most part, the herbicides covered in this article are

- Non-selective; that is to say, they are equally effective on all weeds.
- Contact rather than systemic herbicides so they act on the part of the plant that they are applied to, rather than being absorbed by the plant and travelling to all parts of the plant (salt solution can be an exception).
- Generally short term in their action (Salt solutions can be an exception),
- Several applications may be required for them to be effective, particularly for perennial weeds.
- They are post-emergent, that is to say they will kill weeds that are growing but will have little or no effect on weed seeds that have not germinated.

Weedicide Application

To get the best from organic weedicide sprays the following points should be borne in mind –

- Ensure good spray coverage of your target weeds. Due to fact that they are contact herbicides, they can't kill what they don't touch so the spray needs to cover most of the plant.
- spray in warm weather (24°C+);
- Treat weeds when they are small; and use repeat applications on larger weeds.
- Spraying should be done under favourable weather conditions (low/no wind, no imminent rain) to ensure that the sprayed materials remain on the treated plants long enough to be effective.

<u>Application methods</u>
Following is an extract from an article about various types of sprayers and their use with pesticides. The extract is included here because a lot of the information also works well for weedicides.

Which Sprayer?

There are whole stack of different sprayers on the market, if you only have a balcony sized area you might consider a bottom of the line "Household Multipurpose Sprayer" as shown below. One downside with this type of sprayer (apart from your hand getting tired pumping the trigger) is that the spray nozzle is very fine and particles can easily block it. Any commercial solutions to be sprayed such as pyrethrum spray would work out well but slurries such as sulphur or lime would block the nozzle very quickly. Also, while making and using homemade sprays is great some would need to be well filtered; milk or soap sprays would be fine, but any extract like the old standby chilli and garlic spray would need to be filtered through coffee filter papers before using or you may block the spray nozzle.

There is a slightly larger one available on the market which can be pumped up and so there is no tiresome trigger mechanism requiring to be pumped continually. It has a reservoir of about 2 litres and is designed for use with garden sprays. It doesn't have a flexible nozzle so you need to angle it up under the leaves if required but they are readily available and quite inexpensive. For a dollar or two more you can have exactly the same spray mechanism but with a 3 litre reservoir.

These ones didn't really do it for me though, I needed something bigger, with a reservoir of about 5 litres, which would hold enough spray to do a decent job on the amount of stuff I grow. It would be heavier when full so I wanted a strap so I could carry it over my shoulder. I wanted a hose between the sprayer nozzle and the reservoir to give greater flexibility to spray under the leaves and an easily operable trigger. Seeing as it was going to be a pump up, it should be easily pumped up and have an overpressure relief valve as well. Thankfully the sprayer I got ticked all the boxes.

If you have a market garden sized veggie patch or really want to go heavy duty, you could buy a backpack sprayer. They will hold up to 20 litres but are expensive and heavy to lug around. They most likely would be far too large for even the most extensive back yard.

To decide on the best sprayer for your needs you should consider –

- What sprays you will be using (soluble sprays or slurries).
- The sorts of plants you need to spray
- How often you will need to spray, and
- The area of vegetation you intend to spray.

Mixing Sprays

Many sprays will need to be diluted for use, make sure this is done in containers reserved for this purpose and they are thoroughly washed out prior to use. In general terms a good technique is to fill the sprayer half full of water, add in the required volume of spray concentrate, accurately measured, then top up with water. Replace the

sprayer head and give the sprayer a good shake it should then be ready for use. If using a slurry spray and you take a break, give it another shake before you continue spraying.

Spraying Technique

To get the best out the spraying which you have to do and to minimise the risk of unintended consequences there are a few rules which should be followed –

1. Early morning or late afternoon when wind conditions are low is the best time for spraying, if you must spray during light winds always start downwind and work upwind.
2. Spray only the bits you need to – if the bug is underneath the top leaves, spray there, although fungal spray will need to cover the whole plant.
3. Don't drench the plant with spray, only spray until discrete droplets can be seen covering the leaf. Several light applications are better than one heavy one.
4. When using a commercial spray dilute it as required on the label, a higher concentration will only waste spray and increase the withholding period ie the minimum time between spraying and harvesting.
5. When using pyrethrum based formulations avoid spraying plants in flower to reduce the likelihood of injuring bees.
6. Due to their nature, organic pesticides will breakdown quickly and may need to be re-applied in the case of a re-infestation.

Cleaning the Equipment

Once you have completed spraying it is very important to clean out and decontaminate the apparatus to prevent accidental contamination if somebody uses the sprayer for something else and just in case the next spray to be used is incompatible with the previous one.

The easiest way to do this is to flush the whole system through with water several times, wash out with a mild soap or detergent solution and then give a final rinse with clean water. If a slurry or particulate spray has been used, it is good practice to disassemble and clean out the spray nozzle to make sure no powder is caught within the spray nozzle itself.

Safety Concerns

Assume all pesticides, even the organic ones, are toxic and make sure that they are kept away from children and locked away when not in use. Always decontaminate spray equipment as above, including any containers used to mix up the spray, before locking it away after use. NEVER, EVER put any kind of spray into a food or drink container.

