

ROTATIONS

FACT SHEET

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Good rotations – when do you need a break?

The agronomic value of break crops needs to be considered across the whole rotation not just in respect to the year of production.

KEY POINTS

- When planning rotations, potential and current agronomic limiting factors need to be considered. A break crop can only provide a break if it addresses one or more of these limiting factors.
- Continuous wheat crops are rarely as viable as rotations that include either a pasture or break crop.
- Rotations help spread the risk of the enterprise being affected by economic and natural challenges.
- Break crops can increase water use efficiency in the following cereal crop.
- Modern farming techniques can influence the value or need for break crops in some situations.
- In all rotations sound agronomy is the key to success.

In dry conditions continuous cereals can be grown with little detrimental or negative financial impact. However, in average or above-average rainfall years, including oilseed and pulses in the rotation offers many advantages over a continuous cereal rotation.

Growing a range of cereals and broadleaf crops is an important risk-management tool as it allows for variation in the timing of seeding and harvest, herbicide groups and the competitive ability of crops. It reduces the risk of exposure to frost and outbreaks of pests and disease.

The value of break crops is substantial for many reasons including soil health, weed control, disease and pest management and water use efficiency. New research is demonstrating that rotations including break crops can return more across the rotation.

Problems of intensive cereals

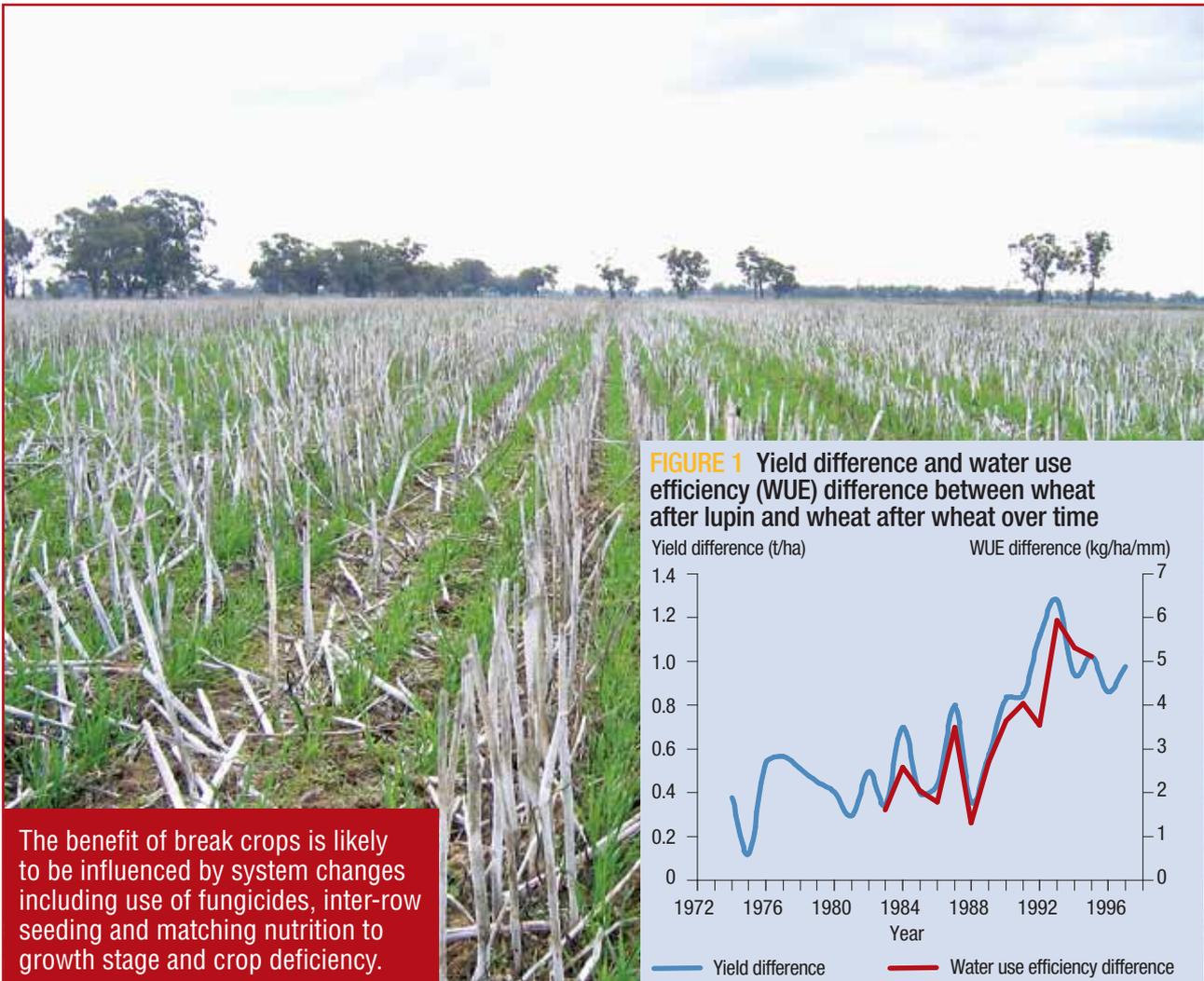
Disease potential

Disease carryover is favoured when cereals are grown in close rotations. This can mean a rapid build-up of soil-borne diseases such as take-all, cereal cyst nematode (CCN) and root lesion nematode (RLN), and of stubble-borne diseases such as crown rot, yellow leaf spot and Septoria. In general, when disease levels are high a two-year break from susceptible hosts will be needed to reduce disease risk. For some diseases, such as take-all, a one-year break may be sufficient. For the break to be effective it is important that grass weeds are controlled as many of these can act as a disease host. Growers can determine the risk of yield loss from soil-borne diseases and crown rot from a soil test carried out before sowing.



Rotations help spread the risk of the enterprise being affected by economic and natural challenges.

PHOTO: EMMA LEONARD



Herbicide resistance

The increased use of selective herbicides for grass weed control in a continuous wheat rotation may lead to herbicide resistance.

Increased fertiliser

Nitrogen inputs are usually increased for the second wheat crop as opposed to wheat following a legume or fallow. Legume crops can leave a beneficial nitrogen base in the soil for use by the following wheat crop. It is estimated legumes can provide a nitrogen benefit equivalent of 0.5 tonnes per hectare to the following crop.

Influence of farming practices

As part of the Profitable Crop Sequencing project in WA, a review of previous research was commissioned, which looked at over 150 crop sequences from trials run in WA since

the 1960s. An important finding was the impact of no-till and improved weed control on wheat following lupin.

