CHOOSING BREAK CROPS FACT SHEET

GRDC Grains Research & Development Corporation

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SOUTHERN REGION

Making the break – the deciding factors

There is good evidence to support the value of including break crops in the rotation but deciding what to grow and how much is not simple – you might want to phone a friend.

KEY POINTS

- A break crop is any crop used to provide diversity to help reduce disease, weed and pest levels in a paddock.
- Choice of break crop type is determined by soil type and regional climate; crop sequence is determined by market and agronomic factors.
- Sourcing regional information from agronomists, consultants, farming systems trials, other farmers and industry bodies is essential when selecting the most suitable crop type and varieties.
- Break crops are especially important in soil management and the application of integrated disease, pest and weed management. They provide the opportunity to use alternative control options and at different timings.

PHOTO: EMMA LEONARD

Introducing oilseed or pulse crops into the rotation can help spread market risk and can offer benefits in terms of disease and weed control; nutrient supply; water use efficiency; and improving soil health and biology.

Overview

In the past decade many growers have tightened their rotation, with continuous wheat or cereals being common, especially in drier regions. While growing continuous cereals might seem initially to be the best, easiest or safest option, over time this can lead to production limitations.

Many factors including poor cereal prices are encouraging growers to review their break crop options. Newer pulse and oilseed varieties, improved farming systems and better production knowledge are now also assisting the adoption of break crops. Varieties are now suited to specific regions and have better disease resistance profiles. Also, disease control strategies are better understood.

Introducing a broadleaf crop, either a pulse or an oilseed, can help spread market risk and can offer benefits in terms of disease and weed control, nutrient supply, water use efficiency and improving soil health and biology. Yet, selecting a break crop is not a simple task as many of these factors interact across the crop sequence.

When making break crop choices there are two sides to the decision – the short versus long-term economic issues and the agronomic limitations that the introduction of the break aims to alleviate. Latest research has identified that break crop choice and the specific varieties chosen need to take into account their optimum sowing date in relation to the timing of the opening rain.

What grows where

Climate and soil type determine which crops can be considered in a rotation but do not generally influence the sequence of crop types grown (Table 1).

Varieties may differ in their tolerance to some factors, for example frost tolerance is generally linked to flowering date and duration of flowering. How early a crop is sown will also impact on frost and temperature interactions.

TABLE 1 SOIL AND CLIMATE REQUIREMENTS FOR OILSEED AND PULSE CROPS SUITED TO THE SOUTHERN REGION OF AUSTRALIA.

CROP	SOIL						CLIMATE				OTHER ISSUES
	Type				Optimum pH	Intolerances	Annual rainfall (mm)	Cold	Heat	Frost	
	Clay	Loam	Sand	Light Sand							
OILSEEDS											
Canola	E	E	E	E	4.6–8.5	Compaction, crusting, waterlogging	450–700				Avoid deep sowing
Brassica juncea	E	E	E	E	>5.0	Residual herbicides, soil compaction, crusting, waterlogging	450–750				Avoid deep sowing
Linseed	E	E	P	VP	4.5–7.5	Waterlogging, iron deficiency	450–750	P	–	P – at flowering	
Soybean	E	G	G	–	4.5–8.5	Waterlogging, hard setting soil not ideal	450–750 and irrigation	Adapted to warm or hot conditions	G	G – for light frosts	
Safflower	E	E	P	VP	>7.0	Waterlogging	450 and irrigation	G	G – as long as moisture is available except at stem elongations	G – late summer rain	
PULSES											
Faba bean	E	E	P	VP	6.5–9.0	Hard pans, moisture stress	300–750	F – pod set poor if <10°C at flowering	P – flowers abort >27°C	F – frost at pod set	
Broad bean	E	E	P	VP	6.5–9.0	Hard pans, moisture stress, sands	450–750	F – pod set poor if <10°C at flowering	P – flowers abort >27°C	F – frost at pod set	
Desi chickpea	E	E	F	P	6.0–9.0	Waterlogging, residual herbicides, shallow soils	350–600	P – pod set poor if <15°C at flowering	F – flowers abort >37°C	P – frost at pod set	
Kabuli chickpea	E	E	F	P	6.0–9.0	Waterlogging, residual herbicides, shallow soils	425- 600	P – pod set poor if <15°C at flowering	F – flowers abort >37°C	P – frost at pod set	
Lentil	G	G	F	P	6.5–9.0	Waterlogging, boron, sodic subsoils, residual herbicides	350–650	P-F – pod set poor if <10oC at flowering	P – flowers abort >27°C	P – at flowering	
Narrow leaf lupin	F	E	E	G	4.0-7.0	Free lime, heavy soils, wet duplex soils	300-750	P-F – pod set	P – flowers abort >27°C	F – frost on pods	
Albus lupin	E	E	P	VP	4.5–7.5	Waterlogging, free lime	400–750	P-F – pod set	P – flowers abort >27°C	F – frost on pods	
Field pea	E	E	F	P	6.0–9.0	Wet soils, residual herbicides	300–650	F – at pod set	P – flowers abort >27°C	VP – frost on pods	
Mungbean	E	G	G	–	4.5–8.5	Soil not ideal	Irrigation				
Vetch	E	E	F	F	5.5–9.0	Waterlogging	250–750	F – at pod set	M – flowers abort >3°C	VP – frost on pods	