Disposal

Don't leave unused spray material in the sprayer. For most homemade sprays you can just pour it out on the ground or into a hole and cover with dirt, they will breakdown quite quickly, and then decontaminate your sprayer.

While spraying is a common way of applying weedicides, for small areas or single plants, particularly where they are nestled in amongst your flowers or veggies, the weedicide can be applied to the leaves of the weed with a paintbrush.

Types of Weedicides

<u>Acids</u>
Vinegar – is a cheap, easily available and very effective weedicide, it is my go-to when I need a chemical weed killer. It kills weeds by rupturing the plant cell walls where it applied and allows the plants' fluids to leak out, drying them out and killing them. It is not a residual herbicide so it will break down quickly and so won't build up in the soil, but it may require multiple applications to be effective, particularly for perennial weeds. It is sprayed undiluted, with the highest concentration of acetic acid that is available.

Lemon juice – may also be used as a weed killer because of its acidic nature, but will be less effective than vinegar, because citric acid is a weaker acid than the acetic acid in vinegar. Its advantage is that it can be home produced.

Day one: prior to application of vinegar spray

Day Four: after application of vinegar spray

Inorganic acids – like hydrochloric acid, sulphuric acid and nitric acid will most certainly kill weeds and, given the chance, do very unpleasant things to the person applying them. They will also do very unpleasant things to the soil and are NOT recommended for use.

Salts

While the term ‘salt’ is usually used to describe table salt (sodium chloride), in this case the term is used to refer to a number of sodium containing chemicals which are used as weedicides and work in a broadly similar fashion. They include table salt, sodium bicarbonate (bicarb, baking soda) and borax (sodium tetraborate).

They can work in two ways. When applied as a solid or, more usually as a solution, to the leaves and stems of a plant will act as a contact herbicide. However, if a salt solution is applied to the ground around the plant deeply enough that it can be absorbed by the roots, it disrupts the water balance in plants, eventually killing them. While salts are cheap and effective weedicides they have one major disadvantage in that they do not break down in the soil. They will remain there until diluted by rain or irrigation and flushed deeper into the soil, down to the water table or by run off to nearby streams, rivers or lakes. Salts will also have a negative effect on soil structure and soil biota as well as surrounding plants. There are many areas around Australia that are already struggling with soil salinity.

Due to all these negative impacts, salts as weedicides or weedicides that contain salts as a component are NOT recommended for use.

Epsom Salts (Magnesium sulphate) is a non-sodium containing salt that I have seen on some websites recommended as a component of weed killer, but I can find no evidence that it actually works. In dilute solution it is a fertiliser (supplying magnesium and sulphur) and may have some weedicidal effects in concentrated solution, but you would have to apply a lot and it would be detrimental to the soil in such high concentrations. It is not recommended as an effective weedicide.

Bleach

Bleach is a reactive and aggressive chemical that is comparatively cheap and readily available. The active constituent of liquid bleach is sodium hypochlorite. There are also likely to be other corrosive compounds like sodium hydroxide present, as well as less nasty compounds like sodium chloride, sodium carbonate and surfactants, all depending on the formulation of the particular bleach you are using. Over time bleach will break down to what is effectively salty water.

The downsides of using bleach is that it is corrosive and can damage your skin and eyes, it is quite alkaline and will impact the soil biota negatively and affect soil pH. As it breaks down it will contribute salt to the soil (check out 'salt' above). While it could be useful in small amounts in isolated areas on particularly difficult weeds, the use of bleach as a weed killer is generally not recommended.

Surfactants

Surfactants (or surface active agents) are general found as one of two types: soaps, which are produced by the reaction of an alkali and a fatty acid of one type or another, and detergents, which are a mixture of synthetic compounds based on petrochemicals. Either are likely to contain sodium.

When applied to plants they can strip off the protective layer from plant leaves, allowing them to dry out and the plant to die. Surfactants applied to the soil can result in raising soil pH and a reduced availability of nitrogen and potassium in the soil. Given time, both soaps and surfactants will eventually break down in the soil albeit possibly leaving some sodium residues behind.

Surfactants also have another property, and that is to reduce the surface tension of water. This allows solutions to cover surfaces, like the waxy surface of a leaf, more completely and thus allowing any weedicidal components

of a mixture to work more effectively. This is why many weedicide formulae on the internet contain ‘dish soap’ as a component. Note: ‘dish soap’ is a detergent not a soap. While a small amount of these chemicals when combined with other weed killers may help to improve their effectiveness, using surfactants as weedicides is not recommended.

Oils

Oils used as weedicides or in weedicide formulations may be vegetable oils like cooking oil, petroleum hydrocarbon oils like white oil or kerosene, diesel or turpentine, or they may be essential (‘botanical’) oils like clove oil.

Petroleum hydrocarbon oils – In terms of effectiveness, I don’t see any advantage of white oil over the more easily broken down vegetable oil. Regarding other hydrocarbons, while I understand that they are effective weed killers, I think they would take considerable time to break down and would therefore pollute the soil, causing problems for the soil biota and so I would NOT recommend their use.

