Magic Harvest

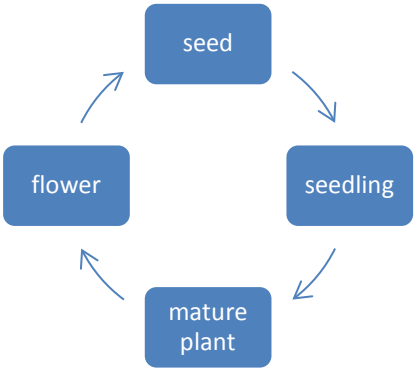
Session2

Facilitated by NRM Education
Course notes adapted and used with permission by City of Salisbury Healthy Communities Initiative

Plants - basic growing information

Plant growth cycles

Plants have growing cycles that progress from, seed to seedling to a mature plant that flowers that produces more seed, which become its offspring and enables the survival of the species.

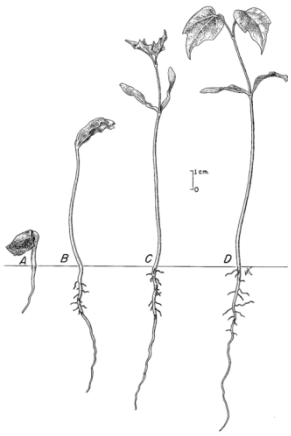


Seed store just enough nutrients to produce the first leaves and roots for it to grow into a seedling. A seed becoming a seedling needs to establish roots in the ground quickly to be able gain water and nutrients from the soil. These roots also hold it in place so wind and other factors don't move it around. Plants need to stay put to grow and this is one of the distinguishing aspects of a plant – it can't just get up and walk away!

An emerging seedling needs to establish leaves to be able to produce food for itself. Using sunlight to make its energy, this process is called photosynthesis, and is unique to plants and essential to life on earth.

Increasing your seed growing success

Seed germination requirements



For seeds to germinate there are particular environmental conditions that need to be met. These vary between plants and include the right:

- Depth
- Moisture
- Temperature
- Freshness

Img:http://commons.wikimedia.org/wiki/File:Acer_seedling_drawing.png

Depth

For a planted seed to become a seedling it requires to be at the right depth. Too shallow and it may be blown or moved away, too deep and it uses all its resources in trying to get the first leaves up to the sunlight, and is unable to, so dies.

Plant seeds twice the depth of their size (width if not round).

Moisture

Seeds require a constant moist environment to germinate in. The soil used to plant seeds into needs to be friable and have contact with the seed, this enables moisture from the soil to transfer to the seed so it can send out its first leaves and roots. To prepare the soil for sowing remove heavy lumps and even off the surface by tapping the seed punnet before planting the seed, or for direct seeding, rake the surface level. Always water the soil before sowing, and after sowing, water with a fine spray every one to two days in cooler weather, and up to once or twice daily in warmer weather.

Always check soil moisture before watering. Overwatering or water logged soil may lead to 'damping off' – a fungal condition that leads to the collapse of young seedlings.

Seed germination requirements cont.

When you are growing seedlings in punnets, the type of environment the punnets are positioned in needs to be considered. Hot and/or windy days can lead to increased evaporation and dry the soil out, killing the developing seedlings.

Seeds with a hard coating can be soaked in water to hasten and improve germination. Use warm diluted worm juice (or water if no worm juice is available) and soak larger seeds such as zucchini, pumpkin, beans, peas and corn for a day then plant out.

Temperature

Seeds will remain dormant and then germinate when the temperature is right. Each plant has a set temperature range it will germinate in. Therefore, sowing at the right time of year will increase germination rate. This information is on the seed packet.

If you have plenty of seeds, and don't mind plants turning up anywhere, scattering seeds around and waiting for them to germinate in their own time works as a gardening method. Some seed is likely to be lost either; blown away, decomposed; or birds and insects will carry it away some for food. To a degree, the loss of seed through birds can be prevented by the home gardener by protecting the newly planted seeds with a physical structure, such as a fine mesh which will prevent birds from digging them up. Plants usually produce a prolific amount of seed to allow for these losses.

Freshness

As with all good things, there is limited life span! Seeds vary in the duration that they remain at their peak viability. This is written on the seed packet as a 'best use by date'. For some plants, such as pumpkin, where you don't need many plants, often you can't use all the seed in the packet before the 'best use by date' and often waste them. This is good motivation for swapping seeds with friends, or saving your own seeds.

