

# LENTILS in South Australia & Victoria



## INTRODUCTION

Lentils (*Lens culinaris*) are an established, high value pulse crop in South Australia and Victoria. They are a winter growing pulse crop widely grown throughout the Mediterranean , southern Asia and the Americas .

Australia 's lentil industry has benefited from the release of better adapted lentil varieties, sustained high grain prices and grower confidence in crop management. Lentils command a premium price compared to other pulse crops such as peas and beans, with many world markets having a preference for lentils as a human food.

Although lentil prices are usually higher than most other pulses, they can be volatile due to fluctuating Australian and world production and world demand. One disadvantage with lentils is the significant price drop to growers if livestock feed market prices become necessary to under-pin the food market.

## Description

Lentil plants are erect in the early stages of growth but may lodge late in spring, particularly if well grown, despite their relative short height. Its many stems originate from near the ground. Leaves are very similar to those of vetches and the two can be confused, especially in the early growth stages.

Lentils flower profusely over a short period and set many pods which contain one or two seeds. Because of their indeterminate growth habit it is possible to find flowers, immature pods and mature pods on a plant at the same time.

Seeds are small in comparison with other pulses and are flattened into a characteristic shape similar to a camera lens.

## GROWING REQUIREMENTS

Lentils are best suited to areas receiving between 350 and 600 mm of annual rainfall. In drier or colder areas, lentils may grow too short to be harvested efficiently. Lentils are particularly sensitive to waterlogging. Spring sowing may be an option in some higher rainfall areas with heavier soils.

## Soils

Lentils are suited to well drained, level, loam and clay loam soils of good fertility. They prefer the better deeper wheat growing soils with higher water holding capacity. Avoid soils which are acidic (pH<6.0 in water) or highly alkaline (pH>9.0 in water). Lentils perform poorly on sandy acidic soils.

They are well suited to the alkaline, self -mulching, grey clays (eg the Wimmera). They also grow successfully on loamy sands in the southern Mallee. Acid soils delay nodulation and reduce yields. Effective drainage is essential. Lentils can grow on heavy clays to loamy sand and cope with low fertility, but they are very susceptible to waterlogging, salinity and soils with high boron.

Boron toxic or sodic subsoils can cause plant death and severely limit lentil yields if they occur within the root zone, and can cause major yield variation within a paddock.

## Paddock Selection

Check list for lentil paddock selection:

Is the rainfall greater than 350 mm/year? (Plus good sub-soil moisture retention)	Yes
If the rainfall >550mm, is spring sowing possible?	Yes
Is the soil heavy and deep enough to hold sufficient water to finish the season?	Yes
Is it a friable soil that does not set excessively hard on surface?	Yes
Is soil pH between 6.5 and 9.0 (in water)?	Yes
Is the soil free draining (ie no waterlogging)?	Yes
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Is the paddock flat and can it be rolled for harvesting? (free of sticks, stones and undulations)	Yes
Is the paddock relatively free of problem weeds? (medics, Bifora, Bedstraw , Wild Radish, vetch, tares, self-sown pulses like dun peas, herbicide resistant Ryegrass in particular)	Yes
Has the maximum plant-back period after herbicides been satisfied? (eg sulphonylureas, Lontrel ®, triazines and imidazolinones)	Yes
Will excessive stubble clumps be removed?	Yes

Consideration of likely broad-leaf weeds is essential. Lentils are poor competitors, but a wider range of registered herbicides are becoming available. Weeds such as vetches, tares, Bifora , medics and self-sown peas and beans are often more difficult to be effectively controlled in lentils.

Special attention needs to be paid to stopping seed set of broad-leafed weeds in the years prior to a lentil crop, or choosing paddocks with low broad-leafed weed burdens.

Paddocks with high levels of herbicide resistant Ryegrass should be avoided when choosing paddocks to grow lentils because of the poor relative competitiveness of lentils. However, because lentils are short in height, there is an opportunity for weed wiping to prevent the taller weeds from setting seed. Crop topping to prevent weed seed set can also be effective, but be aware of its limitations and its timing needs. Crop topping lentils too early can cause quality problems with premature ripening. Lentils are later maturing than field peas, and can be indeterminate in late seasons, hence the weeds may need topping before the crop is ready. Lentil paddocks can be variable in their ripening across soil types in the paddock, and in particular in wheel tracks.

Because lentil plants are short (15 to 80 cm) and must be harvested at ground level, choose flat paddocks free of surface stones or sticks which might damage harvesting machinery, and contaminate the seed sample. Soil surface rolling is often essential to aid efficient harvesting.

Lentils are extremely sensitive to some residual herbicides, eg sulphonylurea herbicides (eg Ally ® , Logran ®, Glean ® and Amber Post). Ensure that maximum plant-back periods on the label are observed.

Be aware of herbicide residues and plant-back requirements in the rotation.

For more detailed information on 'Herbicide residues and rotation planning' [click here for herbicide residual brochure](#), or for [GRDC 2007 brochure](#) 'after the drought' (including herbicide residues)

Lentils are also sensitive to many post-sow pre-emergent herbicides. Ensure that greater than 5cm sowing depth is achieved, the correct rate for the soil type is applied, and the correct soil moisture conditions at application exist. The soil surface needs to be level to maximise safety, and avoid the herbicide washing into the furrows left by press wheels with heavy rain.