E=excellent, G=good, F=fair, P=poor, VP=very poor

SOURCE: Based on information originally published in the Grain Legume Handbook, Pulse Australia publications and Ute Guides

PHOTO: EMMA LEONARD

Broadleaf break crops enable herbicides with different modes of action to be used and weeds to be controlled at different times in the rotation.

Economic issues

Availability of markets and overall profitability of a break crop must be considered. However, crop choice based purely on economic return of the break crop fails to account for the value the break can bring to the whole crop sequence.

CSIRO Plant Industry evaluated data from published experiments in the Southern and Western Regions on the additional yield of wheat following an oilseed, pulse or alternative cereal. Considerable differences in the value of the break were reported. For a 4 tonne per hectare wheat crop the additional yield after an oat break crop was 0.47t/ha, after canola or linseed 0.85t/ha, and after pulses between 1.81t/ha for lupin and 1.10t/ha for field pea.

This data was used to propose the reasons for yield increase. It suggested that residual nitrogen after legumes and the control of take-all were the largest benefits of break crops.

The use of break crops broadens the range of herbicide options available, enabling herbicide mode of action to be more easily rotated. The use of herbicides from different modes of action groups is important in managing herbicide resistance.

Introducing a new crop can require capital investment in equipment and storage, or at least access to a contractor. For example, canola generally needs to be windrowed to achieve even-ripening and minimise seed loss from pod shatter.

Ultimately the choice of break crop will relate to cropping system requirements and to an individual's needs and attitude to risk.

Agronomic limitations

Break crops generally refer to a pulse or oilseed crop grown instead of cereals. However, with the increase in continuous cropping the interactions across the whole crop sequence needs to be considered, many of which are discussed in this fact sheet.

Irrespective of which crop is grown as a break, good crop agronomy is essential. Weed control is especially important as weeds can diminish the value of a break by providing a disease host, using nutrients and water and providing carry-over seedset. For example, in lighter soils research has found that weeds and volunteer cereals growing over summer can reduce subsequent wheat yields by 50 per cent.

When growing new crops local agronomists, farming systems groups and industry projects and organisations such as the Australian Oilseeds Federation and Pulse Australia can provide agronomy information and support (see Useful resources).

Disease

The value of a disease break to subsequent wheat or cereal crops will depend on:

- the disease threat created by previous crops;
- the disease host status of the break crop; and
- the availability and economics of control options.

Knowing which diseases can be transferred between crops by soil, stubble, flying insects or wind is essential when selecting break crops.

Controlling the green bridge before sowing and keeping break crops weed free is vital if disease and pest transmission between seasons is to be minimised.

Soil and crown-borne disease

Take-all and crown rot – breakcrops are particularly valuable for the control of take-all and crown rot in cereals. Currently there are minimal varietal or chemical controls for these diseases.

Cereal cyst nematode (CCN) – pulses and oilseeds provide a break for CCN, providing these crops are kept grass free.

Pythium – break crops are generally not considered a control option for diseases with a wide host range, such as Pythium. However, recent research has shown that Pythium root rot increases under canola and pulse crops but declines under cereal crops, despite being hosted by all crops.

Pratylenchus – canola, mustard and chickpea, together with wheat, are susceptible to the most common root lesion nematode, P. neglectus. Field pea, narrow leaf-lupin, faba bean, lentil and safflower are resistant to P. neglectus offering a break crop option to control this nematode.