Img:www.harvesttotable.com/2011/06/estimating_yields_of_vegetable/garden-bed-intensive-planting/

Img:www.freedigitalphotos.net/images ID 100161166

The first leaves a plant forms will be established from the seed's last resources, and are a turning point for the plant's development. It then establishes mature leaves and stable roots –the seed is no longer!. A plant has emerged, now needing to find its nutrients from the environment around.
The soil condition, amount of sunlight, and protection from strong elements, pests and diseases make the difference now in the plant's life. That is where the gardener's knowledge and skills matter.

Growing your own plants from seeds

Growing your own plants from seed is cheaper than buying punnets of seedlings. You can grow a greater variety than is available from nurseries and you can time your sowing to have plants developing at different stages, therefore have a continuous supply of the vegetables you want. It involves sowing the seeds, caring for them until they a have established a root system, and then transplanting them into your plot. Some plants you may wish to transplant into a larger pot and grow them taller before planting out. Tomatoes are often done this way to get an early start on them, and a large plant can be planted out when the soil is warm enough. This means tomatoes by Christmas!

How to sow seeds in punnets

1. Fill a sterilised container* with moist seed raising mix, sieved potting mix, or a vermiculite and coir peat mixture 1:1ratio.
2. Sprinkle 1 - 2mm layer of worm casting (if available).
3. Mark out where the seeds will be planted. A furrow for fine seeds, or drill holes with correct spacing for larger seeds.
4. Sow the seeds twice the depth of their size. Small seeds can be distributed along a shallow furrow or lightly sprinkled on the soil. Larger seeds can be planted individually.
5. Cover the seeds with a fine material (sieved potting mix or coir peat)
6. Water with a fine mist using a spray bottle.
7. Label with the seed name and date sown.

*To sterilise spray diluted worm juice 1:10 or the same ratio of methylated spirits and water

When sowing in punnets you can control the temperature, light and moisture to provide the best conditions for the seeds to germinate and the seedlings to grow.

Seedlings could be grown in paper rolls or recycled containers.

Not all vegetables are suited to transplanting, some that tolerate it include: basil, broccoli, Brussels sprouts, cabbage, capsicum, chilies, cauliflower, eggplant, leeks, onions, parsley, spring onion, tomato and turnip.

Some summer plants can be sown in punnets then transplanted into small pots. This will establish them for transplanting when the temperature is right. Plants that can be sown in punnets include: tomato, capsicum, chilli, eggplant and zucchini.

When timing your sowing of seeds look at the recommendations for ‘temperate’. Adelaide is zoned as dry temperate for its weather conditions.

Img:http://www.vegetariantimes.com/blog/edible-gardening-101-biodegradable-seedling-containers/

Seeds will take anywhere from a few days to a few weeks to germinate, depending on the temperature. For most the ideal range is between 15°C - 25° C. Solanums need a 20°C - 25° C

Keep the growing container in the sunlight where they can be protected from wind. Putting them on a window sill that faces the sun can be good for when the days are cold.

Putting the punnets inside a low poly box and covering this with a plastic sheet, may help keep the soil warm and protect them from birds. Make sure there is good air flow.

Keep the soil moist.

Planning your garden

Understanding plant's growing habits will assist you to plan for successive harvesting and increase your gardening success.

Factors to consider when deciding, what to grow and preparing for it to grow include:

- Growth habit –to space correctly and avoid disease
- Growth rate –to plan for productive use in the garden space
- The plant's specific nutrient requirements

Growth habits

Width of plants

Plants grow in different habits and shapes, some taking up lots of space climbing or scrambling over a large area such as tomato and pumpkin, others grow tall, such as corn and many occupy a small amount of real estate, such as lettuce, spring onion and carrot.

Individual plant's spacing requirements are written on the seed packet. There are compact growing varieties available for many plants that can extend the range that can be grown in small gardens or pots including: patio tomatoes, mini carrots mini-cabbages and broccoli.