## PLACE IN ROTATIONS

Well nodulated lentils fix their own nitrogen. They do not input as much nitrogen into the soil through fixation as faba bean, field pea or lupin and are similar to chickpea in that regard. Grass free lentil crops are a disease break for cereal crops. Lentil crops are susceptible to some of the same soil-borne diseases as other pulses. Plan a crop sequence which considers disease, weed control, herbicide residues and tillage practices which might affect ease of harvest.

Lentil plants are poor weed competitors but there are weed control options available. Do not sow them into former vetch paddocks to avoid seed contamination at harvest. Other pulses are easily cleaned from lentil seed. Cereals may be the cause of admixtures but this is less likely because herbicide management of self sown cereals is easier in lentil crops.

Lentils are particularly sensitive to clopyralid and sulfonylurea herbicides. Not all labels include lentils in the plant back details, so extra caution and advice from the manufacturer is recommended after using these herbicides.

## VARIETIES

### Types

There are different types of lentils based on the size and internal colour of seeds. Only two types are currently grown.

**Red lentils**, sometimes known as small or Persian lentils, are the most commonly grown. They are sold split for cooking (Masur dhal). The name red lentil is derived from the red kernel (cotyledon) colour which is exposed when split and the seed coat removed. The seed coat varies from light grey, through brown, to black, and may be speckled. Seed size is generally between 4 and 6 mm in diameter.

**Green lentils**, also known as large or Chilean lentils, are used whole for cooking. The seed coat is green to brown and the internal colour of the seed (cotyledons) is yellow. Seed size generally varies between 4.5 to 8 mm in diameter.

**Niche varieties**, for restaurant and specialist uses are being developed, and over the next few years locally adapted varieties of these types may be grown in small quantities under contract. These niche types being developed include Spanish brown types, French green (verde) types, black seeded ('beluga') types and zero tannin types. Local and export market niches exist or need to be developed.

### Variety attributes and yields

The most widely grown red lentil variety is *Nugget*, but *Digger*, *Aldinga* and *Northfield* are also grown for market or adaptation reasons. Be aware of the necessity to market on a variety basis and variety segregation occurs. Price premiums (eg for *Northfield*, *Aldinga*) and discounts (eg *Aldinga*) have sometimes applied to specific

varieties. *Nipper*, a new red lentil variety with ascochyta and Botrytis Grey Mould resistance will become available in 2008.

*Matilda* is currently the only preferred green lentil variety. *Boomer*, a new green lentil with improved seed size and disease resistance will become available in 2008. *Tiara*, a long season green lentil with very large seed size will become available for spring sowings in high rainfall areas in 2008.

For latest SARDI lentil variety sowing guide [click here](#)

For descriptions on varieties for sowing in Victoria [click DPI sowing guide 2007 update](#) and for 2006 lentil guide [click here](#)

## SOWING

Dry sowing can be used successfully in lentils, providing problem weeds like medic are not going to be an issue.

Lentils are well suited to no-till, reduced tillage and stubble retention systems if sown with the right equipment. Sow into friable soil ensuring good seed-to-soil contact. Direct drilling is often possible following a cereal crop. The smaller seed of lentils when sown at reasonable depth helps ensure good seed-to-soil contact and emergence.

## Seed quality

High quality seed is vital. Lentil seed, like other pulse seeds is susceptible to mechanical damage during harvest. Split seed coats, fractured or broken seeds reduce the germination percentage. Fungal infection of seed can also cause staining which will significantly reduce the value of seed at harvest.

Check the current seed analysis certificate for germination percentage and purity before purchase. Legislation requires that only the minimum germination test must be supplied on the label with certified seed. Be sure to ask for the seed analysis certificate for the seed lot being purchased.

Ascochyta and botrytis grey mould are seed-borne, and can reduce germination and yield. Do not keep seed from severely diseased crops. Have seed tested for its disease status. Avoid using seed with greater than 2% ascochyta infection.

Lentils can be affected by a number of seed-borne virus diseases, including Cucumber Mosaic Virus (CMV) and Alfalfa Mosaic Virus (AMV). If possible, source seed which have tested free of viruses.

For information on disease and health testing of seed, [click here](#)

## Seed inoculation and treatment

Lentils require the same rhizobium as field peas (Group E). Inoculation of lentil seed may not be required on the grey clays of the Wimmera if the paddock has previously grown inoculated field pea, faba bean or lentil crops which were well nodulated. The same may be true of some other soil types. If uncertain about rotation history and practice, inoculate and be sure.

Fungal seed dressing can improve seed emergence, especially in wet winters. If using inoculum and seed dressing, apply the seed dressing first and then inoculate immediately before seeding. Do not mix inoculants and seed dressing together unless the inoculant's label specifies compatibility. New granular and other forms of inoculum becoming available may assist in rhizobial survival, particularly in acid soils or when the pulse is sown dry.





For information on assessing nodulation [click here](#).

## Paddock preparation

Adequate weed control measures must be taken the previous spring and before sowing, particularly with the problem weeds. Sufficient moisture and a level soil surface must be present at application for some soil active broadleaf herbicides to be fully effective and to avoid crop damage.

Sow lentil seed into a friable soil and in a manner that ensures good seed-to-soil contact. The retention of adequate plant residue on the surface is important to protect the soil from erosion both during growth and after harvest. On sloping ground, post emergent rolling may be required to reduce the risk of water erosion.

