



Cool season pulse crops suitable for rotation with rice

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in a nutshell

- A Nuffield Scholarship study tour visiting significant players in cool season pulse production around the world has confirmed that irrigators in southern Australia can compete in pulse markets, with some provisos
- There is a need to broaden the research and breeding programs to include irrigated pulse production specifically for irrigation
- There is a need to concentrate on breeding for disease resistance, which has an enormous influence on the economics of irrigated pulse production in Australia

The following article is a summary of Peter Draper's report on his Nuffield Scholarship study of cool season pulse crops suitable for rotation with rice. Undertaken in 2004, his study involved visits to a number of countries with significant production of cool season pulses.

Growing cool season pulses provides a number of positive benefits which include no requirement for nitrogen fertiliser, increased yields for the next cereal, minimal issues with stubble residue and an irrigation requirement which is only supplementary to normal rainfall. However despite the positive features, it is evident that the continuing need to update disease resistance, as well as find available markets, will restrict irrigators in southern Australia producing the main pulses supported by the Australian National Pulse Breeding Program.

Following the completion of the six week Nuffield Global Focus tour, a number of countries were visited to study cool season pulse crop options which may be suitable for rotation with rice in Australia.

Canada

Canada has embraced pulses with increasing enthusiasm since the mid 1980s and is the world's largest pulse exporter. The pulses in order of production are peas, lentils and dry beans. Where climate and irrigation allow, the Canadians' preference is to grow dry beans, a warm season pulse but the crop's distribution is limited to areas which have at least 110 frost free days. Pulses are grown over large areas of Alberta and Saskatchewan, however irrigation of these crops is limited to only small areas in these provinces and the dominant irrigation type is sprinkler. The biggest impact on production of cool season pulse crops was the introduction and use of granular inoculants to inoculate the soil, rather than seed dressings or liquid. Granular inoculants have

proved to be more effective with yield increases even in soils with previous inoculant history. There is a need to trial and release granular inoculants in Australia.

Syria & India

In Syria and north west India, with climates similar to southern Australia, large gains in disease resistance have been made by cross breeding with wild strains of cool season pulse crops into new varieties of faba beans, chick peas and lentils. Of particular concern to southern Australian irrigators are the diseases *Ascochyta* in chick peas and chocolate spot in faba beans. Faba bean varieties available in both Syria and India continue to gain improved resistance to these diseases through breeding programs. In Syria there has also been a successful breeding programme to lower the toxicity of lathyrus or grass pea. This pulse crop is tolerant to extremes of soil water stress conditions, ranging from waterlogging to drought. It would be a very useful rotational crop for rice growers who also run livestock as it can be irrigated without the need for raised beds. For irrigators interested in green manure between consecutive rice crops this pulse crop could handle the extremes of both wet or dry winters.

There is a need in Australia to encourage the Grains Research and Development Corporation (GRDC) to continue investment in pulse development and breeding, including linkages with the International Centre for Agriculture Research in Dry Areas (ICARDA) in northern Syria and organisations such as Punjab Agriculture University in north west India, where climatic conditions are similar to southern Australia and *Ascochyta* is a more significant disease.

England

England is placing increasing importance on faba bean exports, which will lead to increasing competition in the key Egyptian market if their quality continues to improve. Many of the exporters pass beans through colour sorters to help



overcome the quality problems experienced with wet harvests. Beans produced in Australia avoid this added cost as quality is generally very high due to our dry harvest period. On farm, growers in England are moving to lower plant populations to improve yields with less disease and reduced lodging.

Australia

Of the crops I saw, chick peas, faba beans and dry peas still offer the best opportunities for southern irrigators. We have to remain mindful that around the globe other countries are looking to increase pulse production and the pressure will remain to produce high yields, of high quality, at least cost.

The opportunities to value add must also be fully explored to increase profitability. Examples include flour and snack foods which can be manufactured from pulse crops. Legume and rice markets are complementary in many countries and rice growers own infrastructure for storage, manufacture and marketing which in recent years it has been unable to be fully used for rice.