Growing Depth of Vegetables

Shallow rooted 30 - 60cm
broccoli, Brussels sprouts, cabbage, cauliflower, celery, corn, leek, lettuce, onion, parsley, potato, radish, spinach

Medium rooted 60cm - 1.2m
beans, beet, capsicum, carrot, cucumber, eggplant, pea, rockmelon, silverbeet, turnip

Deep rooted
artichokes, asparagus, parsnip, pumpkin, tomato, watermelon

The Australian Vegetable Garden - what's new is old, Clive Blazley, 2010, p19

Growing Width of Vegetables

Narrow growing <30 cm
beetroot, carrot, garlic, lettuce, onion, parsnip, radish, spring onion

Narrow growing 30cm - 50cm
beans, celery, lettuce, silver beet

Wide growing up to 70cm
broad beans, broccoli, cabbage, capsicum, cauliflower, eggplant, peas, sweet corn

Beyond 70 cm
potato, pumpkin, melons, tomato, zucchini

Stake or trellis
(vines, climbers or scramblers)
beans, cucumber, melons, peas, pumpkin, tomato

Depth of plants

Some plants send down deep roots such as carrots, parsnips and chinese radish, whilst others have more surface root systems such as sweet corn, bok choy and radish this means not all vegetables will be good in planter boxes.

Consider both these factors when planning you vegetable patch.

Planning your garden continued

Growth rates

Plants grow and go through their life cycles –seed-to- mature-plant-to-seed at different rates. Some have short life cycles of a few months e.g. lettuce, basil and turnip lasting one season. Whilst others can take many months, tomato, pumpkin, cauliflower, cabbage and broccoli may take 4 months or more before they are ready to harvest. Therefore, some plants occupy the soil for a long time for example, garlic will be ready in 9 months after planting. These plants are called annuals, as their life cycle is over within a year.

Plants that last for numerous years are called perennials. Examples of those that we use in cooking are: asparagus, rosemary, perennial basil and sage.

Considering what plants are your priority means you may have to some empty beds for a while between seasons.

How you harvest produce affects when the beds are empty

When you harvest vegetables you either remove all of the plant e.g. beetroot, cauliflower, carrot, and onion to eat the desired section (you can eat beetroot and carrot leaves!), or remove the ripe pieces and more will grow e.g. beans, broccoli, capsicums, melons, peas, tomatoes and zucchinis. When the growing season ends, the whole of these plants are removed.

Some plants are able to have particular sections taken off and they grow back more. This can mean you can reap large returns over a long period from a few plants. These ‘cut and come again’ vegetables include: loose lettuce varieties, swiss chard and silverbeet, and members of the brassica family (kale, chinese broccoli and mustard).

Maximising production - timing of successive planting and single style or mixing vegetable types

Vegetable gardens can either be set up as: having one crop per section –monoculture; or growing two or more crops in the same space mixed crops –polyculture.

It is easier to practice crop rotation when planting the same family of vegetable in the same bed one year and moving it to another bed the next year.

Fast growing plants can be put in between slow growing crops –intercropping.

Monoculture

With this method of planting the garden bed is prepared for the needs of one type of vegetable only. It is important to think about how much of the vegetable you want per week, and planting out the bed in intervals a few weeks apart.

Img:www.*gardenofeaden.blogspot.com.au/2010/06/how-to-grow-giant-onions.html*

Otherwise your crop will be ready for harvest all at once, which is fine for crops that can be stored like onions and pumpkin, or where the excess can be preserved like gherkin cucumbers. *Img: Corn field, Iowa. Credit: PlanMyGreen/flickr*

With some plants you can pick the plants at a young stage and eat them, and let other plants mature, carrots, onion and lettuce are examples of this.

Planting a block of one species can make the crop more susceptible to disease.

Polyculture

'Polyculture is agriculture using multiple crops in the same space, in imitation of the diversity of natural ecosystems, and avoiding large stands of single crops, or monoculture.'
http://en.wikipedia.org/wiki/Polyculture 1/9/2013

Img:http//blog.mastergardening.com/2011/02/maximize-growing-space-with-intercropping/

Multicropping and intercropping are methods of polyculture that can be easily used at home to increase the productivity of your vegetable garden, and are good for small spaces. Planting in this way increases the diversity of plants grown together and reduces the likelihood of a pest eating your entire crop at once.

Multi cropping

Multi cropping is the practice of growing two or more crops in the same space during a single growing season. There are two forms: double crop or relay crop.

In double-cropping you plant a second crop after the first has been harvested.