Excessively large clumps of stubble must be removed otherwise they will cause seed placement and harvesting difficulties. The surface retention of cereal stubble does not affect lentil germination or growth, and can improve establishment on hard setting, surface crusting soils.

Where soils are below a pH of 6.0 in water, lime applications should be considered before growing lentils.

## Sowing rate

Use densities of approximately 100 - 120 plants/m<sup>2</sup>

The sowing rate required for a variety will depend on the germination percentage of the seed and its seed weight. Use the formula:

Seeding rate (kg/ha) = Plant density (plants/m<sup>2</sup>) x 100 seed wt (g) x 10 ÷ Germination percentage

The number of seeds that emerge from the ground is often less than the viable seeds sown due to non vigorous seedlings, disease, herbicide damage or poor soil structure. Based on previous experience this may necessitate an increase in sowing rate.

## Sowing depth

Sow at a depth between 5 and 10cm. Sowing at this depth helps to avoid herbicide damage from pre-emergent herbicides. Lentils emerge faster than other pulses, but growth is slow in winter. If germination coincides with soil temperatures below 5 ° C, complete emergence may take 30 days.

## Sowing time

Time of sowing is critical for lentil disease control, best yields and frost avoidance.

For information on sowing dates in Victoria see 2006 lentil guide [click here](#).

For information on 'Dry sowing of pulses' [click here](#).

## Rolling

This is a management practice carried out post sowing and can be done from pre-emergent to the 4-5 leaf stage of the crop. It is best done with a rubber tyred roller, when soil is moist but not too wet or dry. Its purpose is to flatten any ridges caused by sowing and press any rocks into the soil leaving a flat bed to allow the header comb to pick up the short crop at harvest. This reduces harvest losses, harvester wear and contamination in the seed sample.

If the soil is prone to hard setting, crusting or erosion on sandy or sloping country, rolling may have to be delayed until the crop has emerged. The safest time to roll lentils post emergent is when they are at the (3-5 leaf) stage. Avoid rolling lentils when plants are just starting to emerge as emerging shoots can be broken off. Rolling lentil crops after emergence should be done under warmer conditions when the plants are limp, and not brittle from cold or frosty conditions. Choose an afternoon or a warmer day to minimise any crop damage. Avoid rolling two weeks before or after applying a post-emergent herbicide. Rolling a crop affected by leaf disease may increase the spread of disease within the crop.

## NUTRITION

### Fertilisers

The crop should be self sufficient for nitrogen (see seed inoculation). Rates of 10-20 kg/ha of "starter" nitrogen may be useful on slightly acid soils.

Phosphorus removal is about 4.2 kg per tonne of grain. An application of 50 kg of single superphosphate per hectare for each tonne of grain of a target yield is required to maintain soil P. Using superphosphate also ensures adequate sulphur for the crop.

Lentils may respond to zinc and molybdenum in soils deficient in these trace elements. Use tissue testing kits available from commercial laboratories to monitor the availability of trace elements.

Crop with Confidence, Rural Solutions SA <http://www.ruralsolutions.sa.gov.au>

## WEED MANAGEMENT

Good weed control is essential because lentils grow slowly during winter and are poor competitors with weeds.

Avoid sowing lentils in paddocks with a history of severe broad-leafed weed problems. Vetches, tares, medics, clovers, Wild Radish, Bedstraw, Bifora and self-sown pulses are particularly hard to control. Preventing seed set of broad-leafed weeds in the year prior to growing lentils is important.

It is essential to plan your weed control strategy before sowing. Delaying sowing is an option in most areas except the lower rainfall areas. This can enable several weed kills before sowing. The application of pre-emergent herbicides is also a useful strategy.

Most grass weeds can be controlled either pre-emergent or post-emergent.

Diflufenican products and flumetsulam are registered for post emergent broadleafed weed control in lentils. Some caution is required, particularly with some varieties being more sensitive.



For South Australia, refer to latest *Pulse weed spraying chart* available from Rural Solutions SA Roseworthy Information Centre are: Freecall: 1800 356 446 [www.ruralsolutions.sa.gov.au](http://www.ruralsolutions.sa.gov.au).

## Avoiding herbicide damage

Under adverse conditions, most post sowing, pre emergent herbicides are capable of causing damage in lentils. Even post emergent applications can also cause crop damage in some circumstances. In most cases damage can be attributed to the products solubility and:

- Sowing too shallow
- Applying the herbicides to dry soils followed by heavy rainfall
- Rate too high for the soil type
- Variety susceptibility differences
- Uneven soil surface
- Washing of herbicide into press wheel furrows

To reduce the risks of herbicide damage when using metribuzin or other products PSPE on lentils:

- Sow at 5cm or deeper
- Apply the herbicides to a level soil surface (eg prickle churning)
- Appreciate that rolling after press wheels may not do enough to level out the furrow
- Avoid applying these herbicides post sowing to dry soils
- Choose the right rate for your soil type (lighter soils require lower rates than heavier soils – seek local advice)
- Check variety susceptibilities

## Crop topping

Lentils can be successfully crop topped with Gramoxone ® to control seed set of annual Ryegrass, however care is needed as timing is critical. Ideally, lentils should be crop topped as late as practical to minimise yield reductions, but the growth stage of the grass often determines the timing. They cannot be crop topped too early because grain quality can be affected with green kernels arising from premature ripening. Lentil variety choice based on maturity time can therefore be important. The lentils ideally should have finished flowering and have well formed seeds in the pods before commencing spraying. The lentils should be starting to turn yellow/brown at this time. Beware of coloured foam marker dyes staining lentil seed through the pods.

