



## Organic Farming: Which Green Manure Should I Grow?

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### Introduction

The Agriculture Note AG1084: *Organic Farming: Green Manures for Vegetable Cropping* describes in general what green manure crops are, their benefits, some matters to consider when choosing green manure crops and how to manage them. This Agricultural Note provides more detailed information from a range of sources about important characteristics of most green manure and cover crops that can be grown in Victoria. Knowing these characteristics may help growers to choose the green manure or cover crop that fits best into their crop rotation, and suits their site-specific conditions and farm plan goals.

However, the reader ought to bear in mind that the information has been collated from many different sources, including some overseas research trial results. This Agricultural Note is designed to inform the reader of the characteristics of various green manure and cover crops. Growers can then make further observations about the effects and performance of particular crops in their specific farm setting.

### Explanation and comments to column headings of the list of green manures

- In general, it must be noted that blank fields in the list mean that information was not available at the time of collating the list. It does not necessarily mean that the crop does not have that particular characteristic. For example, Arrowleaf clover has a blank field in the column *Host/habitat for beneficial insects* because no specific mention was found in the literature about Arrowleaf clover providing habitat for beneficial insects.
- Available space limited the listing of everything that is known about each crop. The emphasis is on important features that are often not readily accessible. Information such as the required temperature range and most suited growing area in Victoria, soil pH, soil type, *Rhizobium* inoculant group for legumes, and minimum growth period has been omitted as it can be easily obtained from sources such as seed merchants. It is important to seek information about these

characteristics as well as those listed in this document, when choosing any green manure or cover crop.

### Green manure/Cover crop

This column contains the common names of annual and a few perennial crops that are either used as a green manure crop or as a cover crop. Being used as a green manure crop means that the crop will be incorporated into the topsoil for decomposition before the planting of a new crop. A cover crop, in comparison, is planted to cover bare soil.

Cover crops are managed by slashing or mulching. Perennial crops are left standing for several years until they lose vigour, while some annuals, for example medics, are left to 'hay off', that is, they are left to go to seed in early summer and to naturally re-germinate the following autumn. Hence, most crops can be used either as a green manure or as a cover crop, although they are often more suitable for one or other purpose.

The listed green manure/cover crops are grouped into 'legumes', 'grasses' and 'other broadleaf crops'.

### Scientific Name

Sometimes it is advantageous to know the scientific name of the plant or animal. The scientific name, commonly written in italics, consists of a genus name, the first part, and a species name, the second part. For example, the scientific name for Arrowleaf clover is *Trifolium vesiculosum*. All clover species with the genus name *Trifolium* (*Trifolium* spp.) are related and one can expect some common characteristics between the different species. *Trifolium* sp. would mean any *Trifolium* clover species.

The full scientific name is plant or animal specific. As common names often vary between different geographical regions, it might be helpful at times, when talking to people from another state or region to use the scientific name for clear identification of the plant or animal.

In the table on page three, common names and scientific names (in brackets) of plants and animals are given, when they occur for the first time. Subsequently, only the common name is used, when known, unless the common

name does not clearly identify the species. For example, root knot nematodes belong to the genus *Meloidogyne*, which has many species, but the most damaging in Victoria are *Meloidogyne hapla* and *M. javanica*. As another example, *Helicoverpa punctigera* and *H. armigera*, both are commonly called native budworm.

At the end of the table is a list of the main disease-causing nematode species.

### Sowing time

The sowing times given are generally recommended for producing the highest yields of the crop. These times might have to be adapted in view of local conditions and a specific farm management purpose.

### Root system

To a large extent, the root system accounts for a green manure/cover crop's soil improving properties. The growing root tips open up soil pores. A deep taproot will loosen the subsoil and bring nutrients to the surface. A strong fibrous root system loosens the soil well and adds a lot of organic matter to the soil. The breakdown of this organic matter produces compounds that bind soil particles together to form soil aggregates. A well-aggregated soil tills easily, is well aerated, has a high water infiltration rate, and, in combination with organic matter, an improved water holding capacity.