The shift to no-till, more intensive rotations and herbicides for in-crop control of weeds in lupin appears to have improved the value of the lupin break.

Water use efficiency (WUE)

The analysis showed that after 1990, the WUE in the lupin-wheat was consistently at least three kg/ha/mm greater than for a wheat-wheat rotation (see Figure 1).

Nitrogen efficiency

Similarly the influence of additional nitrogen in the wheat crop has changed since 1990. It appears that after 1990, wheat-lupin rotations continue to respond to increasing rates of nitrogen. Prior to 1990, wheat-wheat responded more to additional nitrogen than wheat-lupin.

If changes to crop management in the past have influenced the size of the break crop effect then the implications of recent changes to crop management need to be considered. In particular the benefits of break crops are likely to be influenced by the use of more effective fungicides, inter-row seeding to avoid last year's crowns and roots, splitting nutrient application across the growing season, and the reduced effectiveness of weed control.

Information gathered in the review, together with the results from field trials and a whole farm economic analyses are being used to develop a new decision-support model, the 'Land Use Sequence Optimiser – LUSO'. The model is being developed by researchers at the Department of Agriculture and Food Western Australia (DAFWA), University of Western Australia and the CSIRO.

Payback

The costs attributed to a break crop can make it appear unprofitable but in reality the control of grass weeds in a legume is going to have a long-term benefit across subsequent cereal crops. It is often better to compare the gross margins of a sequence of crops to capture the costs and benefits of the break crop.

A 2008 review by CSIRO of 700 Australian and overseas experiments on break crops showed the yield of wheat was consistently higher after a break crop than after a wheat crop. It also found that increased yield was a constant amount, not a percentage change. It showed wheat following oats achieved a 0.5 t/ha higher yield than after wheat; wheat following

canola yielded 0.8 t/ha more and an average 1.2 t/ha after grain legumes, with wheat following lupins achieving the highest yield of 1.8 t/ha.

A second wheat crop after a break crop had an increased yield but this only averaged 45 per cent of the additional yield of the first wheat crop.

Most of the experiments in this review were conducted in average or above average seasons. In drier seasons the benefits of break crops are generally less than these. The researchers also found canola followed by wheat, despite the higher yield in the wheat, was not as profitable as wheat followed by wheat, as assessed from a two-year gross margin.

Other findings were:

- the gross margins of canola-wheat-wheat were greater than for wheat-wheat-wheat, but only when sowing canola before mid-May;
- grazed canola had higher gross margins than grain-only canola when sown before early May, but sharply lower returns for later sowing;
- grain-only wheat followed by two other wheat crops gave the highest gross margin for crops sown after late May. Grazing the first wheat crop gave higher gross margins than for grain-only wheat; and
- gross margins for lupin-wheat-wheat were close to the values for wheat-wheat-wheat when the first crop was sown in late May.