Rhizoctonia – this root disease has a wide host range of crops and weeds; controlling the growing weeds well before sowing plus soil disturbance rather than rotation remain the primary control options.

A PreDicta B™ soil test of DNA can help identify the key disease pathogens present in a paddock.

Disease spread by wind and insect vectors

Decaying stubble of a previously infected crop is an important source of disease for following crops sown into that and neighbouring paddocks. For many crops and diseases a minimum time period and distance between consecutive crops has been established (Table 2).

Generally, foliar diseases attack specific crops or types of crop. Ascocyhta blight can attack various crops but the species differ. For example, only *Aschochyta rabei* infects chickpeas. Conversely, grey mould, *Botrytis cinerea*, is a destructive disease of lentils but can also cause damage in faba beans, chickpeas and vetch (Table 3).

Sclerotinia stem rot is an intermittent disease in some canola growing districts but it has a wide host range across broadleaved species including chickpeas, lupins, sunflowers and capeweed. Host crops should not be grown in succession in a rotation

Blackleg, the most important disease of canola also attacks other brassica crops including *Brassica juncea*, mustard and forage brassicas.

Viruses are often transmitted by aphids but some can also be transmitted by infected seed, for example, cucumber mosaic virus in lupin. Many viruses can infect a range of crop types. For example, green peach aphids feed on lupins, canola and some pulses and spread cucumber mosaic virus in pulses and beet western yellows virus in canola and pulses.

TABLE 2 ROTATION REQUIREMENTS FOR COMMON BREAK CROPS TO MINIMISE DISEASE CARRY OVER WITHIN AND BETWEEN PADDOCKS AND TO PREVENT CONTAMINATION BETWEEN VARIETIES

Crop	Maximum crop frequency (years)	Main disease affecting crop intensity	Distance from last year's stubble and self-sown seedlings of that crop, or similar crop type for the main airborne diseases	Distance from a different variety of same crop
OILSEEDS				
Canola	1 in 4	Blackleg	500m	Minimum of 5m from all commercial crops of non-GM canola
Brassica juncea	1 in 4	Blackleg	500m	
Linseed	1 in 3	Fusarium wilt		
Soybean	1 in 1 rotated with a winter cereal	Phytophthora, sclerotinia, black leaf blight, rust		
Safflower	1 in 3	Phytophthora, Alternaria, Sclerotinia		
PULSES				
Bean	1 in 5	Ascochyta, cercospora	500m (chocolate spot)	400m (out-crossing)
Chickpea	1 in 4	Ascochyta, botrytis grey mould	500m (ascochyta)	–
Field pea	1 in 5	Blackspot	500m	–
Lentil	1 in 3	Ascochyta	500m (botrytis grey mould)	–
Lupin – narrow leaf	1 in 3	Pleiochaeta root rot, brown leaf spot	100m (anthracnose)	500m (anthracnose)
Lupin – albus	1 in 3	Pleiochaeta root rot, brown leaf spot	500m (anthracnose)	500m (anthracnose) 2km (bitterness alkaloids), 400m (out-crossing)
Mungbean	1 in 1 rotated with a winter cereal	Tan spot, halo blights		
Vetch	1 in 3	Botrytis grey mould, ascochyta	500m (botrytis grey mould)	400m (out-crossing between forage varieties)

Note: information sourced from various trials funded by GRDC and industry.

Weeds

With the increase in herbicide resistance, weed control has become the driver of many crop sequences. Issues that need to be considered when selecting break crops for weed control are:

- the type and intensity of weeds anticipated;
- which herbicide or herbicide group can control these weeds;
- if the rotation broadens the range of herbicide modes of action (groups) that can be used for weed control;
- how competitive the break crop is (Table 4); and
- will the herbicides used create residual problems for future crops.

Previous herbicide history must be considered in relation to crop sensitivity to any herbicide residues. Some herbicides used in pulse crops have plant back periods ranging from nine months (simazine), 24 months (flumetsulam) to 34 months (imazethapyr) restricting crop options and preventing canola from being sown for up to three years.

Up-to-date information on the minimum re-cropping interval for pulses and canola for key herbicides in different soil types is found in the Pulse Australia Bulletin – Residual herbicides and weed control (www.pulseaus.com.au).

Information on crop tolerances to specific herbicides is found on the National Variety Trails website (see Useful resources).