Vegetable oils – I have read that vegetable oil can be used as a weedicide, so I got hold of some of our used olive oil, filtered it and sprayed it I sprayed it on some annual (chickweed) and perennial (dandelion) weeds. In terms of the annual weeds all it did was make the leaves look glossy, but after a week on the dandelion leaves they were looking a bit sad, but not decimated by any meansl (this does not show up well in the

photos, but differences are there, trust me!). A caveat here: we are in autumn and although the weather has been fine and clear, it has also been cooler than normal. I think if the vegetable oil were to be applied at a hotter time of the year, it would be more effective.

Initially

After one week

After two weeks

I have also read on the internet about injecting vegetable oil into the soil, wording goes something like this – "For bulbous weeds, like onion weed and oxalis, you can inject vegetable oil into the ground surrounding the bulbs. The oil will coat the bulbs so they suffocate and will then rot into the soil." I have not tried this so I don't know if it works or not, however, the wording is almost the same in references on a number of websites so I think that someone tried this once, and everyone else just copied. There is no way of know who the original poster was or if it really worked. There is room for more research here.

Botanical oils or 'essential' oils – There are e number of essential oil used as weed killers, such as oil of wintergreen, clove oil, orange oil or cinnamon oil in combination with other chemicals. They seem mostly to be used in combination with vinegar, presumably to improve its performance. I have only tried one combination that was vinegar and clove oil I extracted from cloves, but there did not seem to be much improvement over vinegar by itself. That story can be accessed here. I suspect that the vinegar would work just as well by itself and be considerably cheaper.

<u>Miscellaneous</u>

Aged urine – This is not one that I have tried but is advocated by no less of an authority than Jackie French in her book 'Organic Control of Common Weeds'. Her recommendation is to leave the urine for 24 hours to become 'ammoniacal' and apply it undiluted when the soil is dry, twice over a period of 24 hours. She finds that the main disadvantage of this approach is getting hold of enough of the stuff, so next time you have a party…… provide a bucket!

Alcohol – There are two alcohol compounds that are generally used when weedicides are mentioned, the so-called rubbing alcohol, which is 60% - 70% solution of isopropyl alcohol and the ubiquitous methylated spirits (metho, meths) which is greater than 95% ethanol plus chemicals to make it taste bad so people won't drink it.

Formulations generally suggest one or two tablespoons of alcohol per litre of water, so I added one tablespoon of methylated spirits to 500mls of water, swirled it around to disperse and had a spray on some annual (chickweed) and some perennial (dandelion) weeds. After a week there was no observable differences between 'before' and 'after' spraying. Just to check, on another patch of dandelions I sprayed 'neat' methylated spirits to see what would happen. Nothing did, I suspect that the metho evaporated before it could do much damage.

To be fair, the references did talk more about using isopropanol as a weedicide so I got hold of some Isocol (64% isopropanol) and mixed in the ratio of 2 tablespoons to 500ml of water and sprayed it on another patch of weeds. The results were the same, after checking for several weeks there were no changes to the weeds

Mixtures

There seems to be one main weedicidal mixture out there on the internet, and it is a combination of various ratios of –

- Vinegar,
- Epsom salts or table salt or bicarbonate of soda, and
- Dish 'soap' which is, of course, a detergent. If a true soap is mixed with vinegar it will break down to an oily residue and will not be able to function as a surfactant.

Following is one example, but there are many –

- 1 gallon white vinegar
- 2 cups Epsom salt or table salt
- ¼ cup 'Dawn' dishwashing soap

From the detailed information about the ingredients above, it can be seen that there are some problems with this formulation, particularly in terms of the previously referred to 'salt' component. My suggestion would be to go with the vinegar, and perhaps a small amount of dishwashing detergent to help the vinegar wet out the leaves of the target plants.

Conclusion

Having looked around at the recommendations I have been able to track down it seems to me that vinegar is still the best bet option with or without a small amount of surfactant added to help its coverage and with or without a small amount of essential oil(s), but for me they are yet to be proven. There are other chemical products that are easily available and out there, they may even be effective, but they tend to bring other drawbacks with them. Based on the information I have provided (and you own researches) it is up to you to make the choice of which weedicide(s) will work best for you in your situation. Although it is worth progressing non-chemical weed control strategies first.

5.4 Cultural Control Techniques

Techniques for the cultural control of weeds work by improving the ability of our target crops (ie our veggies) to compete more effectively with weed species.

While cultural control of weeds is more often used in broad scale farming, it has techniques which can be used by the urban veggie grower to help their fight against weeds as well. Some cultural controls like mulching, solarisation and direct watering have already been covered in other parts of this series. Other cultural management techniques like summer tillage, stale seedbed and blind tillage are more suited to broad scale farming than the backyard organic grower.

There are, however a number of techniques for cultural weed control that can be implemented on a small scale in our backyard veggie growing efforts to help reduce weed problems. While these methods are unlikely to control weeds by themselves, when integrated with other weed control strategies mentioned previously they can be effective in reducing our weed problems in the long term.

Cultural control methods

• **Use high quality, fresh seeds** - they are more likely to produce vigorous and competitive plants. There also some evidence to suggest that varieties with larger, plumper seeds will germinate and grow more quickly.