In relay cropping the second crop is sown amidst the first crop before it has been harvested. The sowing of the second crop is often done as the first crop is nearing its full development. The first crop is harvested once it has finished making room for the full development of the second crop.

Img:www.harvesttotable.com/2011/06/estimating_yields_of_vegetable/garden-bed-intensive-planting/

Maximising production - timing of successive planting and single style or mixing vegetable types

Intercropping

In this method two or more crops are grown in the same garden plot. As not all plants can be intercropped, some planning is required: taking into account the soil type and nutrient levels; the climate they will grow in, and the growing habits of the specific plant varieties. It is particularly important not to have crops competing with each other for physical space, nutrients, water or sunlight.

Intercropping examples

- Climbing beans growing up corn with pumpkin growing underneath to shade the corn roots
- Carrots and onions. Both like the same soil type and carrot roots are deeper that onion roots.
- Lettuce doesn't like too much heat and can be shaded by growing underneath a cucumber which is climbing on a trellis
- Radish, lettuce and spinach: harvested in that order; the radish will be picked first allowing the lettuce to grow in its space; similarly the lettuce will be eaten before the spinach is ready.

The individual crops could be mixed, in together in the available space.

Examples of intercropping strategies includes:

- Planting a deep-rooted crop with a shallow-rooted crop
- Sowing a fast growing crop with a slow growing crop, so that the fast growing crop is harvested before the slow growing crop starts to mature.
- Climbing crops can be grown with other crops that are able to offer support.
- Crops that need shade in summer can be grown under taller or climbing crops.

Img:http://newurbanhabitat.com/2013/06/10/adventures-in-polyculture/

Or the plantings could be done in rows, or where crops are arranged in alternate rows.

Img:http://secrets-of-self-sufficiency.com/intercropping-techniques

Polyculture

vegetable	intercrop with
Asparagus	Tomato, Parsley, Basil
Bush Beans	Potato, Cucumber, Corn, Strawberry, Celery, Summer Savory
Pole Beans	Corn, Summer Savory, Radish
Brassica - Cabbage Family	Aromatic Herbs, Celery, Beets, Onion Family, Chamomile, Spinach, Chard
Carrots	Radishes, Lettuce, Rosemary, Onion Family, Sage, Tomato
Celery	Onion, Cabbage Families, Tomato, Bush Beans, Nasturtium
Corn	Potato, Beans, Pumpkins, Cucumber, Squash
Eggplant	Beans, Marigold
Lettuce	Carrots, Radish, Strawberry, Cucumber
Allium - Onion Family	Beets, Carrots, Lettuce, Cabbage Family, Summer Savory
Parsley	Tomato, Asparagus
Potato	Beans, Corn, Cabbage Family, Marigolds, Horseradish
Pumpkins	Beans, Corn, Marigold
Radish	Carrots, Nasturtium, Lettuce, Cucumber
Spinach	Strawberry, Beans
Squash	Nasturtium, Corn, Marigold
Tomato	Onion Family, Nasturtium, Marigold, Asparagus, Carrots, Parsley, Cucumber
Turnip	Aromatic Herbs, Celery, Beets, Onion Family, Chamomile, Spinach, Chard

Vegetables for Spring Growing

Vegetables have preferred temperature ranges that they will grow in. They will either, not grow if it is too cold for them, or bolt to seed if it is too hot for them.

Spring weather can still have cold nights, so resist the temptation to plant vegetables that need the heat. The soil temperature needs to be consistently above 12°C for most summer vegetables. This means waiting until late September or early October to plant.

Some summer plants can be sown in punnets then transplanted into small pots. This will establish them for transplanting when the temperature is right. Plants that can be sown in punnets include: tomato, capsicum, chilli, eggplant and zucchini.

When timing your sowing of seeds look at the recommendations for 'temperate'. Adelaide is zoned as dry temperate for its weather conditions.

