



## IRRIGATION RESEARCH & EXTENSION COMMITTEE

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FOR IRRIGATION CROPPERS

### **Benefits of pulses in irrigation rotations**

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- *Pulses have a role in irrigation rotations not just for the traditional 'nitrogen fix' and 'disease break' but also as a cash crop in their own right, and a valuable part of the whole farming system.*
- *Growing the new varieties to maximise their advantages will assist growers to produce a viable, quality pulse product to sustain their farming system and markets.*
- *Trials are being conducted in irrigation regions to investigate the suitability of the new pulse varieties under best management guidelines and to assess their value in the rotation.*

## Introduction

There is the potential for pulse expansion in the irrigation districts of southern New South Wales and Victoria. Already growers are achieving consistently high yields with faba beans, field peas and new chickpea varieties that fit into the various irrigation rotations and farming systems. Limitations to yields in the past through disease, weeds and waterlogging have been identified and overcome through paddock selection, better layouts and management of newer and better varieties.

## Rotations

Paddock rotations are extensively used on irrigation and while there appears to be no 'standard' rotation there is an awareness of not extending cereals (including rice) past two consecutive crops, and the need to include other crops such as pulses, canola or several years of legume based pasture (if livestock are involved) in rotations.

Rice continues to be a high priority for farmers, with as much area being grown as possible by most, and other crops based around this to enable maximum production. However bed layouts that include summer crops such as maize, or are unsuitable for rice or don't include rice have a more structured approach to rotations, and often see the inclusion of faba beans, canola etc other than cereals. The ability to be able to water up crops, and irrigate more often on beds with less risk of waterlogging is a decided advantage, but good border-check layouts and free draining soils can achieve similar results.

Determining the most suitable rotation requires careful planning with the prime aim to achieve sustainability and the highest overall profit. The rotation must be flexible enough to cope with key management strategies such as maintaining soil fertility and structure, controlling crop diseases, and controlling weeds and their seed set. Commodity prices must also be considered but not a key driver at the expense of other long term benefits.

## The nitrogen benefit

Pulses provide many benefits in cropping rotations, including the ability to fix atmospheric nitrogen (N<sub>2</sub>), resulting in more soil N for cereal crops. The amount of nitrogen fixed is determined by how well the crop grows. Crop growth reflects the effectiveness of nodulation, seasonal conditions and management, and the level of nitrate in the soil at planting.

Below is a nitrogen budget for faba beans from the New South Wales Department of Primary Industries showing total nitrogen fixed in both above-ground (shoots) and below-ground (roots and nodules) which in faba beans is about 30% of total biomass.

The nitrogen balance is the difference between (nitrogen fixation and nitrogen applied) and (nitrogen harvested in grain or hay and nitrogen volatilized [lost] from crop and soil). The Nitrate-N benefit is the **extra nitrate-N available at sowing** in a soil that grew a pulse crop in the previous season compared to one that grew a cereal crop.

The nitrate-N benefit from faba beans, over a range of grain yields is shown in the following Table.

Grain yield (t/ha)	Shoot dry matter (t/ha)	Low soil nitrate at sowing (50 kg N/ha)			Mod soil nitrate at sowing (100 kg N/ha)		
		N fixed (kg/ha)	N balance (kg/ha)#	Nitrate-N benefit (kg/ha)	N fixed (kg/ha)	N balance (kg/ha)#	Nitrate-N benefit (kg/ha)#
1.0	2.8	49	12	15	39	2	3
1.5	4.2	83	25	26	68	10	11
2.0	5.6	120	40	41	100	21	22
2.5	6.9	158	58	45	133	33	36
3.0	8.3	196	75	49	167	45	49
3.5	9.7	234	92	53	202	60	60
4.0	11.1	274	111	57	237	74	64

Source: David Herridge, NSW DPI Tamworth

The values in this Table were derived from extensive research in the northern grains region of New South Wales and can be used as a guide in other situations such as irrigation showing the potential for faba beans to fix reasonable amounts of N even under high soil N situations. It is possible to assume that a 4t/ha faba bean crop will have a nitrate benefit of around 60kg/ha to the following cereal crop. This is equivalent to 130kg/ha of urea and farmer experience has shown this to often be the case when assessing a crop's total nitrogen requirement after faba beans.