### Avg biomass t/ha & avg kg N/ha

Biomass is a term used to describe the weight of a living crop. Data on biomass were not available for all crops. Figures in t/ha indicate the average fresh biomass a crop will have produced by the time of incorporation. When dry matter figures are quoted, these are stated as 'dry matter'. Dry matter figures are derived from harvesting and then oven drying the plants.

Biomass produced is directly related to the health of the crop and the length of growing time. Hence the great range of expected yields. For some legumes, data was available on the kg of nitrogen per ha added to the soil by the incorporated crop. This is noted in the list as avg (average) kg N/ha.

### Weeds, pests and diseases suppressed (incl. allelopathy)

In this column, data is given on the effects of green manure/cover crops on weeds, vegetable pests and diseases. Weeds, pests or pathogens may be suppressed through an allelopathic affect. Allelopathy refers to the effect that plants or micro-organisms have in stimulating or inhibiting the growth of neighbouring plants or micro-organisms through the production of organic compounds. Allelopathy is an important attribute for pest and disease control. For example, biofumigation by plants from the brassica family is grounded on allelopathy. Brassicas contain chemicals, called glucosinolates, which are basic substances for the formation of the chemicals isothiocyanates that suppress soil pathogens. Weeds may also be suppressed by strong competition, mainly for light, but also water, from the green manure/cover crop. Pests and pathogens may be reduced, when the green manure

crop acts as a 'break crop', i.e. it is not a host to the pest or disease and thus breaks its lifecycle.

### Host of these vegetable diseases and Host of these vegetable pests

Most green manure/cover crops are susceptible to, or hosts of, pests and diseases that are crop specific and do not affect vegetables. Those pests and diseases are not listed. For example, the cereal root disease 'Take-all' (*Gaeumannomyces graminis*) may affect a barley green manure crop but will not affect the next vegetable crop.

Some pests and diseases, however, may attack a green manure/cover crop as well as a vegetable crop. In this case, it is important to weigh up the potential risks of these pest and disease effects against the benefits, when choosing crops. Pests and diseases might proliferate in the green manure/cover crop and attack the following vegetable crop. On the other hand, a low level incidence of pests in the green manure crop may not excessively diminish the green manure's growth and can have the benefit of being a food source to attract and allow the survival of beneficial insects that will then protect the cash crop.

### Host/habitat for these beneficial insects

An important function of green manure/cover crops is to provide food and shelter for beneficial insects. Most crops do this to some degree. Prolific bloomers especially, are a source of nectar and pollen, important food sources for insects. Some crops are well known for supporting beneficial insects particularly well and they have been listed.

### Can be sown in combination with

Planting a mixture of green manure or cover crops instead of a monoculture makes use of synergies between the plant species. Soil microbial communities are more diverse under species-diverse pastures than under monocultures. Listed are commonly used combinations of crops, but other combinations are also possible.

### Other features

The last column lists a range of other additional important features of these crops.

### Contacts

- **Australian Quarantine and Inspection Service (AQIS) Organic Program**  
*For information on certification organisations, the 'National Standard for Organic and Biodynamic Produce' and export requirements for organic produce.*  
Tel: (02) 6272 3928  
Email: [organic@aqis.gov.au](mailto:organic@aqis.gov.au)  
Internet: <http://www.daff.gov.au/aqis/export/organic-bio-dynamic>
- **Organic Federation of Australia (OFA)**  
*Australia's peak organic industry organisation.*  
P.O.Box 369, Bellingen NSW 2454  
Tel: 1300 657435  
Email: [info@ofa.org.au](mailto:info@ofa.org.au) Internet: <http://www.ofa.org.au/>