• **Plant well grown seedlings rather than direct sowing seeds** – This is won't work for root crops but will work for everything else. We do this by germinating our seeds in punnets, then potting the seedlings on into newspaper pots, growing them on and then planting several weeks, up to a month after germination, newspaper pot and all.

• **Growing plants closely together** – As well as using higher seeding rates, vegetable seedlings can be grown more closely in rich organic soil, which has the effect of shading out weeds that have germinated as well as reducing weed germination by reducing light. The same caveats apply as above for close seeding, we plant our veggies on a grid, 20cm to 30cm away from the plants adjacent to them and this works well for us.

• **Where direct seeding is required use increased seeding rates** - and narrow row spacing if you plant in rows. While this technique will allow the veggies to outcompete the weeds for light, air and nutrients, they will also compete with each other, so some research may have to be done to find the ideal spacing for each crop. Also, where this technique is used for crops like carrots, they can be sown thickly, and then as they grow they can be thinned strategically leaving room for larger carrots to grow, and the thinnings eaten as baby carrots

• **Maintaining good soil fertility** – some weeds such as wild carrot, dandelion, thistle and plantain are pioneer species and thrive in poor soil, maintaining soil fertility organically will reduce the impact that these weeds will have. These soil fertility techniques include adding compost, adding other soil amendments like wood ash, biochar or rock dust, using cover crops/green manures, crop rotation and inter-planting. Some of these techniques help to maintain fertility but also impact on weeds in their own right.

Well grown green manure crop

Green manure crop cut before flowering

• **Cover crops/green manures** – This technique involves growing plants to cover open ground which then outcompete and suppress weeds, shade the ground to reduce weed germination. Cover crops and green manures can also be used to add nitrogen and organic matter to the soil by sowing nitrogen fixing species, cutting them down before flowering and incorporating them into the soil. Nitrogen fixing species that can be used include peas, clovers or vetches, non-nitrogen fixing species include millet, mustard, wheat and radish. It is important to select species and varieties that suit your climate and the time of year they are being sown. More details on our use of green manure is available here.

• **Use of 'cleaning' crops** – This is a specific type of cover crop or green manure used to 'clean' the soil of weeds and soil borne diseases. The idea to sow mustard seed thickly as part of a rotation, let it grow, cut it down before it flowers, and water the area. As the mustard plants break down they release compounds called glucosinolates which in turn release a gas, isothiocyanate. This acts as a soil fumigant killing plant disease organisms in the soil (and I suspect some of the soil biota as well) and weed seeds. I have not tried this but there is enough information out there to suggest it could be an interesting technique to add to the repertoire. Of course, mustard being a brassica, brassicas should not be grown on land so treated as part of the next rotation.

• **Crop rotation** – crop rotation has been used as part of cultural weed management in broad acre growing working on the idea that growing the same crops over and over tends to make weed infestations worse. This is less of a problem in the backyard but crop rotation can still help with weed suppression, particularly if used in association with close planting and mulching. There are a number of rotation systems out there, a common 4 year rotation starting with potatoes and possibly a green manure to suppress weeds, followed by peas and beans to replace nitrogen, followed by brassicas and leaf crops to use the nitrogen, followed by root crops and alliums then back to potatoes. Another strategy is to not plant from the same vegetable family, two seasons in a row. Crop rotation is also is good for making things hard for plant pests and diseases. More information on how we manage crop rotation

• **Use of livestock** – in the farming world this would be grazing with goats, sheep, cattle or pigs but as this is difficult (not to say disconcerting for your neighbours) in the suburbs, the most logical candidates are chooks or rabbits (perhaps even guinea pigs!) We include chooks in our rotation so that as part of a chook tractor such that they change veggie plots every two weeks. They are great for digging up and eating weeds, increasing fertility with their manure and digging in any remaining straw mulch into the soil.

Chooks in the chook tractor work for us!

• **Interplanting** – also referred to intercropping in farming circles, it is simply growing two or more crops together, as opposed to monoculture, which is growing one crop in a given productive area. An associated technique is 'undersowing' where a second crop is sown under a crop which is already growing on the land. These techniques are particularly applicable where no mulch is being used. The interplanted and undersown crops will shade and outcompete germinating weeds seeds for light, water and nutrients. For example, where a slow growing crop like cauliflower or tomatoes is being grown, interplanting a quicker growing crop like radishes or lettuce will shade out the weeds while still producing a yield. Also, In the 'three sisters' planting technique, corn is interplanted with squash and beans, the beans providing nitrogen for the corn (as well as producing beans) and the squash shading and competing with weeds (as well as producing squash).

As mentioned previously, using cultural techniques will not control weeds on their own, but if we are growing organically we should implementing as many of these techniques as practical anyway. Not only with they help us control weeds but have associated with them many 'side' benefits like maintaining soil fertility, controlling pest and diseases and increasing yields from a given plot of ground, So it can be seen that it is important to make room for as many of these techniques as possible, when developing your weed control strategy.