Break crops provide the opportunity to use alternative herbicide groups or methods to control weeds, especially grass weeds, which may not be possible or economically viable to control in a cereal crop.

- Grass weeds can be controlled in broadleaf crops with different herbicide groups to those used in cereals. Rotation of herbicide groups is a central part of managing herbicide resistance (see Useful resources).
- Pulses and major oilseeds generally benefit from early sowing (although this has to be balanced with disease management). Early sowing can limit the time available for pre-seeding weed germination and control. However, the early growth and canopy closure of canola can present good competition to grass weeds.
- The flexible sowing window for safflower presents opportunities for double-knock use of herbicides and conventional mechanical methods of weed control.
- Be aware that pulse crops tend to rate poorly for early competition against weeds and are susceptible to yield loss due to weeds (Table 4). Sowing pulses in wider rows can assist weed control providing there is adequate stubble cover, the pulses are sown into standing stubble and low soil disturbance systems are used to minimise weed germination. Otherwise wide rows could increase a weed problem (see Useful resources). Post-emergent herbicide application or inter-row shielded sprayers become necessary options as a planned or salvage operation. Visit www.pulseaus.com.au for information about wide row pulses and stubble systems.
- Most pulse crops can be crop topped or desiccated helping to prevent seed-set of annual ryegrass and later maturing in-crop weeds such as prickly lettuce and wild radish. Desiccating or windrowing canola and some pulses can have a similar result.
- The introduction of canola varieties with tolerance to glyphosate, triazine or imidazoline herbicides has provided greater in-crop weed control options when growing a canola break (Table 4).

TABLE 3 LENTIL DISEASES AND POTENTIAL FOR CROSS INFECTION FROM OTHER PULSES

Disease	Lentil	Field pea	Faba bean	Vetch	Chickpea	Lupin
BOTRYTIS GREY MOULD						
Botrytis cinerea	**	*	**	**	**	*
Botrytis fabae	**		**	**		
SCLEROTINIA						
Sclerotinia sclerotiorium	**	**	*	*	**	**
BACTERIAL BLIGHT						
Pseudomonas syringae pvv syrinae	**	**				
ASCOCHYTA BLIGHT						
Ascochyta lentis	**					
PHOMA BLIGHT						
Phoma medicaginis var pinodella	*	**	**	*	**	*
GREY LEAF SPOT						
Stemphylium botryosum	**				*	**
VIRUSES						
Cucumber mosaic virus	**		*			**
Lueteovirus complex (eg BLRV & BWYV)	*	**	**	**	**	
Alfalfa mosaic virus	**		*	*	**	
ROOT ROTS						
Fusarium	*	*	*	*	*	*
Pythium	*	*	*	*	*	*
Rhizoctonia	**	**	**	**	*	**
Botrytis seedling blight	**	*	**	*	**	*

** This disease has caused major damage on this crop
* This disease occurs on this crop but has not caused major damage
Not a host

SOURCE: Lentil Ute Guide, a more complete table of pulse disease interactions is found in the Grain Legume Handbook

- There are weed and crop combinations that result in minimal weed control opportunities, which should be avoided. For example, winter pulses in paddocks dominated by black bindweed or wireweed, conventional (non herbicide tolerant) canola with Group A resistant grasses and/or brassica weeds.
- Crop weeds need to be managed throughout the whole rotation. Do not wait until a paddock is over-run with weeds before deciding to introduce a break crop. For example, a pulse crop grown immediately after herbicide resistant ryegrass that has been allowed to build up and is out of control, will not solve the weed problem. In this situation a herbicide tolerant canola might be a better initial option.
- If weed control is the driving factor behind the selection of a break crop and control options are limited, a brown/green manure or hay crop may be the best option. Results indicate these practices can achieve up to 90 per cent control of germinated weeds providing the operation occurs before viable weed seeds have been set.

Insect pests

There is little research to support the use of specific crops to reduce insect pest populations. However, planting large areas with the same crop type or tight rotations can provide the opportunity for pest species to multiply.

Adjacent crops, weeds and non-cropped areas can host pest insects, for example aphids, redlegged earth mite, slugs and snails. Interaction between these areas and crops selected for a paddock need to be considered.