Green manure/ Cover crop	annual /perennial (a),(p)	Scientific name	Best sowing time	Root system	Avg Biomass t/ha & avg kg N/ha	Weeds, pests and diseases suppressed, (incl. allelopathy)	Host of these vegetable diseases	Host of these vegetable pests	Host/habitat for these beneficial insects	Can be sown in combination with	Other features
<b>Legumes</b>											
Birdsfoot Trefoil	p	<i>Lotus corniculatus</i>	autumn, spring	highly branched 30-60 cm depth	8 t/ha; 30-180 kg N/ha (nitrogen per ha)			native budworm ( <i>Helicoverpa punctigera</i> (previously <i>Heliothis punctigera</i> )), root-knot nematodes <i>Meloidogyne javanica</i> , <i>M. hapla</i> , cyst nematodes ( <i>Heterodera</i> spp), root-lesion nematodes ( <i>Pratylenchus</i> spp.)	minute pirate bug ( <i>Orius tristicolor</i> )	slow-growing grasses	tolerates droughty and waterlogged soils; contains tannin, which, when grazed, reduces need for drenching lambs; slow regrowth after slashing
Biserrula	a	<i>Biserrula pelecinus</i>	autumn	deep (0.70- 1.2 m)	4-7 t/ha			lucerne flea, vegetable weevil, jassids, <i>Helicoverpa</i> spp., aphids; has some tolerance of red legged earth mite, blue oat mite		sub-clover, Serradella	best on acidic sandy soils
Clovers		<i>Trifolium</i> spp.		taproot with spreading branched laterals; rhizomes; stolons	4 - 10 t/ha	generally weed suppressing when fully established; fast initial growth is important	<i>Pythium</i> spp.; <i>Sclerotinia</i> spp.	species dependent most nematode species: <i>Meloidogyne</i> spp., <i>Xiphinema</i> spp., stem & bulb nematode ( <i>Ditylenchus dipsaci</i> ), <i>Tylenchorhynchus</i> spp., red legged earthmite, lucerne flea, cowpea aphid, alfalfa aphid	generally pollen and nectar food for beneficial insects; lacewings, spiders		
Arrowleaf clover	a	<i>Trifolium vesiculosum</i>	early autumn to mid- winter	deep	5.5-11 t/ha		<i>Rhizoctonia solani</i> ; but no significant diseases recorded in Australia	red legged earth mite, lucerne flea at seedling stage, <i>Meloidogyne graminicola</i> , <i>M. incognita</i>		annual grasses	resistant to bean yellow mosaic virus; intolerant of alkaline soil
Balansa clover	a	<i>Trifolium michelianum</i>	early autumn	extensive	5-6 t/ha dryland; 7-8 t/ha under irrigation	tolerant of red legged earth mite when mature	<i>Pythium</i> sp at seedling stage; alfalfa mosaic virus	red legged earth mite, lucerne flea, lucerne aphid at seedling stage, <i>Meloidogyne graminicola</i> , <i>M. incognita</i>		Persian clover, sub- clovers, salt tolerant grasses, tall wheat grass, annual & perennial clovers, annual grasses, lucerne, ryegrass	moderately tolerant of salt, water logged soils and drought
Berseem clover	a	<i>Trifolium alexandrinum</i>	early autumn	up to 60 cm	10 t/ha	early vigorous establishment needed for weed suppression; does not suppress fathen ( <i>Chenopodium album</i> ) and mallow ( <i>Malva</i> sp.)	cucumber mosaic virus	plant parasitic nematodes in limited numbers, esp. <i>Meloidogyne</i> spp., incl. <i>M. javanica</i>	bees & other pollinating insects; nectar food for many insects	white clover, oat, cereal rye, annual rye grass	
Crimson clover	a	<i>Trifolium incarnatum</i>	late summer, early autumn	deep taproot	5-8 t/ha; 54-85 kg N/ha	less weed suppressing than more prostrate clovers	<i>Pythium</i> sp, <i>Rhizoctonia</i> sp.	blue-green aphid, pea aphid, thrips, several nematode species incl. <i>Meloidogyne hapla</i> and <i>M. arenaria</i>	bees, ladybirds, bigeyed bug ( <i>Geocoris</i> sp), minute pirate bug	cocksfoot, white & sub-clover, burr medic, cereal grains, vetches, annual ryegrass, tall fescue	decomposes rapidly, when incorporated; higher water use efficiency than hairy vetch
Persian (Shaftal) clover	a	<i>Trifolium resupinatum</i>	late summer to autumn	dense	8-15 t/ha; 85-160 kg N/ha	quick ground cover for weed suppression		red legged earth mite, lucerne flea, <i>Meloidogyne</i> spp., incl. <i>M. javanica</i>	bees & other pollinating insects; nectar food for many insects	tall wheat grass in waterlogged areas; other clovers	tolerates medium salty and waterlogged soils; excellent regrowth after slashing