6.0 Maintaining the System

A gardeners' work is never done and this is perhaps more true of weed management than anything else. Weed management is a long term commitment and by keeping up with the maintenance tasks of your weed management program you can prevent (or at least head off) any weed resurgences. Most of these have been discussed before, but it is worth mentioning them again in the context of continuing actions.

- **Prevention is still better than cure**

Avoid bringing weeds onto your site by getting your seed from reputable suppliers, planting into punnets where appropriate and not buying/bringing weed species into your yard or when buying mulches etc. Also avoid leaving open spaces and cultivating the soil to stop weed seeds already existing from germinating. Make sure you check yourself over when return from a walk in the bush, just to make sure you (or your pets) are not bringing weed seeds with you!

Always check for cobbler's pegs!

- **Regular observation**

This is one of the most valuable tools in your weed maintenance arsenal. Keeping a regular eye out, at all times of year is always worthwhile, so you can identify where weeds are starting to become a problem. Treating weeds earlier rather than later means that not only have you hit them before they can mount a serious attack, but smaller, less established weeds are easier to treat than established weeds. Perennial weeds can be especially troublesome once established.

- **Know your enemy!**

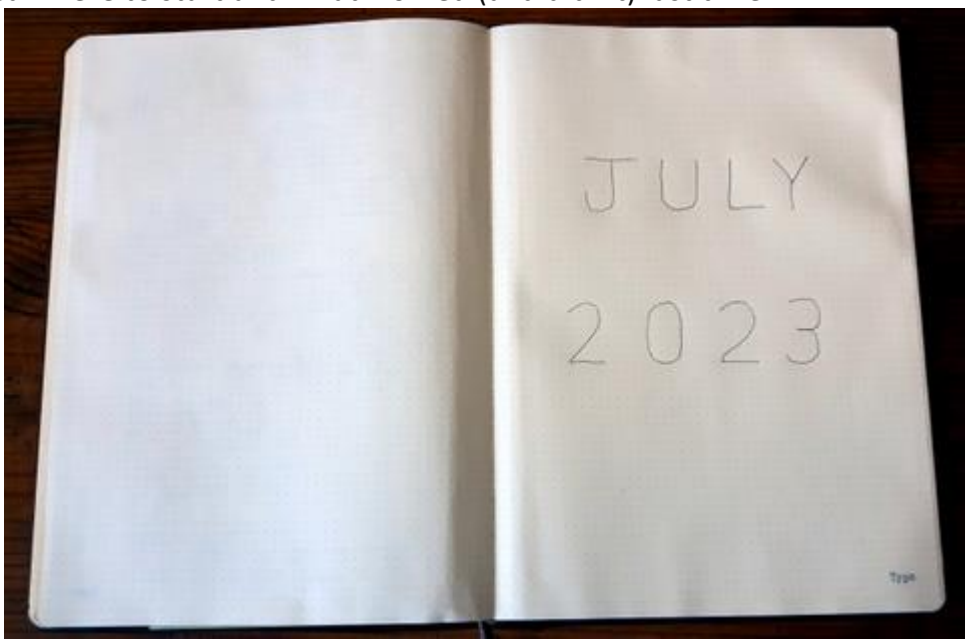
If you have new weeds crop up, check them out and research them. Are there any characteristics of this weed not seen before, which might require modifying control strategies?

- **Cultural controls**

Keep up to date on cultural controls over time. As mentioned previously, while they are unlikely to totally control your weeds in and of themselves, they will generally make your yard less attractive to weeds and slow down their establishment, making the easier to control. Do this by using practices such as maintaining soil fertility, using of covers crops/green manures, and cleaning crops, following crop rotations, using animals and interplanting.

- **Record successes and failures**

When researching your weeds and experimenting with the various methods of weed control, record what you find out and your weed management successes and failures. This can help you next time a particular weed becomes a problem, as you will have some idea where to start and what worked (and didn't) last time.



A Bullet Journal can be a great way of recording your observations

- **Look after your tools**

….and any equipment that you use in your weed management efforts, whether it is keeping any sharp implements sharp, any sprayers clean and ready to go or making sure your flame weeder gas bottle is full and in date. Make sure that tools and equipment are stored securely under cover, they will be well protected against corrosion and 'unauthorised use'. Keeping things up to date will make it easier when you need those tools and equipment next time.

7.0 Weed Management – A Process summary

A friend of mine, whose opinion I unfortunately trust, suggested to me that there needed to be a summary of some description that, while it left out all the bumf that I write, covered all the major points. In this way people could circumvent the long story and just focus on what to do. This is my attempt to do that!

Part 1 - What is a weed? A weed is a plant out of place.

Why remove them? They compete with target plants and can act as a host for pests and diseases; they can cause allergies, dermatitis or physical damage and in some cases, poisoning. They can inhibit germination or growth of other plant species, cross-pollinate with target species and they can look like crap. (umm, have poor aesthetics).

Part 2 – know your weeds

Follow this process to discover what weeds you will be dealing with. Of particular help later on is to find out which are annual and which are perennial weeds.