## Weed wiping

Weed wiping is being successfully used in lentils to prevent weed seed set of herbicide resistant Ryegrass and other tall weeds in the crop. Crop height needs to be a consideration in lentil variety choice.

## DISEASE MANGEMENT

### Ascochyta blight (*Ascochyta lentis*)

Ascochyta blight is the most serious disease of lentils in Australia . Most commerical varieties are unlikely to have significant yield losses due to ascochyta blight. However, ascochyta blight does infect lentil seed, causing a discolouration of grain, which will significantly reduce its market value.

#### Symptoms of foliar infection

The disease appears as round whitish lesions with a brown margin On leaves and pods. Black fruiting bodies in the lesions identify the problem as disease and not spots caused by herbicide damage. Severe infections cause leaf yellowing. Tips of stems wilt, turn brown and die. Pod infection spreads to the seeds which turn purple-brown and shrivel in whole or part.

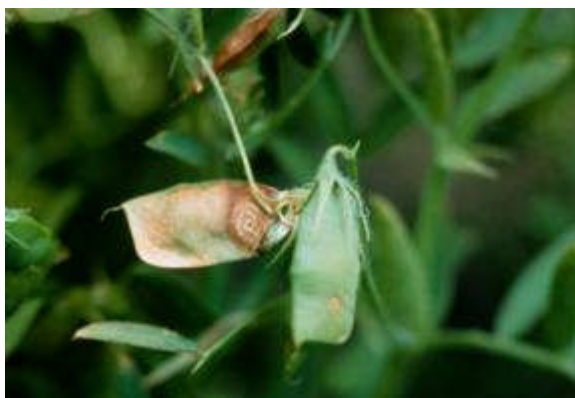
#### Disease Cycle

Ascochyta blight can be both seed and stubble borne. Wind borne spores from Infected lentil stubbles can blow into adjacent paddocks and infect new lentil crops. Infection can occur at any stage of plant growth, but is more significant later in the season during late flowering and pod fill. Wet weather favours disease development and spreads spores within crops by rain splash. This spreads infection onto new crop growth, including pods.

#### Control

Prevent disease by using disease free seed (seed tests are available), and sowing into areas free of infected lentil stubble. Fungicidal seed dressings help control seed infection. Destruction of stubble by burning, cultivation or grazing helps to minimise disease carry-over between seasons. Delay sowing until early June, early sowing increases the exposure time of the crop to the disease. The variety Northfield is the only current commercial variety resistant to seed infection by ascochyta. In other varieties Strategic fungicide sprays may become a part of management during flowering and pod fill.

The ascochyta blights of field pea, chick pea and faba bean are specific to those crops and will not cause ascochyta blight on lentils.



Ascochyta infection on pods.



Ascochyta lesion on leaf, note small, black pycnidial fruiting bodies in the centre of the lesion.

### Botrytis grey mould (*Botrytis spp*)

Botrytis grey mould infects lentil seed but more importantly can cause crop devastation in wet years. A dense crop, lodging, and rain in late spring provide ideal conditions for the disease.



## Symptoms of stem and pod rot

All above ground plant parts can be affected by grey mould (*Botrytis fabae* and *B. cinerea*). Lesions on leaves and pods are initially dark green, but turn greyish-brown as they age. Grey mould also develops on flowers. If the canopy is wet for long periods, the pathogen grows on to the stems, which quickly become covered with a fuzzy layer of grey mould. When the weather turns dry, clouds of spores are released into the air when plants are disturbed. Severely infected leaves, flowers and pods wilt, and fall to the ground. If wet conditions continue the stems become girdled with spreading patches of brown within the crop and dying plants are seen.

## Symptoms of seedling blight

Seed from severely infected crops is often discoloured and shrivelled. If infected seed is used for planting, plant establishment is usually poor, due to low germination and increased seedling blight. Blighted seedlings emerge, but are yellow, stunted, and usually die after one or two weeks. If germination takes place under wet conditions, mycelium from infected seedlings can grow through the soil to neighbouring plants, leaving patches of blighted and dying plants in the field. When grey mould-infected seedlings are pulled up, grey mycelium can often be found on the stems just under the soil.

## Disease cycle

The fungus that causes grey mould is always present to some extent on pulse crop residues, especially chickpea and faba bean. Airborne spores are released from old infected crop residues early in the season that infect new crops. Grey mould can infect lentils at any time during the growing season, but epidemics generally develop late, after the plant canopy has closed. Periods of high humidity in spring favour the rapid development of the disease. The fungus may establish a foothold on senesced plant parts, or on tissues damaged by hail, wind and machinery. It can also attack healthy plants, and has a broad host-range that includes faba bean, vetch, chickpea, field pea, and lucerne,. Flowers and pods are particularly sensitive to grey mould infection, reducing pod set and seed quality. After harvest, the fungus survives as mycelium on plant residues, and as sclerotia (long-lived survival structures) in the soil.

## Control

Prevention of seedling blight requires disease free seed. Seed treatment with thiram and thiabendazole combined, or thiram will control most, but not all, botrytis infection.