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Red clover	short lived p; a	<i>Trifolium pratense</i>	early autumn	taproot to 90 cm, spreading branched laterals in top 12 cm	5.5 t/ha; 1.6-2.2 t/ha dry matter; 50 kg N/ha	allelopathic effect against wild mustard; suppresses weeds	<i>Fusarium wilt (Fusarium oxysporum)</i> , common pea mosaic virus, cucumber mosaic virus, alfalfa mosaic virus, <i>Sclerotium rolfsii</i>	root knot nematodes <i>Meloidogyne</i> spp., incl. <i>M. javanica</i> and <i>M. hapla</i> , root lesion nematodes., cyst nematodes	ladybirds, hoverfly, lacewings, wasps	can be inter-planted into short crops only	some varieties tolerate waterlogged soils; some varieties resistant to Sclerotinia crown rot
Rose clover	a	<i>Trifolium hirtum</i>	autumn	taproot up to 2 m	7 t/ha; 75 kg N/ha			nematodes <i>Meloidogyne incognita</i> & <i>M. javanica</i>	minute pirate bug	sub-clover, barrel medic, lucerne, perennial grasses	drought tolerant
Strawberry clover	p	<i>Trifolium fragiferum</i>	spring	taproot to 1m, in wet and saline soils the roots remain in the top 8-10 cm	3.7-11 t/ha; 40-330 kg N/ha	vigorous stand has a low, thick weed smothering growth habit	<i>Sclerotinia</i> sp.	red legged earth mite, blue oat mite, stem & bulb nematode, cyst nematode, root-knot nematodes <i>Meloidogyne hapla</i> , <i>M. javanica</i> , but not good host for <i>M. incognita</i> and <i>M. arenaria</i>	beneficial insect attractor	tall wheat grass, Puccinellia, white clover, perennial rye grass, phalaris, tall fescue	tolerates waterlogged soils & medium saline soils; medium drought resistance
Sub-clovers	a	<i>Trifolium subterraneum</i>	autumn	taproot with fibrous supporting roots	3.3-9.5 t/ha; 100-225 kg N/ha	smothers weeds generally; St. John's Wort ( <i>Hypericum perforatum</i> )	<i>Fusarium</i> sp., <i>Rhizoctonia</i> sp., <i>Aphanomyces</i> sp., red leaf virus	several plant parasitic nematode species	ladybirds, bigeyed bug	medics, annual and perennial grasses, lucerne	tolerates temporary flooding, drought; can be serious weed in annual vegetables; loosens compacted soil
Sweet clovers	a; bi-annual	<i>Melilotus</i> spp.	autumn	strong taproot	2.5-9 t/ha	suppresses weeds due to quick growth; nematodes		several plant parasitic nematode species	bees, large predatory wasps, Tachinid flies	tall wheat grass; cereals	tolerates salinity & water logging; some varieties toxic to livestock; drought resistant; alleviates soil compaction
White sweet clover		<i>Melilotus alba</i>	autumn	deep taproot		may suppress <i>Sclerotium rolfsii</i> , if incorporated into the soil		<i>Meloidogyne hapla</i> , <i>M. incognita</i> , <i>M. javanica</i> , cyst nematode.	blossoms attract bees, Tachinid flies, large predatory wasps		poor competitor, especially during establishment; excellent at loosening topsoil and subsoil, and releasing P and K; drought tolerant once established
Yellow sweet clover		<i>Melilotus indica</i> or <i>M. parviflorus</i> or <i>M. officinalis</i>	autumn					<i>Meloidogyne hapla</i> , cyst nematode.			
White clover	p	<i>Trifolium repens</i>	autumn	shallow, most roots to 20 cm; stolons; taproot may reach 90 cm	12-25 t/ha; 1.6-3.5 t/ha dry matter; 40-270 kg N/ha	smothers weeds; may reduce thrips and brassica pests when intercropped	<i>Pseudomonas syringae</i> , <i>Sclerotium rolfsii</i> , <i>Rhizoctonia</i> sp., <i>Fusarium</i> sp., Anthracnose ( <i>Colletotrichum</i> sp.)	many arthropods, mites, many plant parasitic nematode species, Western Flower Thrip, spider mite	bees, aphidophagous (aphid eating) insects (hover flies, lacewings, predatory midge, predatory myrid, lady beetles)	other clovers, medics, grasses, but grasses difficult to maintain	