Spring Sow and Summer Grow

vegetable	days to harvest	minimum temperature to germinate	spacing between plants	spacing between rows	sowing times
beans climbing	60	15	15	70	Oct - Jan
dwarf			10	50	Oct - Dec
broccoli chinese	130	10	40	60	Jun - Mar
cabbage	120	10	30	50	Any
carrot	60	12	10	20	July - Mar
cauliflower	180	10	30	50	Dec - Feb
capsicum	150	15	50	50	Aug - Dec
cucumber	70	15	100	120	Sep - Jan
eggplant	120	18	60	60	Sep - Dec
lettuce	45	12	30	30	Any
melons	120	18	100	150-200	Aug - Dec
pumpkin	120	15	100	200	Sep - Dec
sweet corn	120	10	20	100	Sep - Feb
tomato	130	18	60	100	Aug - Dec
zucchini	60	15	100	100	Sep - Jan

Pest management

Improve the health of your plants by improving the health of your soil. This can be achieved by building up the microorganism levels in the soil by adding compost and worm castings, and reducing digging. This is long term project possibly taking 2 – 3 years.

Recommended book:
Kevin Handreck, *Gardening Down-Under, A Guide to Healthier Soils and Plants*

Reduce stressing the plants by:

- Growing in good soil
- Protecting from the wind and harsh sun
- Maintaining proper distances between plants
- Don't over fertilize – this produces sugary, sappy, soft growth that encourages sap sucking insects.
- Only apply a shallow layer of mulch

Plants can tolerate a certain degree of nibbling by insects, especially as they are more mature. But younger seedlings are quite susceptible, and taking some preventive measure can ensure your crops survive enough for you to get some too!

A number of chemical free methods to manage pest for all vegetables follows.

Know your garden visitors

Start by knowing what insects are in your garden. A large percentage of garden pests are most active at night, so go out with a torch and find out who is in your garden. Take a picture, if you can, or write down an accurate description, as a lot look similar. Look at books, or on the net, to identify those pests sighted.

There are two main types of pest you may see.

- Chewing
- Sucking

Look for signs such as: shiny, slimy trails left behind by snails and slugs, droppings from caterpillars or locust, and the scratching marks of birds (and cats), to help identify the particular type of pest. Having identified them, investigate the options for the best way to deal with them.

Books:

Tim Marshall, *Bugs, The Ultimate gardens Guide to Organic Pest Control*

Judy McMaugh, *What Garden is Pest or Disease Is That?*

Jackie French, *Natural Control of Garden Pest*

Jane Davenport, *Garden Guardians*

First, assess whether the damage is worth doing something about, a minor loss maybe fine for you and waiting a few days while for natural predators to move in maybe a good strategy. I

Some methods to deal with pests feature below.

Pick off

Regularly inspect your garden for caterpillars, snails and slugs and pick them off.

Physical barriers

Physical barriers are a simple method to stop pets (yours and visiting ones) getting into your beds. Wire mesh and netting can exclude even small insects.

Placing clear plastic drinking cups, or cut in half drink containers over seedlings buried in the soil a bit can be a simple barrier.

Traps

For snails bury plastic containers, such as a margarine tub that has a section 3 cm long and 1-2 cm deep cut out of the top long edge, in the garden. Almost fill with beer and place the lid on. Check each morning, empty out the drowned ones and refill.

For earwigs, slaters and millipedes scrunch some newspaper in small garden pot. Coat with vegetable oil or the oil from tins of fish. Empty out each morning.

Decoys

Placing small butterfly shaped bits of white plastic around brassicas is said to confuse the white cabbage moth into believing that another moth is there, and it moves on.

Pest management

Good bugs – attracting beneficial insects

The insect world is a case of eat or be eaten. Many insects eat other insects straight out, whilst some lay their eggs in other insects for their young to eat them as they develop. To utilise the eating habits of insects, you need to encourage a variety of creatures into your garden. This is done by:

Growing a mixture of plants which provide shelter, pollen and nectar throughout your garden, and having plants flowering all year round will attract a lot of beneficial insects.

By not spraying, even organically, you will allow a few pests to be in the garden as well, thus providing the predators with some food.

Predator insects include
- praying mantis,
- ladybird larvae
- lace wings
- hover fly
- Assassin bugs
- robber flies
- wasps

plant a diverse range of herbs and flowers
avoid spraying - even organically
to invite good bugs in

Biodiversity

In your yard create an environment to attract creatures that will eat some for your pests. Provide a home for frogs, lizards and birds.