Follow recommended sowing times and sowing rates for your district. Crop canopy management is a key component of controlling botrytis grey mould. Crops with excessive vegetative growth are prone to infection and losses due to botrytis infection. Airflow through the crop canopy will reduce humidity and severity of the disease.

Foliar fungicides need to be applied prior to canopy closure to prevent grey mould becoming established in a crop. Fungicides should be considered in crops that are at a greater risk from grey mould.

All lentil cultivars are susceptible to grey mould, but Northfield , Cobber, Matilda and Aldinga are particularly so. Susceptibility is enhanced by lush growth that provides a humid microclimate.

Lentils should not be grown in paddocks recently infected by grey mould in chickpea or lentil, or by chocolate spot in faba bean. Grey mould is both seed and stubble borne. Later sowing and reduced seeding rates will reduce crop canopy density.



Leaves infected with botrytis



Botrytis infected stem, note fuzzy layer of grey mould on infected tissue

### Lentil disease guide and management summary

Disease	Organism	Symptoms	Occurrence	Hosts	Control
Ascochyta blight	<i>Ascochyta lentis</i>	On leaves, small round whitish lesions with brown margins. Lesions often containing small black fruiting bodies of the fungus. Lesions can also form on stems causing premature death. Pod infection can ultimately result in black discolourations on seed.	Common in all lentil growing regions in southern Australia . All varieties except Northfield are at risk of seed infection by ascochyta blight.  Damage is most likely in wet seasons.	Lentils – seed, stubble and self sown plants.	Seed dressings.  Resistant varieties.  Foliar fungicides.  Crop rotation.  Avoid early sowing.
Botrytis grey mould	<i>Botrytis spp.</i>	Leaves: White round lesions/spots without black fruiting bodies as in ascochyta blight.  Stems: Light brown sections form on stems that are covered with fluffy grey mould. Botrytis grey mould can cause branches to die and cause discoloured and shrivelled seed.  In severe cases large brown patches can form in the crop.	Most likely to occur in dense, lodged crops when there is frequent rain late in spring.	Most legumes.	Seed dressings.  Low plant density.  Avoid early sowing.  Crop rotation.  Resistant varieties.

## Viruses

For information on how to minimize viruses in pulses and control of their transmission by aphids and other vectors, [click here](#). For more information on specific viruses, for Bean Leaf Roll Virus (BLRV) [click here](#) for more information. For Alfalfa Mosaic Virus (AMV), [click here](#). For Cucumber Mosaic Virus (CMV), [click here](#) For Bean Yellow Mosaic Virus (BYMV), [click here](#)

## Disease information



"Lentil disease management strategy for southern region GRDC" [click here](#)

and for 2007 updated tables, [click here](#).

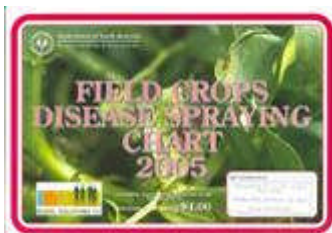


For information on 'Pulse seed treatment and foliar fungicides' [click here](#)

For the latest information on permits and registrations in pulses visit the Pulse Australia site at <http://www.pulseaus.com.au> or

<http://services.apvma.gov.au/PubcrisWebClient> (registrations)

<http://www.apvma.gov.au/permits/permits.shtml> (permits)



For South Australia, refer to latest *Field crops disease spraying chart*. Available for purchase from Rural Solutions SA Roseworthy Information Centre are: Freecall: 1800 356 446 [www.ruralsolutions.sa.gov.au](http://www.ruralsolutions.sa.gov.au).

## INSECT PESTS

### Establishment pests: Red legged earth mite (RLEM) (*Halotydeus destructor*) and Blue Oat Mite (BOM) (*Penthaleus major*).

Damaged leaves have a rasped silvery appearance, turn brown and shrivel. Damage is most severe when cold, wet or dry conditions slow seedling growth.

Strategic prevention may involve foliar spraying in the previous spring. Clean cultivation in autumn and attention to weeds on fence lines is also essential. If possible keep a distance from paddocks of the species preferred by mites - pulses, pasture legumes, oilseeds and Capeweed.

Use of a registered, bare earth insecticide post sowing, will protect germinating seedlings when most vulnerable. Seed treatments work best when mites are active during germination yet numbers are not too high.

Monitor young crops weekly. Inspect plants in 0.5 m of crop row at 10 different sites within the crop. Weather conditions affect mite activity. If weather is fine estimate the numbers per leaf, if cold and cloudy estimate the numbers per 100 cm<sup>2</sup> (10 cm x 10 cm) around the base of the plants. Repeat this at 10 sites within the crop. Mite damage is typically greater around the edge of paddocks, where there is higher pressure from mites invading from outside the paddock. An average of 50 mites per area warrants spraying.

### Establishment pest: Lucerne Flea (*Sminthurus viridis*)

A small, wingless, light green, flea-like insect which jumps when disturbed. Symptoms of damage are a "window pane" hole or ragged leaf edges. The host species for flea is similar to that for RLEM. Sub clover and lucerne are also preferred hosts. Control of flea is similar to that for RLEM.

Crops should be monitored regularly, at least weekly, for signs of damage. If Lucerne Flea is suspected, look for the presence/absence of damage on 10 plants, repeat at 5 sites. An average of 10 or more holes per leaf may warrant control.