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Cowpea	a	<i>Vigna unguiculata</i>	late spring, summer	strong taproot, laterals near surface	4-5 t/ha; 2.2 t/ha dry matter; 70-350 kg N/ha	suppresses weeds through vigorous growth; suppressed <i>Meloidogyne arenaria</i> , <i>M. incognita</i> , <i>Heterodera glycine</i> in green house experiment	Fusarium wilt, <i>Rhizoctonia solani</i>	cowpea aphid; <i>Meloidogyne</i> spp, leafminers, leafhoppers, mites, thrips, aphids	bees, ladybirds, predatory wasps, ants, soft-winged flower beetle	Japanese millet, sorghum, soybean, peanut	warm climate crop, suitable only for the north region of Victoria; moderately drought resistant because taproot draws moisture from deep in the soil profile
Fenugreek	a	<i>Trigonella foenum-graecum</i>	autumn	deep taproot	1.5 t/ha dry matter			<i>Rhizoctonia solani</i> , Fusarium Wilt, <i>Meloidogyne incognita</i> , <i>M. javanica</i>		field bean, cereals (barley)	some drought and salt tolerance
Faba bean	a	<i>Vicia faba</i>	autumn	taproot; strong root system	5.5-9 t/ha; 22-90 kg N/ha			root knot nematodes <i>Meloidogyne</i> spp; bean aphid	extra-floral nectar source from early vegetative growth to late pod filling		break crop for fields with <i>Sclerotinia minor</i> ; does not respond to mowing or grazing
Field pea	a	<i>Pisum sativum</i>	(early) autumn	shallow	6.5-9.5 t/ha; 3 t/ha dry matter; 30-140 kg N/ha		Fusarium wilt, <i>Aphanomyces</i> sp., <i>Sclerotinia</i> sp.	aphids, plant parasitic nematodes	aphid predators, eg. 7-spotted ladybird ( <i>Coccinella septempunctata</i> ), Syrphid flies; bees, native pollinators	cereals (usually oats, but also rye, barley, wheat); brassicas	on its own not vigorous enough to suppress weeds
Lucerne or alfalfa	p	<i>Medicago sativa</i>	late summer, spring	deep taproot	8 t/ha dry matter	clover seed; <i>Sclerotium rolfsii</i>	Alfalfa mosaic virus	<i>Pratylenchus penetrans</i> , <i>P. neglectus</i> , <i>Meloidogyne arenaria</i> , <i>M. hapla</i> , <i>M. incognita</i> , <i>M. javanica</i>	food & shelter for beneficial insects; assassin bug, minute pirate bug	grasses	there are winter active and winter dormant lucerne varieties
Lupins	a	<i>Lupinus</i> spp.	early autumn	strong deep taproot	10 t/ha; 60-350 kg N/ha, varieties differ		<i>Sclerotinia</i> sp., cucumber mosaic virus, <i>Rhizoctonia</i> sp., Anthracnose sp., bean yellow mosaic virus	red legged earth mite, native budworm, several cyst nematode and root knot nematode species; thrips	ladybirds; bees; important honey plant;	wheat	species vary in pH preference; alkaline tolerant species do not like free lime; iron deficiency on calcareous soil
Medics	a	<i>Medicago</i> spp.	autumn; (early spring)	deep	8 t/ha; 1.5-2.5 t/ha dry matter; 55 - 220 kg N/ha			red legged earth mite, root lesion nematode species	lacewings, hoverflies		deeper rooted and more drought tolerant than sub-clovers; different species and varieties with different characteristics for various growing conditions and pest and disease resistance or susceptibility
Barrel medic	a	<i>Medicago truncatula</i>						red legged earthmite; blue oat mite, springtails or lucerne flea; pea aphid; <i>Meloidogyne. hapla</i>		sub-clovers; lucerne	
Gama medic	a	<i>Medicago rugosa</i>						red legged earth mite; Sitona weevil ( <i>Sitona humeralis</i> )			
Snail medic	a	<i>Medicago scutellata</i>						red legged earth mite, blue oat mite, springtails or lucerne flea; pea aphid			
Strand medic	a	<i>Medicago littoralis</i>						red legged earth mite, blue oat mite, springtails or lucerne flea; pea aphid			