Lace wing

Img:http://australianmuseum.net.au/image/Green-Lacewing-Elizabeth-Tasker

Hover flies

Img:http://en.wikipedia.org/wiki/File:Syrphidae_poster.jpg

Keep some vegetables and herbs flowering too
Brassica family - flowering turnip, mizuma, mustard
Salvias, sage or rosemary
Carrot family - dill, fennel, coriander, giant flat-leaved Italian parsley, bronze fennel, basil
Chinese spinach
As well as flowers such as
cosmos, golden rod (*Solidago* sp.) calendula, marigold, Queen Anne's lace

There are local native plants that are being used by food producers in Virginia to deter pest species. Information about this including on the insects and plants involved can be found at http://www.sardi.sa.gov.au/__data/assets/pdf_file/0005/103469/SARDI_Reveg_Guide_2009.pdf

Sprays

Local Native Plant Species

These plants also attract beneficial predators and have low water requirements.

Fragrant Saltbush (*Rhagodia parabolic*);

Ruby Saltbush *(Enchylaena tomentose)*

Coast Saltbush (*Atriplex cinerea*)

Seaberry Saltbush (*Rhagodia candolleana*)

An effective way to control of scale, aphids, white fly, leaf miner, mealy bug and mites on roses, other citrus, stone fruit and most house plants is horticultural oil. It works by suffocating the insect pests, so it's really important to get good coverage, making sure get the oil covering all over the insects.

Horticultural oil is easy to make with ingredients you're likely to have in the kitchen. It's safe and non-toxic.

Mix Together:

- 2 cups of vegetable oil
- ½ cup of dishwashing detergent

When you shake it, it goes a really milky colour and that's where it gets a name 'White Oil' and it will actually store safely for a couple of months.

To use it, add 2 tablespoons of the concentrate to a litre of water and it's ready to go.

Be careful not to spray in hot weather as it can burn and avoid spraying soft-leafed plants like lettuce and fern. You should also avoid using oil sprays within a month of the applying a sulphur-based fungicide

Chemical Use

On some occasions natural methods are not working and an off the shelf product may be the last resort. Below are some examples of off the shelf products that are considered to have a low toxic rating.

Ants use citrus spray

Heavy duty scale use Pest Oil

Black cherry aphids use pyrethrum

Caterpillars on brassicas use Dipel

Notes

Integrated Pest Management

Adapted from source:
http://www.atlantishydroponics.com/info/beneficial-insect-chart

Beneficial insect IPM Chart

Effective control *

Partially effective control #

Will eat anything it can find +

Bacteria ^

		HARMFUL INSECTS										
		Spider mites	Flat Mites	Aphids	Thrips	White Flies	Fungus Gnats	Gnat Larvae	Mealy Bugs	Scale	Beatles	Caterpillars
BENEFICIAL INSECT	Lady Bug *Hippodamia convergens*	*		*	*	*			#	*		
	Pirate Bug *Orius insidiosis*	*		*	*	*			#	*		
	Praying Mantis *Tenodeera sinensis*	+	+	+	+	+	+	+	+	+	+	+
	Green Lacewing *Chrysopa rufilbris*			*	*	*			#	*		
	Spider mite predators *Phytoseiulus persimilis, Neoseiulus californicus, Mesosesiulus longipes*	*										
	Spider mite destroyer Stethorus puncticum	*										
	Whitefly Parasite					*						
	Aphid Predators		*									
	Aphid Parasite		*									
	Predatory Nematodes				*		*	*				*
	Trip Predator Mites Amblyseius cucumeris	*			*							
	Fungus Gnat Predators *Hypoapis*	*			#		*	*				
	Mealy Bug Destroyer *Crytolaemus montrouzein*			*					*	*		
	^ Spinosad *Saccarophyspora spinosa*	#		*								
	^ Bacillus thuringiensis						*	*				

Resources

Books

Homegrownsa, Jon Lamb, The Advertiser

Gardening Down-under, Kevin Handreck, CSIRO

Organic Vegetable Gardening, Annette McFarlane, ABC Books

One Magic Square, Lolo Houbein, Wakefield Press

Seeds

The Diggers Club: www.diggers.com.auGreen Patch Seeds: www.greenpatchseeds.com.au

Eden Seeds: www.edenseeds.com.au

Beautanicals Vegetable Seeds Australia: www.vegetable.seedsaustralia.com.au

Goodman Seeds: www.goodmanseeds.com.au

The Lost Seed: www.thelostseed.com.au

The Italian Gardener:
www.theitaliangardener.com.au

New Gippsland Seeds and Bulbs:
www.newgipps.com.au