### Flowering and podding pest: Native Budworm (*Helicoverpa punctigera*)

Native Budworm moths migrate into Victoria from inland Australia in spring. Female moths lay eggs on leaves, stems, flowers or pods. Significant damage is caused by large larvae (more than 1cm long) burrowing into pods and feeding on developing grain.

Budworm larvae can be many colours but all have a dark line down the centre of the back and a pale broad stripe along each side of the body. The skin appears bumpy. Stiff, short black hairs are usually evident along the body.

Weekly monitoring to detect larvae should begin at flowering. Increase to twice weekly from early podding or from when moth activity has peaked. Sweep with a 38 cm net 10 times in at least five different areas of crop. Spray when five or more larvae are collected in 10 sweeps. Delay spraying until the majority are about one cm long, Spraying too early increases the risk of a second population developing before harvest. Do not delay too long. Larger caterpillars require higher rates of insecticide and are the ones which bore into pods.

Crops that have lodged cannot be swept effectively. In lodged crops, shake half a metre of row vigorously over a white tray or Fertiliser bag. Repeat 5-10 times. Control is warranted if an average of one larvae per metre of row is detected. For more information [click here](#).

For information on lesser budworm (*Heliiothis punctifera*), [click here](#)

## Flowering and podding pest: Lucerne Seed Web Moth (*Etiella behrii*)

The larvae bore into pods and mature there. When fully fed they exit to pupate in the soil. Controlling larvae is difficult as they remain inside the pods and are protected from sprays.

Management involves controlling the moths before they lay eggs. The slender bodied moth has a distinct beak. The wings are grey with a white streak along the front and a yellow band near the base. The wingspan is approximately 2 cm. For more detailed information, [click either here](#) or else [here](#) for a detailed brochure on monitoring, flight prediction model and controls, or [click here](#) for other information.

## Snails

*“Bash ‘Em, Burn ‘Em, Bait ‘Em: Integrated snail management in crops and pastures”*. This colour manual produced by SARDI contains information about snail lifecycle and habits as well as practical guidelines on preventing grain contamination, harvester modifications and cleaning options. It includes a section on the fly biocontrol agent being released in S.A.



Available from the Roseworthy information centre on 1800 356 446 and costs \$20 (GST inclusive) plus \$5 postage and handling. See also [more information](#)



Guide to the key pests of Pulses [click here](#).



For south Australia, refer to latest *Insect spraying chart field crops and pastures* Available for purchase from Rural Solutions SA Roseworthy Information Centre are: Freecall: 1800 356 446 [www.ruralsolutions.sa.gov.au](http://www.ruralsolutions.sa.gov.au)

## HARVESTING

Lentils can be challenging at harvest with possible lodging and a relatively low crop height, varying from 15 to 50 cm, depending on time of sowing, soil, seasonal conditions. Machinery modifications and early harvesting have improved the efficiency of harvest now. All except very short crops will show some lodging at maturity, but some varieties are more erect than others. Pods may develop at all levels of the crop, and ripening can be uneven if the season is extended. Crop topping or desiccation can ensure uniform ripening of the crop.



## Timing

Monitor crops regularly when close to harvest. Lentils ripen unevenly and current varieties are short and tend to lodge. The seed that develops from the first flowers (those lowest on the plant) will mature before seed from the later flowers. Some foliage may still be green when the crop is ready to harvest. Harvest when the lower pods have turned pale brown in colour and the seeds rattle in the pods. Seed moisture content of 15% is satisfactory, although seed needs to be at 12 or 13% for safe storage.

Crops that remain upright at maturity are more prone to pod drop during windy conditions, so early harvest is essential to capture the yield produced.

Crop desiccation may assist uniform, quick ripening or dry late infestations of weeds. The desiccant should be applied when fifty percent of the crop has turned colour. Harvest before the crop becomes brittle.

Timing harvest as early as possible is extremely important, and attention to timeliness and efficient harvesting is profitable as harvest losses in lentils can be considerable. Losses of more than 800 kg per ha have been measured in commercial paddocks. Late rains or severe winds that flatten crops do play a part in harvest and quality losses. Appropriate variety selection, paddock choice, having a harvester front that can be set low enough to pick up maximum numbers of pods all help.

Often the difference between a crop that is easy to reap and one that is more difficult is 2 to 5 days (because of lodging). This reinforces the importance of reaping lentils as soon as they are ready.

## Harvester settings

Conventional machinery can be used for harvesting, but it is necessary to cut at ground level to get the crop into the comb. Floating or flexible cutter bars are a distinct advantage, and blowers or a vortex reel enable lentils to be harvested lower to the ground and ensure good crop feed. Thinner, shorter or lodged crops are more challenging, and harvest direction may have to be one-way. An extended cutter bar table and air assistance will also be of value in reducing harvest losses. Axial or rotary harvest drums cause much less seed damage. Harvesting with an open-front machine (with crop lifters) is possible. Some closed-front machines can be used with moderate success if they can harvest low enough and some fingers are removed.

Direct head at the minimum drum speed. Lentils thresh readily. Try a concave setting fully open at the front, and half closed at the back. Lentil seed is heavy compared with stem and leaf trash, so it is safe to use draft to remove trash.

## Harvesting for quality

Seed quality is the ultimate issue as lentil seed is predominantly for human consumption. Buyers of green lentil do not want chipped, cracked or de-hulled seeds. The larger seed of the green lentil make them prone to mechanical damage. Seed damage and losses during harvest can be minimised by harvesting early morning and by a combination of low drum speed and a wide concave clearance.