Divide your weedy spaces up into manageable areas and then download a plant identification app if you are going to use one or get hold of some weed identification books. Go out into your weedy area and systematically identify all weeds in the area using your app and/or weed identification books. Then record all information (common and scientific names) on all weeds present. Once the area is complete, transfer the information to weed spreadsheet. Once you know what weeds you have you can research more about them with confidence.

Part 3 – Assess your weeds (optional)

Look at each weed in turn and rate them on their invasiveness and persistence from 1 to 5 then multiply the two figures together to get the PITA score, then record that on your spreadsheet. This will help to identify which weeds will be a priority to treat first.

Part 4 – Prevention is better than cure

Be aware that weed seeds and runners can be brought onto the property in materials bought in from off site, and by wind, water, animals or ourselves. They will also be some pre-existing weed seeds in the soil.

Strategies

To prevent weeds being brought in by materials imported from offsite – buy seeds from reputable suppliers, start seeds in punnets rather than direct sow. Consider buying shrubs and trees bare rooted, if not buying bare rooted, consider root washing. Consider using chooks to remove seeds from mulch, use mushroom compost rather than other amendments and/or compost amendments before using them.

In all cases research what you are bringing onto your property to identify problems first.

Where existing seeds are being dealt with – avoid cultivating the soil, use mulch on bare soil, apply water directly to where it's needed rather than indiscriminate use of sprinklers, encourage ants which will feed on the weed seeds and keep an eye on bird roost areas.

Part 5 – Weed control

General considerations – be knowledgeable about the weeds you are dealing with, and research the best ways of controlling each weed species. Apply controls when weeds are young and not established, or at least before they have had time to seed. Be aware of hazards and act appropriately, always keep an eye out for budding weed problems. Start from the edge of the weed patch and work inwards, and be realistic about what you can achieve and don't kill yourself, but be thorough and don't move on until the current patch completed. Don't let spaces remain empty and be responsible, don't let your weeds become your neighbours' or the local bush's problem.

Physical control methods – These are broken down into a number of groups such as heat, barriers and physical removal. Heat includes solarisation or covering an area with plastic and killing weeds over an area with solar heat, or using targeted heat in the form of boiling water or a flame weeder. Barriers include plants used as a barrier, soil compaction or mulch to protect an area from weed invasion and physical removal is exactly what it sounds like – weeding, using various implements.

Chemical control methods - I have tried a number of homemade organic weedicide sprays and of all of them vinegar, with perhaps a small addition of dishwashing liquid to help it coat the leaves, is the most effective. Avoid all weed killers that contain salt as it will take a long time to wash through the soil and may inhibit plants growing where it is applied for a long time. There are others but most are not recommended.

Cultural control methods - These techniques work by improving the ability of our target crops to compete more effectively with weed species. Cultural controls include using high quality seeds, planting well grown seedlings, planting them closely together. Where direct seeding is required using increased seeding rates. Maintaining good soil fertility and use techniques such as cover crops/green manures and crop rotation which are effective. The use of cleaning crops, animals such as chooks and interplanting are also good weed control techniques. While cultural techniques on their own will not control weeds they are effective techniques to include in weed control strategies and have many other side benefits as well.

Part 6 – Maintenance

Weed management is a long term commitment and once they are under control, the system needs to be maintained to keep them under control. Maintenance activities include continuing to keep an eye out for potential weed infestations and remembering that prevention is still better than cure, making sure that activities to this end are continued. Also continue any cultural controls in place to reduce weed infestations in the long term. Recording your successes and failures is also worthwhile in the longer term so that if a problem weed raises its ugly head you will know what to do (and what not to do!).

8.0 Resources

Weeds –Compiled by J. N. Whittet - NSW Department of Agriculture (AUS) 1968 (Second Edition) No ISBN – This imaginatively titled book is directed mainly at farmers but still has lots of good information about the identification of weeds, nothing remotely organic to be seen in the controls here though Chapter one talks about weed problems in agricultural and pastoral areas of NSW, chapter two covers weed legislation in NSW and considering how legislation will have changed in the last 50 years, will be well out of date. Chapter three discusses toxic weeds and their effect on livestock, chapter four covers control of weeds ecologically, biologically, mechanically and chemically and chapter five focuses on chemical control. Chapter six (almost half the book) is a description of individual weeds and appropriate control measures. There are a large number of line drawings and colour plates, especially in chapter six.

Field Guide to Weeds in Australia – C. Lamp & F. Collet – Inkata Press (AUS) 1989 ISBN 0 909605 53 X – The first three chapters cover What a weed is, reproduction and dispersal and plant identification in general terms. The rest of the book is a series of 331 monographs on individual weeds covering what they look like and where they grow as well as other snippets of information about each weed. Each monograph lists the Latin name, common name, family, a description of the plant and an indication of its status as a weed. There is a colour photograph attached to each monograph but no recommendations on control strategies.

The Weed Book – Mark A. Wolff – New Holland Publishers (AUS) 2012 ISBN 9781877069932 – The bulk of the book is a series of over 120 monographs on individual weeds each giving a description, origin of the weed, distribution around Australia and how the weed is dispersed, as well as a colour photo of each weed. There is a very interesting chapter on hand weeding that I haven't seen anywhere else but generally the main focus on weed control is chemical control.