Breed for irrigation

It is essential that we liaise with plant breeders for selection of high yield under irrigation as the priority; around the world varieties are moving toward increasing yield under drought stress. Less than 20% of the world's cultivated land is irrigated but it accounts for half the value of global crop production. International and national crop breeding and research programs however place a high priority on overcoming stress from drought. This is not always conducive to achieving maximum yield when moisture stress can be alleviated with irrigation.

Despite the focus on varieties for dryland conditions, big gains are being made in a number of areas which will open new opportunities for irrigators in southern Australia. It is pleasing to see the beginnings of change with GRDC funding increasing in the irrigation sector. Irrigation produces half the profit in Australian agriculture and there is large

potential to increase irrigation productivity. The liability has been the lack of crop varieties which have been specifically developed for irrigation. It is critical that irrigation sites are included in the national variety trials so that irrigators can compare performance of available varieties under irrigation. The follow on is to select varieties which perform better under irrigation and look toward breeding better varieties specifically for irrigation. Given that irrigation represents less than 1% of the land cropped in Australia, it can be easily forgotten when the research levy funds are being allocated.

Collaborate overseas

Good collaboration already exists between Australian pulse breeders and their international colleagues, which is backed by funding through GRDC and the Australian government. The benefits of this are beginning to flow with new varieties becoming available that overcome some of the difficulties that previous varieties had under irrigation in southern NSW. Coupled with this is the move toward 'beds in bays' combined with high speed watering, which will reduce the risks of waterlogging and allow a wider range of pulses to be grown in the rotation without the current cost of removing levees and installing new beds at the completion of rice cropping.

The new faba bean variety Nura is a product of this international cooperation. It performed well with one fungicide application in 2005 compared with the seven or eight applications used on the current recommended varieties to keep chocolate spot under control. The new variety was released at the end of 2005 and has the potential to reduce growing costs significantly. Also progressing through seed increase is a variety of chick pea which is resistant to *Ascochyta* and *Phytophthora* root rot. Similarly, this variety completed the 2005 season in southern Australia with one fungicide application. *Ascochyta* resistance to this level has not previously been available to irrigators in southern Australia and the disease has prevented success with chick peas in the past.



Figure 1: Field peas in Canada - the country's largest pulse crop



Figure 2: Chick peas breeding team in India




Flood irrigation provides a less favourable environment for disease than sprinkler irrigation but it is critical to grow chick peas on raised beds and irrigate quickly. Field peas are another option for irrigators now that good resistance to lodging is available with new varieties. For rice farmers who still maintain livestock, grass pea is a new opportunity for forage or green manure having good tolerance to waterlogging and very low neurotoxin levels which has constrained the use of grass pea previously. The new variety Cerora will be available after seed increase during the 2006 season.

Adopt new practices

Cool season pulses demand a higher level of management than the winter cereals and it is important to get the basics right. In Canada, granular inoculants contributed to productivity increases and they are currently being developed in Australia. There is also the requirement of higher soil pH and sulphur levels than those associated with the dominant red irrigation soils in southern NSW, so lime and gypsum applications may be required.

Conclusion

My Nuffield scholarship provided valuable insight into the global status of cool season pulse crops. Furthermore all of the countries toured are significant players in pulse production but I believe that irrigators in southern Australia can compete in this arena with some provisos. First and foremost is the need to acknowledge that most research to date is with dry area or drought resistant varieties. Obviously there is a need to broaden the research and breeding programs to include irrigated pulse production. Equally important is the need to concentrate on disease resistance which has an enormous influence on the economics of irrigated pulse production.

A full report on this study, and other Nuffield reports, is available for download at www.nuffield.com.au 

Further information

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Figure 3: Lathyrus or grass pea in breeding program in Syria



Figure 4: Irrigation infrastructure in Syria