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Mung bean	a	<i>Vigna radiata</i>	late spring, summer				as other legumes, esp. cowpea, since cowpea and mung bean are related	<i>Helicoverpa punctigera</i> , green vegetable bug; green mirids; thrips			warm climate crop, suitable only for northwest region of Victoria
Serradella	a	<i>Ornithopus</i> spp	autumn, (winter)	deep	3-6 t/ha	aphids	<i>Rhizoctonia</i> sp., Anthracnose sp.	<i>Helicoverpa punctigera</i>		ryegrass, fescue; clovers, Biserrula	variational difference in relation to growing conditions; tolerates acidic soils; not suited for heavy clay soils and very alkaline soils
Soybean, trailing		<i>Glycine soya</i> or <i>G. max</i>	summer		4 t/ha	weed suppressing			insect attraction	millet, cowpea, sweet corn	
Vetch	a	<i>Vicia</i> spp.	early autumn, spring, summer			possibly lettuce		nematode species	ladybirds, bigeyed bug		
Hairy vetch	a	<i>Vicia villosa</i>	early autumn, spring, summer	taproot 30- 90 cm	4.8-7.8 t/ha; 2.2- 5.6 t/ha dry matter; 90-150 kgN/ha			flower thrips ( <i>Frankinella</i> spp), many nematode species, aphids, two-spotted spider mite	aphid predators, minute pirate bug; bigeyed bug, soil arthropods	wheat, oats, cereal rye, barley	toxic to cattle; nematode resistant; more winter hardy than common vetch; high water use efficiency
Purple vetch	a	<i>Vicia atropurpurea</i> , (the old name <i>V benghalensis</i> was still found in the literature)	spring to summer		4.8-7.8 t/ha; 2.2- 5.6 t/ha dry matter; 55-225 kg N/ha	suppresses weeds, especially star thistle		Two-spotted mite; cyst nematode species, <i>Pratylenchus vulnus</i> ; possibly <i>Meloidogyne javanica</i>	bees, many beneficial insects (assassin bug <i>Apiomerus</i> spp., minute pirate bug., lacewings, ladybirds)		
Woolly Pod vetch	a	<i>Vicia benghalensis</i>	early autumn	taproot to 80 cm	6.5 t/ha	weed smothering	major host for <i>Sclerotinia minor</i>			cereals, especially oats	toxic to cattle
<b>Other broadleaf crops</b>											
Brassicac	a	<i>Brassica</i> spp.				soil pathogens: fungi and nematodes; also spiny sowthistle ( <i>Sonchus asper</i> ), scentless camomille ( <i>Matricaria</i> sp.), amaranth ( <i>Amaranthus</i> sp.), barnyard grass ( <i>Echinochloa crusgalli</i> ), meadow foxtail ( <i>Alopecurus</i> sp.), wheat	clubroot ( <i>Plasmodiophora brassicae</i> ), downy mildew ( <i>Peronospora parasitica</i> )	aphids, caterpillars, snails, slugs			Brassicac can be grown for biofumigation; brassica crops vary in content and type of glucosinolates and hence biofumigant effectiveness; does not host the very important vesicular-arbuscular mycorrhizal (VAM) soil fungi