To service the human food market it is necessary to produce a quality sample without cracking, staining or insect damage. Visual appearance is everything in marketing. Early harvest is important for quality reasons, as well as more efficient harvesting and to avoid crop losses.

Lentils can be delivered at up to 14% moisture content where aeration is possible, aiding early harvest. Lentils are ready to harvest when nearly all the pods are brown and dry with seeds rattling within them. At this stage, lentil plants in the wheel marks and many lentil stalks may still be green. Timing generally coincides with harvesting of barley crops.

Harvesting early, when some seeds and pods are still green is preferable to delaying until all seeds are dry. This avoids pod drop and shattering of the early pods and excessive lodging, but may necessitate the aeration of the harvested grain. The risk of ascochyta spoilage of seed increases with delayed harvest.

Lentils are often better reaped up and back in the one direction, rather than around the paddock. The “frustration factor” of growers harvesting lentils is an issue, but the high value of lentils well justifies spending a little more time and effort.

## Windrowing

Windrowing of lentil crops for uniform ripening and earlier harvest has generally been considered impractical because the lentil windrows often lack bulk, are difficult to pick up from the bare ground, and tend to be blown around in strong winds when left to dry down. However, some growers have had success in placing wide swathes into a bulkier windrow and using a ‘cotton wheel roller’ to compact the windrow. Windrowing has also been successful when it is done directly in front of the harvester. This can aid the harvesting of short crops or reduce snail contamination in the sample, but does not assist uniform and early crop ripening.



For more information on ‘Windrowing and desiccation of pulses’ GRDC Hi-Grain update 2003, [click here](#)

For information on maximising lentil quality at harvest, [click here](#).

## Desiccation

Chemical desiccation of lentils is sometimes necessary to ensure even maturity for harvest or to ‘brown off’ late weed infestations to improve the ease of harvest. To reduce yield and quality loss when desiccating it is best to apply desiccants when over 90% of pods are mature.

## Storage and handling

The moisture content of grain being stored on farm for seed should be no more than 13% to discourage mould growth and insect infestation. If the moisture content of harvested grain is too high, aerated storage will prevent spoilage. Alternatively moving the grain from one silo to another on a warm dry day can reduce moisture content by 1 to 2 percent.

Lentil seeds are more prone to mechanical damage than most other pulses. Keep handling to a minimum, particularly when using screw augers.

Damage to silo side walls and even collapse can occur when emptying silos with stored lentils. Growers are advised to store lentils in field bin type silos only (those with low walls) or only partially fill taller silos. It is also advised that lentils are unloaded slowly in smaller amounts than other crops.

Good grain hygiene is important with lentils. Contaminants such as insects, other grains, animal excreta, rodent carcasses etc. are undesirable in lentils. Cereal grains are particularly difficult to clean out of lentils so must be removed in crop. Harvesters, grain handling equipment and storage bins should be cleaned prior to harvesting lentils. Vetch contamination must be minimised.

## Harvesting for seed

Select an area as free as possible from diseases, pests and weeds. Ensure that headers, bins, augers and other equipment are free of cereal contamination as these grains are hard to remove during cleaning.

## Handling and storage

Keep handling to a minimum, particularly when using screw augers which tend to grind seed. Lentils are more prone to mechanical damage than seeds of field peas, faba beans, lupins and chickpeas.

The moisture content of stored seed should be no more than 13%. If moisture in the harvested seed is too high, aeration in storage will prevent spoilage, particularly during the first two weeks after harvest. Moving the grain on a warm, dry day by transferring it from one silo to another is a means of reducing the moisture content by 1-2%.

## MARKETING

### Commercial buying and selling arrangements (current as of May 2007)

Variety	Commercial Partner/Licensee	Royalty	Market restrictions
Northfield <sup>(1)</sup>	AFCA	Seed	None, but PBR so no farmer to farmer trading
Aldinga#	AFCA	None	None
Cassab#	Agracorp* (see note below)/ABB grain(exTLC)/Aust Grain Export Pty Ltd/PeaCo	None	None now
Cobber#	ABB grain (ex TLC)	End Point	no longer "closed loop" 2006
Digger#	ABB grain (ex TLC)	End Point	No longer "closed loop" 2006
Matilda#	ABB grain (ex TLC)	End Point	No longer "closed loop" 2006
Nugget#	PlantTech Pty Ltd	End Point	Under contract, multiple buyers
Nipper#	AWB Seeds	End Point	Under contract, multiple buyers
Boomer#	AWB Seeds	End Point	Under contract, multiple buyers
Tiara#	AWB Seeds	End Point	Under contract, multiple buyers

\* NOTE Wimmera Grain Company is the AgraCorp commercial contact in Victoria.

A Northfield is the only variety listed above to have PBR protection and therefore seed of this variety cannot be sold, traded or given away, nor can it be 'traded over the fence' without authorisation of the owners or licensee.

# These varieties are not subject to PBR but have a number of different types of royalty/marketing arrangements associated with the growing of these varieties. Farmers choosing to buy a lentil seed should check the royalty/marketing arrangements for that variety with the seed agent.

For more detailed PBR information [click here](#)

**For an up to date list of Lentil traders and their contact details visit the Pulse Australia website**

<http://www.pulseaus.com.au/crops/lentils> This website also has production and price estimates for most pulse crops.

