# Break crops in stubble

## Taking a break from wheat

Break crops for wheat include a range of pulses (lupins, faba beans, lentils, chickpeas and field peas), canola and oats, as well as vetch and clover species.
The key benefits of break crops in a cropping systems include:

- Increasing cumulative gross margins for a crop sequence
- Improving nitrogen accumulation and cycling
- Spreading price risks across commodities
- Management of herbicide resistant grasses
- Improved disease and pest control by changing host plants
- Easier crop establishment in retained stubble due to reduced stubble loads

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# Break crops in stubble retained systems

## Selecting break crops

The choice of break crop species should take into account the paddock history of weed species, weed resistance status, disease and insect pests, economics of the crop, stubble load and type of opener.

A review of break crops showed wheat following canola increased yield by 0.8 t/ha compared to wheat after wheat, and wheat after legumes increased yield by 1.2 t/ha.
However, many of these trials were not undertaken with stubble-retained systems, where some benefits may be compromised. Our recent studies, summarised here have focussed on break-crop benefits in stubble-retained systems. There are some tips and tactics to maximise the benefits.

## Break crops in the system - profitability and yield

From a range of studies undertaken in SE NSW in stubble retained systems over the past 8 years (2008-2016), crop sequences which include brassica and/or legume break crops have been shown to be as profitable, and in many instances more profitable than continuous wheat

**TIP: Consider reducing or removing wheat stubble if sowing wheat into wheat stubble**

Break crops offer flexible management options in stubble retained systems. These include low risk options such as growing vetch for hay, grain or brown manure or legumes for stock feed, or higher risk options such as growing high value pulse crops for human food (chickpeas, lentils and faba beans) - all can be profitable and depend on what you are trying to achieve. Canola was very profitable in the year it was grown, but had little impact on the yield of the following crops. Pulse crops were less profitable, but had greater rotational benefits for subsequent wheat crops which lasted for the following two years due to increased N supply and lower costs of production.

**FACT: sequences including a break crops had higher 3-year gross margins.**

*Further reading (including tables) available on the Break Crops resources document at http://www.farmlink.com.au/LiteratureRetrieve.aspx?ID=201594*

**FACT: Break crops provide profitable crop sequence options in stubble-retained systems**

**TIP: Chose the break-crop that suits your paddock circumstances**

*For more information refer to "Profitable break crop management guide" which can be found on the Farm-Link website under the projects section http://www.farmlink.com.au/project/crop_sequencing*

*Lupins sown inter row after a cereal crop. Photo: Tony Pratt, Farm-Link. RR canola, lupins, wheat (high input) and field peas in stubble retained systems*

## Nutrient cycling

The use of nitrogen (N) fixing legumes provide a cost-effective supply of N to reduce dependence on N fertilisers. Legumes contribute to the total N content of cropping soils when the amount of N fixed exceeds the N harvested in grain. The amount of N mineralised from legume residues that becomes available for a subsequent crop is dependent on the type of pulse crop, whether it is grown for grain or brown manure, amount of rainfall, temperature over summer and legume species. To estimate the additional mineral N (kgN/ha) supplied from pulse crop residues to the subsequent cereal or canola crop, multiply the grain yield of the pulse crop x 15.

**Tip: Additional soil N from legume crop = grain yield of the pulse crop (t/ha) x 15**

**Tip: When choosing a legume break crop "Grow what you can and grow it well" for maximum input of N into the cropping sequence**

*Further reading (including tables) available on the Break Crops resources document at http://www.farmlink.com.au/LiteratureRetrieve.aspx?ID=201594*

In stubble retained systems, other options to improve N cycling include:

- Increasing number of legume crops sown in the rotation;
- Grazing cereal, canola or legume crops before GS30 or budding; and
- Grazing stubbles to increase accumulation of soil miner-

# Break crops in stubble retained systems

## Weed management

Fact: In stubble retained systems, wheat grain yield decreases by around 0.5 t/ha for every tonne of Annual Rye Grass dry matter in the spring

Canola is the most significant break crop for weed management in cereal crops because of the numerous herbicide and varietal choices (Conventional, TT, RR, RT or Clearfield). Hybrid canola varieties are more vigorous which assists them emerge through stubble, produce more early dry matter and ensure early canopy closure. Pulse crops can also be a good choice when managing grass weeds, as they can be sprayed with selective grass herbicides, "brown manured" or cut for hay prior to weed seed set.

Recent experiments showed that in stubble-retained systems, a 'single break' was not always sufficient to reduce the seed bank of high ARG populations to low manageable populations and 'double breaks' were necessary.

**Tip: Double-breaks may be required to manage severe ARG infestations in stubble-retained systems**

**Tip: Don't just rely on herbicides for weed control in stubble retained systems**

Crop competition is extremely important to suppress early and late emerging annual weeds. Disc openers offer the advantage of being able to sow crops at narrower row spacings in stubble-retained systems to improve crop competition! Weed control in pulse crops in stubble retained systems needs close attention. Even with good early herbicide management, weeds can increase in number and dry matter. Spray topping legume crops at maturity has been very effective at reducing ARG seed set. Select a legume pulse crop with a similar maturity to the grass weed (ARG weeds mature later than wild oats so they are suitable to be controlled using this method).