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Canola or rape	a	<i>Brassica napus</i>	autumn	deep taproot	5.5-7 t/ha 3.3 t/ha dry matter	spiral nematode ( <i>Rotylenchus reniformis</i> )	<i>Rhizoctonia</i> sp., <i>Sclerotinia sclerotiorum</i>	nematodes, cabbage moth ( <i>Plutella xylostella</i> )		cereals	organic and biodynamic growers be aware of GMO status
Yellow or White mustard	a	<i>Sinapis alba</i> or <i>Brassica alba</i> or <i>B. hirta</i>	spring to early autumn	shallow		nematodes; some potential to reduce wireworm and slugs; allelopathic effect against weeds	<i>Rhizoctonia</i> sp., clubroot ( <i>Plasmodiophora brassicae</i> )	turnip aphid ( <i>Hyadaphis erysimi</i> ), cabbage aphid ( <i>Brevicoryne brassicae</i> ), thrips	ladybirds, hoverflies	cereals	
Indian mustard		<i>Brassica juncea</i>	spring to early autumn	taproot	5.5-9.5 t/ha dry matter						
Fodder brassicas	a		autumn	shallow	10-15 t/ha dry matter						
Buckwheat	a	<i>Fagopyrum esculentum</i>	mid-spring	short taproot with fibrous laterals, top 25 cm	1-1.5 t/ha	smothers weeds	<i>Rhizoctonia solani</i>	root lesion nematode	hoverflies; nectar seeking insects	cowpea	cool climate; short season (matures in 8-10 weeks) summer crop; extracts phosphorus in low phosphorous soils; honey crop
Linseed		<i>Linum usitatissimum</i>	autumn	shallow			Fusarium wilt, <i>Rhizoctonia solani</i>	<i>Helicoverpa punctigera</i> , root-lesion nematode spp., <i>Meloidogyne artiellia</i> , <i>M. incognita</i>			Fusarium resistant varieties exist; break crop as hardly any disease problems; trap crop for <i>Orobanche</i> sp. (broomrape); needs presence of vesicular arbuscular mycorrhizae (VAM) for efficient phosphorus uptake
Sunflower	a	<i>Helianthus annuus</i>	spring to summer	strong taproot, lateral branches	4-5 t/ha dry matter	nematodes; sweet corn ( <i>Zea mays</i> ), sorghum ( <i>Sorghum vulgare</i> ), Guar ( <i>Cyamopsis tetragonoloba</i> )	<i>Sclerotinia sclerotiorum</i>	<i>Helicoverpa</i> spp., several plant parasitic nematode species	arbuscular mycorrhizae (AM)		
Marigold	a	<i>Tagetes minuta</i>	spring to summer			nematodes					
<b>Cereals and Grasses</b>											
Barley	a	<i>Hordeum vulgare</i>	late summer, autumn, early spring	strong, fibrous	7.5-17.5 t/ha; more than oat, cereal rye, wheat	flailed barley inhibits cereal rye; strong tillering at base, hence better weed control than oats; rye, wheat		host for nematode <i>Meloidogyne javanica</i> ; minor host for <i>M. arenaria</i>	damsel bug, ( <i>Nabidae</i> sp.), Encyrtidae parasitoid of cutworm larvae	brome, cereal rye, annual clovers, medics, vetch; pea, barley, white mustard	