## Disease Management

Pulses also play a vital role in controlling major cereal root diseases, particularly take-all, root lesion nematode, and crown rot that are all prevalent in irrigation soils. Take-all must have a cereal or grass host to survive, and pulses being a non-host can be used very effectively as a one-year disease break-crop in a cereal rotation, provided other grasses and volunteer cereals are controlled. *Pratylenchus neglectus* and *P. thornei* in southern cropping regions can cause root damage and yield losses. They have a wide host range including cereals, grass weeds, pasture, forage legumes and oilseeds. With the exception of chickpeas, pulses have good resistance to both species and so reduce nematode populations in cropping rotations.

Crown rot is harder to control and is more prevalent in the north. Control of this disease involves the strategic use of pulses and oilseeds as a break crop and those with denser canopies such as faba beans can aid in the breakdown of infected cereal residue.

Cereal root diseases become more prevalent in years when cereal rotations are extended beyond two successive crops. Yield losses can be quite significant without careful thought to rotations involving break crops.

The combination of higher soil nitrogen and reduced root diseases is cumulative and can result in a dramatic increase in subsequent cereal yields.

## Stubble Management

Pulses such as faba beans can be sown on wide rows up to one metre and chickpeas up to 80 cm enabling inter row spraying with non-selective herbicides using hooded shields, and inter-row cultivation. Sowing pulses between standing rows of cereal stubble is now becoming possible with GPS guidance and autosteer sowing systems enabling greater trash clearance through heavy stubbles, reducing the need to burn. Improving soil structure and reducing fuel and labour costs through direct drilling.

## New Pulse Varieties

There have been a number of new pulse varieties released in recent years that have shown great advances in both yield and disease resistance for irrigation growers. Variety Management Packages have also given information on how to best manage these new varieties from relevant information provided from independent, credible trials and sources.

VMPs are now available for new varieties of faba beans, field peas, and chickpeas.

### Faba beans

In 2005, many southern bean growers took on Farah as the new variety to replace Fiesta, and now the new variety Nura has been sown for seed increase with similar resistance to ascochyta and improved resistance to chocolate spot and rust.

The Nurah VMP outlines how to place less emphasis on ascochyta control, without ignoring the risk, and concentrate more on chocolate spot control in high-risk situations.

Key points are:

- No foliar fungicide for ascochyta control at 6-8 weeks post-sowing unless a severe ascochyta risk. *Cercospora* may however need controlling.
- At early flowering-podfill, concentrate on foliar chocolate spot control.
- Ascochyta control measures through rotation and isolation distances from bean stubble will still be required with Nurah in high-risk situations.
- Nura is shorter than Fiesta and Farah and may be less inclined to lodge.

Nura seed increase blocks should be well isolated from other faba bean crops to ensure that cross-pollination does not occur with older varieties.

### Field peas

Interest in peas has been strong, particularly in the erect variety Kaspera that can be grown on beds and has shown consistent yields of 3 t/ha or better with less input costs than most other crops.

The Kaspera VMP suggests to growers that:

- Using higher plant populations may be beneficial with Kaspera
- Downy mildew control is not needed
- Closer management to avoid bacterial blight may be needed with Kaspera
- Monitor closely for insects during the short flowering and podding period
- Crop topping is possible with Kaspera despite its bulkiness
- Kaspera can be easier to harvest, but avoid excessive harvest speeds, and harvest on time. Header modifications may be required.

### Chickpeas

The new disease resistant chickpea varieties for the southern region became available in 2005, starting with the desi Genesis 508. A new release last year has seen a small kabuli called Genesis 90 distributed widely in southern regions including irrigation. Through the VMP, growers of the new Genesis series of ascochyta resistant chickpeas can have confidence that:

- They only require one foliar fungicide to protect from ascochyta pod infection to ensure seed quality
- The new varieties are also being trialed and grown under irrigation this year

- That the market will accept the new chickpeas but established varieties may be preferred
- The southern desi chickpea industry can re-establish and grow with these more reliable varieties.

Two new desi varieties from the NSW DPI at Tamworth have also been released, named Flipper and Yorker having improved disease resistance bred initially for the northern chickpea region. Trials are now being conducted to look at their suitability in other regions and rainfall zones in NSW including irrigation areas. There is further research into kabuli types that can attract premiums, but size is very important in this limited and discerning market.

## **In Conclusion**

- The advantages of each particular crop may be judged more accurately if rotations are worked out and gross margins of each particular rotation are calculated and compared to others.
- Wheat crops following break crops such as faba beans regularly show yield responses that are 20% above those of wheat following wheat.
- Pulses can be used in integrated weed management to help control resistant weed species.
- Diversity of crops in a rotation is important particularly for continuous cropping systems that now prevail in most irrigation areas.

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