Nutrient supply

Crops vary in their use and requirement for nutrients by crop type and overall bulk of dry matter produced. This makes it hard to provide information about break crop choices in relation to nutrition. Growers are encouraged to:

- review local nutrient research for different crop types, including National Variety Trials;
- soil test and tissue test; and
- create nitrogen budgets for the whole crop sequence.

Pulse crops, in symbiosis with rhizobia, fix nitrogen from the air. The amount of nitrogen left behind depends on how much is fixed and what is removed in grain and forage. The quantity of nitrogen fixed is influenced by many factors including: crop type; presence of appropriate rhizobium; growing conditions; above and below ground dry matter production; amount of stubble incorporated and soil nitrogen status. Large bulky crops, such as faba beans, or lupins grown in soils with low nitrogen status, can fix more nitrogen than shorter crops or those grown on soils with high initial nitrogen status.

Under intensive cropping rotations, the use of minimum tillage and retained stubble has resulted in an increase in available soil nitrogen. This nitrogen is from free-living nitrogen fixing soil organisms.

TABLE 4 CROP CHOICE OPTIONS TO AID WEED MANAGEMENT

Crop	Competitive ability	Weeds with poor or no control options	Key weeds to target
OILSEEDS			
Canola – open pollinated	Medium	Group A resistant grasses, brassicas e.g. wild radish, mustard, wild turnip, fumitory	Grass weeds
Canola – hybrid	Medium to high	Group A resistant grasses, brassicas e.g. wild radish, mustard, wild turnip, fumitory	Grass weeds
Canola – imidazoline tolerant	Medium	Group B resistant brassicas	Grass weeds – particularly brome grass, Group A and M resistant grass weeds, 'imi' susceptible broadleaf weeds
Canola – triazine tolerant	Low to medium	Triazine resistant brassicas	Grass weeds, triazine susceptible broadleaf weeds, fumitory
Canola – Roundup Ready®	Medium	Glyphosate resistant weeds, storksbills	All
Brassica juncea	Medium	Group A resistant grasses, brassicas e.g. wild radish, mustard, wild turnip, fumitory	Grass weeds
Linseed	Low	Some broadleaf weeds	Grass weeds
Soybean	Low	Burrs (Xanthium spp), Ipomoea spp	Winter and summer grasses
Safflower	Low	Some summer broadleaf weeds	Grass weeds
PULSES			
Beans	Medium	Wild radish, musk weed, vetch	Grasses
Chickpeas	Low	Fumitory, black bindweed, wireweed (no-till and stubble retention), vetch	Group A susceptible grasses, Medic
Lentils	Low	Group B resistant broadleaf weeds	Grasses
Field peas	Medium	Fumitory, bifora, vetch	Grasses
Vetch	Low	None if grown for green/ brown manure or hay/silage	Grasses, broadleaf weeds
Mungbean	Low	All summer broadleaf weeds, especially Burrs (*Xanthium spp*), *Ipomoea sppwinter* and *summ*	Winter and summer grasses

SOURCE: based on a table from Integrated Weed Management Manual in Australian Cropping Systems)

Levels of available soil nitrogen that are too high can make the paddock unsuitable for crops where the protein percentage needs to be low, for example malting barley or biscuit (soft) wheat.

Season and soil type are a key influence on a crop's nutrient supply and/or removal. Therefore, local research and experience is the best source of information about nutrient supply and removal by different crops.

Water use

Crops differ in their water usage. The total amount of water removed from the soil profile influences water availability to the following crop. A crop's water use efficiency (WUE) influences the overall productivity of the current crop.

Traditionally, WUE has been assessed on an annual basis, however, there is increased interest in looking at it across the whole crop sequence. This is because for every additional millimetre of stored soil moisture there is the potential to increase cereal yield. In a review of Australian trials in the southern region by CSIRO, the average yield increase for wheat was 34 kilograms per hectare per millimetre of stored moisture.

Soil type, effective summer weed control and stubble cover will all influence the amount of stored soil water lost during the summer. These factors need to be taken in to account when assessing moisture carryover and crop choice.

The GRDC's National Water Use Efficiency Initiative commenced in 2009 and is investigating the management factors that most influence WUE, including the role of break crops.

In some situations, using too much water is the issue; deep rooting crops including canola, safflower, lucerne and lupins can be used to drain the soil profile, lowering the watertable and the potential for salinity.

While mungbean and soybean production is limited in the southern region, mungbean is a better option if water supply is limited.