Green manure/ Cover crop	annual /peren- -nial (a),(p)	Scientific name	Best sowing time	Root system	Avg Biomass t/ha & avg kg N/ha	Weeds, pests and diseases suppressed (incl. allelopathy)	Host of these vegetable diseases	Host of these vegetable pests	Host/habitat for these beneficial insects	Can be sown in combination with	Other features
Oats	a	<i>Avena sativa</i>	autumn	fibrous	9-13 t/ha	non- or poor host to nematode <i>Meloidogyne hapla</i> and <i>M. javanica</i>		several plant parasitic nematode species		cereal rye, which increases mycorrhizal colonisation	
Cereal rye	a	<i>Secale cereale</i>	autumn	fibrous; stronger than other cereals	4.5-11 t/ha	rye residues on the surface suppress: sweet corn, weeds (pigweed, barnyard grass, fathen ( <i>Chenopodium album</i> )); non- or poor host to nematode <i>M. hapla</i> , <i>Pythium</i> spp.		nematodes <i>Ditylenchus dipsaci</i> , <i>Heterodera avenae</i> , <i>Aphelenchus tritici</i> , <i>Meloidogyne arenaria</i> , <i>M. javanica</i>	ladybirds	Berseem clover, oats	drought resistant
Wheat	a	<i>Triticum</i> spp	autumn	fibrous	4-9.5 t/ha	stem & leaf residues suppressed annual ryegrass ( <i>Lolium rigidum</i> ) in laboratory trial; cultivar dependent	Cavity spot ( <i>Pythium violae</i> )	several plant parasitic nematode species	damsel bug, ( <i>Nabidae</i> sp.), Encyrtidae parasitoid of cutworm larvae	soybean	Cavity spot ( <i>Pythium violae</i> ) is a widespread carrot disease in Northern Victoria and South Australia
Japanese millet	a	<i>Echinochloa utilis</i> or <i>E. crusgalli</i>	spring, summer	fibrous, mainly top soil	up to 35 t/ha; 4-7t/ha dry matter	weed smothering; nematode <i>Paratylenchus projectus</i>		<i>Meloidogyne arenaria</i> , <i>M. incognita</i> , <i>M. javanica</i>		soybean; cowpea	more cold tolerant than Siberian millet
Siberian or White Panicum millet	a	<i>Echinochloa frumentacea</i>	spring, summer	fibrous, mainly top soil	up to 35 t/ha; 4-7 t/ha dry matter	weed smothering through prostrate growth					optimum temperature 25-30°C; grows more slowly than Japanese millet; better regrowth after grazing or slashing
Forage (Pearl) millet	a	<i>Pennisetum</i> sp.	spring, summer	larger and deeper than Japanese millet		suppresses weeds through vigour		several plant parasitic nematode species			growth habit similar to sorghum
Puccinellia	p	<i>Puccinellia ciliata</i>	autum, late winter, early spring							tall wheat grass, strawberry clover	main use for reclamation and ground cover on very saline & waterlogged soils
Sorghum/ Sudan grass	a	<i>Sorghum vulgare</i>	spring, summer	fibrous	16-22 t/ha	wheat; nematodes <i>Meloidogyne hapla</i> ; weeds		several plant parasitic nematode species, corn aphid		cowpea	needs N fertilisation after cutting
Tall wheat grass	p	<i>Thinopyron ponticum</i>	winter to spring							Puccinellia, tall fescue, phalaris, strawberry clover, white clover, Balansa clover	used for reclamation and as ground cover of saline and water logged soils
Ryegrass	a; p							slugs, snails, red legged earth mite, blue oat mite			
Annual ryegrass	a	<i>Lolium rigidum</i>	early autumn	extensive, shallow							will become a weed, if let go to seed

Green manure/ Cover crop	annual/perennial (a),(p)	Scientific name	Best sowing time	Root system	Avg Biomass t/ha & avg kg N/ha	Weeds, pests and diseases suppressed (incl. allelopathy)	Host of these vegetable diseases	Host of these these vegetable pests	Host/habitat for beneficial insects	Can be sown in combination with	Other features
Perennial ryegrass	p	<i>Lolium perenne</i>	autumn to early spring	extensive, shallow		clovers; allelopathic effect against weeds				Legumes (white, red, subterranean clovers, lucerne), temperate grasses (fescue, cocksfoot, phalaris)	

### List of disease-causing nematodes:

- Root knot nematodes: *Meloidogyne* spp
- Root lesion nematodes: *Pratylenchus* spp
- Cyst nematodes: *Heterodera* spp.,
- Stem and bulb nematodes: *Ditylenchus* spp.

### References

This list was compiled from numerous information sources. Much of this information can be found on the internet. For Australian conditions, useful sources are publications by the Australian State Government Departments for Agriculture and Primary Industries:

- New South Wales Department of Agriculture: <http://www.dpi.nsw.gov.au/>
- Department of Primary Industries, Water and Environment, Tasmania: [www.dpiwe.tas.gov.au](http://www.dpiwe.tas.gov.au)
- Department of Primary Industries, Victoria: [www.dpi.vic.gov.au](http://www.dpi.vic.gov.au)
- Department of Primary Industries, Queensland: [www.dpi.qld.gov.au](http://www.dpi.qld.gov.au)
- Primary Industries and Resources South Australia: [www.pir.sa.gov.au](http://www.pir.sa.gov.au)
- Department of Agriculture, Western Australia: [www.agric.wa.gov.au](http://www.agric.wa.gov.au)
- Very comprehensive is the Cover Crop Database from the University of California at <http://www.sarep.ucdavis.edu/ccrop/>
- Nemaplex nematode-host association database, <http://plpnemweb.ucdavis.edu/nemaplex/index.htm>

### Please note:

Information on this list is current at the time of publication. New information through research is constantly produced, for example in relation to biofumigants.

For explanations of column headings, refer to the cover pages.

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