## Prices and markets

Red lentil prices have ranged from \$400 to \$550 per tonne. A realistic budgeting price is between \$350 to \$400 per tonne delivered, but the product must meet receival standards. Some varieties like Northfield have sometimes had a price premium while others like Aldinga have had a price discount. Variety price differences can vary from season to season, and are based on supply and demand. Variable costs of production are about \$160 to \$240 per ha depending on the inputs used.

Australian lentils are exported to over 40 overseas countries including India , Pakistan , Egypt , Spain , Mauritius and France . Turkey has been the major exporter of red lentils, providing a major proportion of world supply. Canada , traditionally a green lentil producer, also produces red lentils and is a major competitor in world markets. Canada , USA , and New Zealand are the main exporters of green lentils.

For Australia to expand its market share, growers and processors need to pay particular attention to the production of high quality lentils which will compete favourably with our overseas competitors.

## Receival standards

The national receival standards for lentils are set by the pulse industry by Pulse Australia, and reflect the market requirements for a quality food product. Varieties are segregated with only 1% off-type varieties allowed. Delivery requires low discolouration or staining of grain seed coat (1% maximum) and lentil kernel (maximum 1% poor colour), as well as low insect damage and breakages (defectives 3% maximum) and minimal foreign material or impurities (3% maximum). Sizing through round and slotted screens may also occur. Failure to achieve these receival standards may mean price discounts, re-cleaning or market rejection if severe.

	Maximum moisture content (%)	Minimum purity (%)	Maximum defective plus poor colour (%)	Screen size for defective (mm)	Poor colour maximum (%)	Foreign material maximum in total (%)
<b>Red lentil receival standard</b>	14	97	4	2.00 or 2.2 slotted	1 seed coat 1 kernel	3
<b>Green lentil receival standard</b>	14	97	4	2.00 slotted	1 seed coat 1 kernel	3
	<b>Unmillable material maximum</b>	<b>Snail maximum</b>	<b>Insect maximum</b>	<b>Nominated weed seed maximums (maximums for each type)</b>		
<b>Red lentil receival standard</b>	0.5 (0.3% soil)	1 per 200g	15 per 200g	See footnote for weeds and amounts allowable		
<b>Green lentil receival standard</b>	0.5 (0.3% soil)	2 per 400g	30 per 400g	See footnote for weeds and amounts allowable		

### Definitions:

*Defective grains:* includes poor coloured grains, broken, damaged and split, shrivelled, distorted, grub eaten, sprouted and affected by field mould.

*Poor colour:* if cotyledon is distinctly blemished and/or off colour from the characteristic yellow colour of the predominate class, including the 1% visible ascochyta.

*Foreign material:* includes unmillable material and all foreign vegetable matter (includes cereals, Wild Oats, oilseeds, other legumes and weed seeds not otherwise specified).

*Unmillable material:* includes soil, stones, metal and non-vegetable matter .

***Nominated foreign weed examples:***

Type 1 (4 per 200g): three -cornered jack

Type 2: (nil per 200g): wild garlic, coriander and any other tainting agents.

Type 3a (1 per 200g in total): Bathurst burr, caltrop.

Type 3b (2 per 200g total): vetches (tares).

Type 3c (4 per 200g total): heliotrope.

Type 4a (10 per 200g total): cut leaf mignonette, melilotus (if no taint ) nightshades, skeleton weed, variegated thistle,.

Type 5 (20 per 200g in total): knapweed, salvation jane

Type 6 (5 seeds/5 pods total per 200g) medic pods, marshmallow pods, saffron thistle, wild radish pods

Type 7a (10 seeds per 200g total): other pulses.

Type 7b (10 seeds per 200g total): cereals, turnip weed, bindweed.

Type 7c (1 seed in total per 200g): safflower, sunflower.

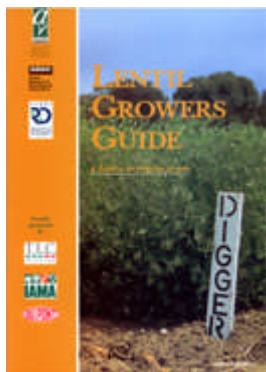
Type 8 (100 seeds per 200g): bellvine.

Small foreign seeds (0.6% by weight): amsinkia, canola, charlock, marshmallow seeds, hedge mustard, etc.

See pulse receival and export standards at [www.pulseaus.com.au/standards/](http://www.pulseaus.com.au/standards/)

## FURTHER INFORMATION

Grain Legume Handbook and its 2006 updates. (The Grain Legume Handbook Committee)



Carter J, Materne M (1997) *Lentil Growers Guide: A guide for the production of lentils* (2 nd ed) (Agriculture Victoria – Horsham)

Topcrop Lentil Paddock recording card, [click here](#)

To identify early growth stages in vetch, [click here](#)





*Pulse & Canola - Frost Identification: The back pocket guide (Bulletin 4401)* (TOPCROP Australia, Grains Research and Development Corporation) Free from some local DPI offices or Ground Cover Direct Free phone 1800110044 fax 1800009988.



Wurst M. et al (2002) *Winter Pulse Disorders: The ute guide* (Primary Industries and Resources SA) For sale through some local DPI offices and Ground Cover Direct Free phone 1800110044 fax 1800009988.

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