PHOTO: EMMA LEONARD

Time of sowing can be critical, and including a range of crops in the rotation can help ensure timely sowing for the whole cropping program.

Other factors to consider

The introduction of a new crop or crop sequence can present logistical and management challenges and opportunities.

- **Time of sowing –** appropriate sowing times need to be achieved for all crops in the rotation otherwise yield penalties due to frost or short seasons can be experienced. For example, for each week canola sowing is delayed, yields drop around five per cent in SA and Victoria and around 10 per cent in NSW; this can be greater in years with a dry finish. Detailed time of sowing guides are available from state departments, Pulse Australia and the Australian Oilseeds Federation.
- **Row spacing –** while constant row spacing for all crops is common, research and farmer experience is suggesting wider row spacing improves pulse yields, especially in drier regions. Details on wide row pulses and stubble systems can be found on the Pulse Australia website. Using a row spacing that is a multiple of existing tine set-up is becoming more common, for example, 250mm cereals and 500mm pulses and canola. This enables inter-row sowing and easy set-up on most seeding bars. Non-sowing tines need to be lifted. Spacings up to 750mm are used in pulses and canola to provide the possibility of using shielded sprayers inter-row.
- **Stubble cover post-harvest –** pulse and oilseed crops, especially lentils and field peas can result in considerably less stubble cover across the soil surface than a cereal crop. Stubble cover is reduced further when wider row spacing is used. This lack of stubble not only can result in less soil protection but also reduced summer stockfeed. Pulses sown into standing cereal stubble leave residual cereal roots and stems even after the pulse is harvested. Spreading chopped pulse stubble at harvest provides better soil protection than leaving stubble in header rows.

- **Agronomy –** each crop has its individual agronomy requirements, for example soil type, seeding depth, nutrition, herbicides, disease identification and management; learning to grow a new crop successfully requires planning, time and effort.
- **Equipment –** the majority of operations for growing pulses and oilseeds can use the same equipment as for cereals. Canola requires windrowing. Pulses and oilseeds can be damaged in a flight auger; alternative designs like belt shifters are preferred. Harvester modifications, such as the use of a flexi-front and alternative screens may be required when harvesting pulses. Some pulse crops may require cleaning after harvest to ensure market grade is delivered.
- **Storage –** on-farm storage may lucrative markets for break crops but these crops may require specialised storage, for example oilseeds and pulses are best stored in aerated storage. Pulses and oilseeds are deemed less suitable than cereals to be stored in grain bags, also known as silo, sausage or harvest bags (visit www.pulseaus.com.au).
- **Marketing –** issues that need to be considered include availability of delivery locations, contract specifications, storage requirements and meeting the receival standards to achieve market grade.

Useful resources:

Publications available from Ground Cover Direct Bookshop	**www.grdc.com.au/bookshop**
2011 Farm Gross Margin and Enterprise Planning Guide	**Email ground-cover-direct@canprint.com.au**
Grain Marketing Lingo	**www.grdc.com.au**
Integrated Weed Management Manual in Australian Cropping Systems	**Email ground-cover-direct@canprint.com.au**
Ute Guides – topics include peas, faba beans, lentil, vetch, chickpea disorders and winter pulse disorders	
Grain Legume Handbook 2008	**www.grdc.com.au/grainlegumehandbook**
Raising the bar publications – various oilseeds	**Email ground-cover-direct@canprint.com.au**
GRDC Research Update papers	**www.grdc.com.au/researchupdates**
Herbicide resistance mode of action groups	**www.grdc.com.au**
Farm Budgets and Costs – NSW Department of Industry and Innovation	**www.dpi.nsw.gov.au/agriculture/farm-business/budgets**
Australian soybean marketing guide	**www.australianoilseeds.com**
Yield Prophet®	**www.yieldprophet.com.au**
PreDicta B™, Root disease testing service, SARDI	**www.sardi.sa.gov.au/products__and__services/entomology/diagnostic_service/predicta_b**
Black Spot Manager, information for WA, SA and Victoria	**www.agric.wa.gov.au/PC_92989.html**
Publications available from Pulse Australia	**www.pulseaus.com.au/Search_Publication.aspx**
Wide row pulses and stubble systems	
Residual herbicides and weed control	
Use care with pulses in grain bags	
Australian Oilseeds Federation	**www.australianoilseeds.com**
National Variety Trials, especially resources	**www.nvtonline.com.au**

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