Organic Control of common Weeds – Jackie French – Aird Books (AUS) 1989 ISBN 0 947214 06 2 – This is a great little book, just like you would expect from Jackie French. Chapter one covers living with weeds i.e., what to do with them, chapter two covers weed management including the twelve steps to weed control and weed control strategies for lawns, flower beds, orchards, pasture and vegetable gardens. Chapter three covers fighting weeds including biological control, natural herbicides, companion planting, green manuring and homemade herbicides. Chapter four covers using weeds and includes edible weeds, medicinal weeds, drinks and weeds that can be used as pesticides. Chapter five lists some common weeds, their identification and control. The book has no photos but lots of line drawings.

Weed – Tim Marshall – ABC Books (AUS) 2010 ISBN 9 780733 327742 – This small book is a gold mine of information on organic weed control and if you can only buy one book on weed control (in Aus) this should be it! There is a helpful section at the start detailing how best to use the book. Chapter one discusses what a weed is including how they propagate, annual vs perennial weeds and a working definition of the term 'weed'. Chapter two talks about taking control of weeds including intercropping, cover crops,

crop rotation, barrier cropping, mechanical, thermal and chemical control. Chapter three lists common weeds and potential control strategies for each one. Chapter four covers 'good' weeds and how they can be used. Chapter five covers environmental weeds and their control, Chapter six is a quick reference guide listing a weed and then the options for various types of control (physical, chemical, thermal, cultural). The book has a small number of line drawings.

The Wild Wisdom of Weeds – Katrina Blair – Chelsea Green Publishing (US) 2014 ISBN 978 1 60358 516 3 – Part one of the book (Back to Basics) covers the authors' journey with wild plants, symbiotic relationships, these plants as part of nature's Permaculture and "wild intelligence". Part two, the majority of the book is a series of extensive monographs on thirteen wild foods: amaranth, chickweed, clover, dandelion, dock, grass, knotweed, lambs quarters, mallow, mustard, plantain, purslane and thistle. Each monograph covers the Latin and other names, description, current uses, history, edible uses, medical actions, medicinal uses and a series of recipes. Lots of colour photos.

The Wondrous World of Weeds – Pat Collins – New Holland Publishers (AUS) 2017 ISBN 978 1 921517 79 2 – After a very short introduction on what a weed is, the majority of the book is made up of monographs on over 100 weeds present in Australia. Each monograph lists the common and Latin names, were it is distributed within Australia and what its preferred habitat is. The monograph then provides a general description of the plant and detailed descriptions of its leaves, flowers and fruit/seeds. This followed by the plants' uses as edible, medicinal or on the farm and in the environment. Finally is a reference for further reading and any warnings regarding the use of the weed. There are several colour pictures of each weed covered in the monograph.

Weeding without chemicals – Bob Flowerdew – Skyhorse Publishing (US) 2012 ISBN 978 1 61608 647 3 – While this edition was published in the US, it was originally published in the UK and is written from a UK perspective. This is not a particularly information dense book, but has some interesting insights. The first part of the book covers what weeds are, why they appear and where they come from. The next part covers why we should weed and when, which weeds are worst and why herbicides should not be used. There is a one-page general approach to weed identification and the rest of the book is on weed control. This includes weeding by hand, while standing up and sitting down, solarisation, methods of excluding weeds like close growing and green manures and weed suppression using various mulches. This is followed by suggestions for organic weed killers (chemical and physical) and composting to finish off weeds. There are then a series of recommendations for weed control in psecif circumstances live veggie gardens or under fruit trees. The book has lots of colour photos.

Gardener's Companion to Weeds – Suzanne Ermet, Leigh Clapp (photographs) – New Holland Publishers (AUS) 2001 ISBN 978 1 87633 477 2 – While this book is mainly about identification of weeds, it starts off with a small section on how to use the book, what a weed is, and control methods: chemical (not organic), and non-chemical weed control. The book is then divided up into sections on aquatic weeds, lawn weeds, garden weeds, pasture and wasteland weeds and invasive plants. Each section is set out A to Z, based on the common name of each weed. Each weed monograph has a colour