PHOTO: EMMA LEONARD

Rotation trials

The Increasing Profitability of Cropping Systems in WA using Lupins, Oats, Oilseeds and Pulses project is funded by DAFWA and GRDC. The trial aims to predict when weeds and diseases are starting to increase before it becomes too obvious, and to demonstrate the effects of different management and rotation options.

An analysis by DAFWA of 40 years of crop-sequencing trials (10,191 records) found few trials reported wheat on wheat yields above 2.5t/ha while wheat following lupins out-yielded wheat following wheat in the majority of experiments, even when high rates of nitrogen were applied in the wheat year. Lupin-wheat-wheat and wheat-lupin-wheat out yielded wheat-wheat-wheat in most experiments.

Other findings were:

- a wheat crop gained more yield when following field peas or lupins than following fallow. On average wheat after lupins out-yield wheat after wheat by 0.5t/ha;
- the poorest yields from wheat on wheat occurred when take-all or high levels of annual ryegrass or brome grass were recorded, indicating such a rotation needs to be managed with good agronomy; and
- the occasions where the lupin sequence failed were when wild radish was not well controlled in the lupin phase and weeds swamped the following cereal crop.

The change in production systems has resulted in a break of lupins bringing greater value to the system than with conventional cropping practices.

Analysing financial data of businesses growing continuous cereal, compared to mixed farming and lupin-wheat rotations found while the continuous cereal produced the highest incomes in some years, they also produced the lowest incomes in other years. In contrast, the businesses with mixed farming or lupin-wheat had a similar level of income in each year.

FREQUENTLY ASKED QUESTIONS

Q: My neighbour has grown wheat on wheat for 10 years and his crops seem to be just as good as mine

A: 'Break crops' do not intrinsically boost yields – it is not a guarantee.

Firstly, a break crop can only provide a break to limiting factors such as soil fertility, weeds, disease or pest. For example, break crops have provided minimal benefit to subsequent wheat crops in recent dry years because water was limiting. In other situations there may be no root disease limiting cereal production. Therefore, the inclusion of a break crop provides little or no benefit. It is important to try and determine what is limiting your cereal production before deciding to grow a break crop and indeed what break crop to select.

Secondly, growing the break crop alone does not automatically provide the benefit expected. A weedy low biomass poorly nodulated lupin crop will provide little if any 'break'.

Thirdly, the season and your agronomy have to allow any potential effect to be realised. In other words, if there is

some other limiting factor, such as the lack of reliable spring rain or a nutrient deficiency, the inclusion of a break crop in the year prior may not help to correct these issues.

Q: The gross margins on break crops such as lupins and field peas are not attractive. How can we be expected to grow them?

A: Simply looking at the gross margins of an individual crop can be misleading. For example, many of the costs associated with growing field peas could realistically be attributed to the following crop. Both post-emergent grass weed control and crop topping later in the year to stop ryegrass seed set are probably of more benefit to the following cereal crop and the whole system than the field pea crop. It is often better to compare the gross margins of a sequence of crops which tries to capture the cost of benefits of the break crop.

Growers should always ask if they can capture the same benefit as growing a break crop in another way (winter-cleaned or spray-topped pasture, fallow, inter-row sowing), particularly if that method has a lower risk or the likely benefit of a break crop is marginal in the first place.



The value of controlling in-crop germinations of ryegrass in a broadleaf break crop such as faba beans needs to be off-set against the whole crop sequence not just the bean crop.

Useful resources:

■ Websites in each state

NSW

Victoria

WA

Queensland

Tasmania

SA

www.dpi.nsw.gov.au

www.dpi.vic.gov.au

www.agric.wa.gov.au

www.dpi.qld.gov.au

www.dpiw.tas.gov.au

www.sardi.sa.gov.au

■ CSIRO www.csiro.au or John Angus

Email j.angus@pi.csiro.au

■ *Increasing Profitability of Cropping Systems in WA using, Lupins, Oats, Oilseeds and Pulses*, Dr Peter White, DAFWA

(08) 9368 3508 or Email peter.white@agric.wa.gov.au

■ *Profitable crop sequencing*, Mark Seymour, DAFWA

(08) 9083 1111 or Email mark.seymour@agric.wa.gov.au

■ *Breaking the crown rot cycle*, Dr Margaret Evans or Dr Grant Hollaway

(08) 8303 9397
(03) 5362 2111

■ PreDicta B™ – a DNA-based soil analysis service for key soil and stubble borne diseases. Contact your local agronomist or to locate your nearest supplier, email your contact details and location to

predictab@saugov.sa.gov.au

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