*Canola is used as a break crop for cereals if grass weeds are a problem.*

*Photo: Phil Bowden*

*Further reading (including tables) available on the Break Crops resources document at http://www.farmlink.com.au/LiteratureRetrieve.aspx?ID=201594*

## Disease management

The main wheat diseases that cause problems are the cereal root diseases, Crown Rot, Take-all, Rhizoctonia and the leaf disease Yellow leaf spot. Establishing wheat in sequence with canola or pulse crops will reduce pathogens and weeds.

Combined with resistant varieties and seed or fertiliser fungicides provides good integrated control. For crown rot, a local experiment in 2001 showed the greatest reductions in the infection of subsequent wheats were in the order of canola<chickpea<wheat<barley.

Many break crops are prone to a range of diseases so careful management is critical to minimise blackleg and sclerotinia in canola, ascochyta blight in lentils, chickpeas, fababeans and field peas, and chocolate spot in fababeans.

Paddock selection, sowing resistant varieties, application of fungicides to treat seed and fertiliser plus the timely application of foliar fungicides are critical to protecting all crop types. Crop monitoring is essential.

For more information, refer to the GRDC "Stubble disease strategies" guideline at http://www.farmlink.com.au/project/crop-sequencing or download NSW DPI factsheets at http://www.dpi.nsw.gov.au/content/agriculture/broadacre/winter-crops/pulsesor.

## Break crop establishment in stubble

Poor establishment of small-seeded crops such as canola can be a problem in stubble-retained systems. In an ongoing experiment at Temora, a 22% reduction in the establishment of TT canola was found when sown with tines and coulters into a 7.3t/ha wheat stubble, compared to establishing into a previous legume hay crop. Previous research has shown that winter growth is reduced when canola emerges through stubble. A 10-15% reduction in the emergence of wheat sown into wheat stubble (approximately 8.5t/ha) compared to wheat following canola has been measured in tine seeding systems. Pulse crops tend to establish more easily into heavy wheat stubbles compared to either wheat or canola crops. In recent experiments, vetch established successfully into a 9t/ha barley stubble using both disc and tine seeders, and there was no significant difference in faba bean establishment into an 8.5t/ha wheat stubble compared to a bare/burn treatment (no stubble).

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# Break crops in stubble retained systems

## Break crop establishment in stubble

*... from previous*

Establishing large seeded pulse crops such as faba beans, lupins and field peas into a cereal stubble can also assist in reducing the stubble by mineralisation, allowing crops such as canola to be established easier the following year. Remember, some crop legumes are frost-sensitive and establishing into stubble can potentially increase the risk of frost damage.

**Tip: Remove or reduce stubble above seeding rows in canola**

**Tip: Remove or reduce heavy wheat stubbles in frost-prone paddocks**

## Herbicide residues in soil and straw

Residues from herbicides used in the current or previous cropping phase can impact on the choice of subsequent crops. The risk of crop damage cannot be ignored, particularly where rainfall has been minimal. Canola and other pulse crop types differ in their sensitivity to residual herbicides. Pulse crops are particularly sensitive to residual Lontrel Advance (Clopyralid 600g/L) with residues in the straw of treated crops potentially affecting pulse crops for up to 24 months.

**Tip: Always check herbicide label used against each crop type**


# Insect pests

Alternating crops will change the spectrum of pests that are present. Canola and some pulses attract more insects and mites than cereal crops. Small canola seedlings are vulnerable from emergence to about 4 leaf. Before sowing, the risk factors that need to be considered include the previous crop-type, the amount of stubble in the field, in-field weeds that have developed over summer, weeds around the edge of the field, and the history of insect damage and insecticide-use in the field. Retaining stubble is expected to increase the likelihood of pest outbreaks, dependant on the extent to which the conditions become more suitable for pest species and unsuitable for beneficials. Slugs and snails do better in moist environments created by high stubble loads. Slaters and millipedes, which are primarily detritivores, can increase their numbers in retained stubble fields. Anecdotally, crops seem to be most susceptible when a previously high level of stubble has been exhausted and pests begin to feed on emerging crops for nutrition and moisture.

There is some evidence that the presence of stubble discourages aphids from landing on emerging crop plants. This may reduce transmission of viruses carried by aphids to the crop. As virus damage is worse if infection occurs at a young crop growth stage in canola, stubble may delay infection long-enough to allow the crop to get past the rosette stage. However, the management of over-summer weed hosts of aphids near the field is critically important for reducing the number of aphids around in the first place.

In stubble retained systems, the careful use of chemicals (e.g. seed dressing with imidacloprid and fipronil) at sowing will assist in reducing pest numbers below the economic injury level while keeping beneficial insects. A rotation that contains diverse crops will always be less prone to pest attack than a monoculture. For more information refer to the DPI Insect guide at http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/284576/Insect-and-mite-control-in-field-crops-2013.pdf

The IPM guidelines for grains website lists the insect pest species that may attack a range of crop-types. http://ipmguidelinesforgrains.com.au/

**Tip: Seed dressing with Imidacloprid and fipronil will benefit seedling emergence in stubble retained systems**

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