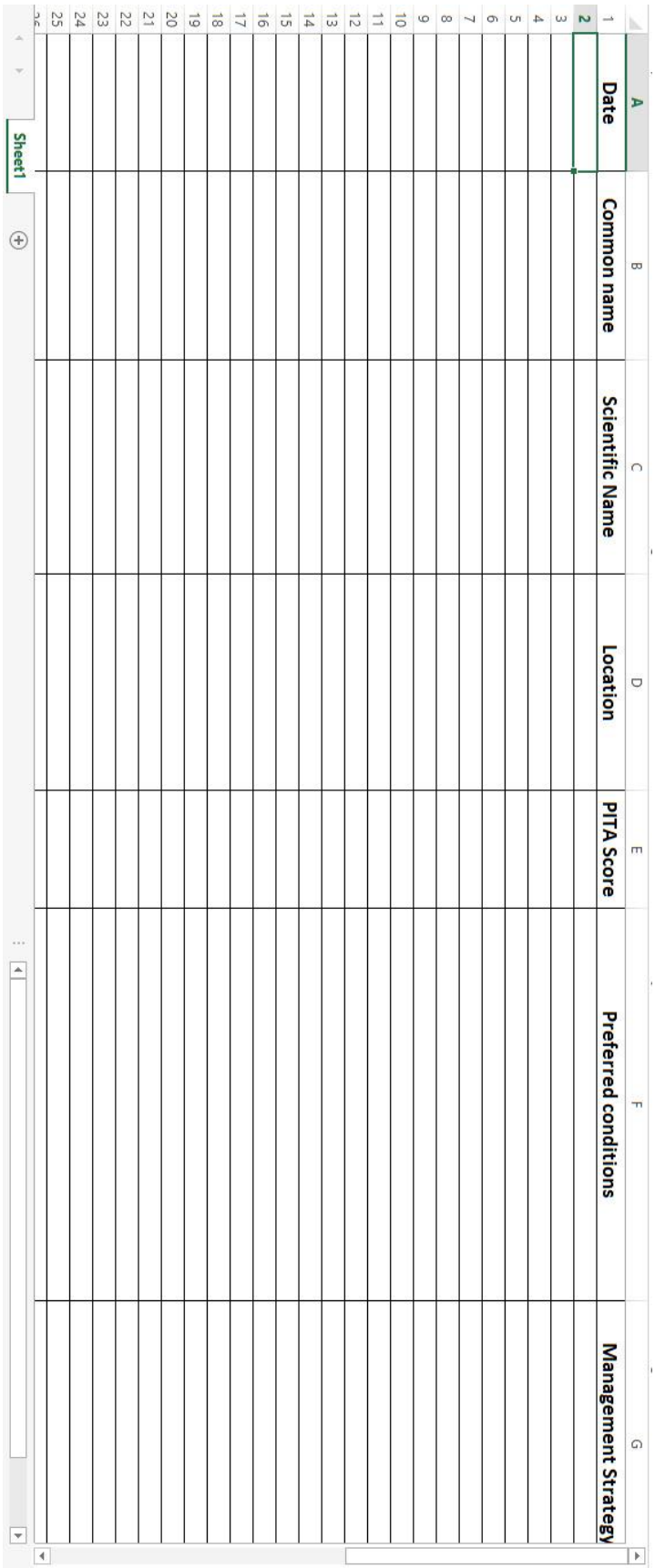
photo, general description, where they can be found, specific control methods and how the weeds multiply (Disperse). The book has lots of colour photos.

Weeds – An illustrated botanical guide to the weeds of Australia – B.A Auld & R.W. Medd – Inkata Press (AUS) 1992 ISBN 0 909605 37 8 – The book starts of with an introduction and guide to plant groups, then is composed of a series of monographs, broken down into three groups under the headings of Pteridophytes (ferns), monocotyledons and dicotyledons. Each group is set out A to Z based on the scientific name of each weed. Each monograph starts with the family of the weed, its latin name and common name, followed by the origin of the weed a description, the distribution of the weed and it's importance, and colour photo. This one is fairly technical! Lots of colour photos.

Controlling Weeds Without Using Chemicals – Jo Readman – HDRA/Search Press (UK) 2000 ISBN 0 85532 934 3 – I like this book, but it is little dissapointing that almost half the book is taken up with weed identification rather than weed management as such. The first section of the book is on the ecology of weeds covering lifecycles of various types of plant, how weeds spread vegetatively and how they regenerate. The next section (Know Your Weeds) is about weed identification and contains a colour photo (mostly) and description of 95 common weeds (in the UK). The next section covers the benefits of weeds and how to use them, followed by a small section on why weeds are a problem. On page 44 (of a 61 page book) we get to the principles of organic weed control, which covers composting, presowing cultivations, planting effectively, mulches, green manures, crop rotation, raised beds and hygiene. The next section covers weed removal (hoeing, hand weeding, flame weeding, followed by a sction on weed control in the lawn, and woody weeds. Lots of colour photos, but not a huge amount of detail in each section.

Weed Free Gardening – Tasha Greer – Cool Springs Press (US) 2022 ISBN 978 0 7603 7323 1 – This is a great book, that helped me think more holistically about weed management. I am not 100% sure that all of it is translatable to Aus but it is a great book to make you think. It is written in and introduction and four sections. The introduction covers why the war on weeds cannot be won and the origin of weeds. Section one covers how to prevent weeds being imported onto your property, Section two covers maintaining your property to make it less hospitable to weeds by looking at soil, drainage, adding organic matter and increasing mycorrhizal networks. Section three (reconciliation) covers various ideas to use weeds in weed control. Part four is entitled creating peace in the garden and covers various ways of growing (no dig, grow beds, grow bags) that are less affected by weeds. Throughout the book are a series of specific recommendations, one called 'weed whack' which talks about weed control strategies and the second one is 'tool bar' which is a series of discussions of the various tools that can be used to manage weeds. This is a great book, worth having. Lots of colour photos.

Appendix 1



Date	Common name	Scientific Name	Location	PITA Score	Preferred conditions	Management Strategy