Profitable broadleaf crop sequencing in South Eastern Australia

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ABSTRACT

In low rainfall regions of south-eastern Australia, farmers have increasingly adopted continuous cereal cropping strategies as non-cereal crops are perceived as riskier than cereals due to greater yield and price fluctuations. There is a need for non-cereal crop and pasture options to provide profitable rotational crops, disease breaks and weed control opportunities for cereal production. This project will develop an improved understanding and implementation of management practices for Brassica, pulse crops, pastures and other options to reduce the risk of crop failure and improve whole farm profitability in low rainfall south-east Australia. Five small plot experiments will be conducted at locations and environments to be decided by each management group to investigate not only a wide range of break crop and pasture types but also differing management options. The sites will be on long term wheat paddocks and central to each experiment will be a break phase of 2 years followed by 2 years of cereal. Canola and mustard options, either as grain crops or in forage mixes, will be important break phases in all these experiments. Agronomic outcomes from this project will be examined for their economic and risk impacts through existing activities of each group. Extension of project outcomes will be achieved via the existing activities, networks and infrastructure of the 5 FS groups partnering in this proposal. The project management group will ensure scientific outcomes are reported in appropriate scientific fora. A guide for improved decision making for the implementation and management of break phases in low rainfall south-eastern Australia will be developed and promoted to the regional communities as part of this project.

Key Words: break crops – low rainfall – weeds – diseases - rotations

INTRODUCTION

In low rainfall regions of south-eastern Australia broad-leaf crops make up only a very small proportion of the total area of sown crops. In a survey of the Victorian, South Australian and New South Wales Mallee regions with <350 mm of annual rainfall, it was found that <5% of farmers grew grain legumes or oilseeds. Although pulse and canola cropping has declined, 65-70% of grain producers in the southern region still grow pastures in rotation with crops. Many of these pastures tend to have variable and low legume contents, are currently dominated by annual species (grasses and weeds), may be of little benefit to following crops and can support many major cereal diseases.

Farmers have increasingly adopted continuous cereal cropping strategies as non-cereal crops are perceived as riskier than cereals due to greater yield and price fluctuations and generally higher input costs have reduced all cropping gross margins. Reduced profitability and interest in livestock enterprises have also increased cropping intensities. There is a need for non-cereal crop and pasture options to provide profitable rotational crops, disease breaks and weed control opportunities for cereal production. The current alternative to cereals, poor performing volunteer annual grass dominant pastures, are havens for cereal pests and disease and often seen as having a negative impact on subsequent cereal yields and quality.

The landscape in low rainfall south-eastern Australia is now dominated by paddocks which have been in continuous cereal (often wheat) for many years now and farmers will need to rotate out soon as grassy weeds, cereal diseases and pests start to severely restrict productivity in these paddocks. This project will identify break options which will allow them to do that with least cost and optimum benefit to cereals once the paddock is returned to wheat again.

MATERIALS AND METHODS

This is a collaborative project between five major farming systems groups operating across the low rainfall zone of south eastern Australia (Eyre Peninsula, Upper North, Mallee Sustainable Farming, BCG and Central West). It is one of several projects currently funded by GRDC as part of its national Crop Sequencing initiative.

This project incorporates 4 approaches which, when combined in packages, will provide improved industry confidence in broad-leaf crops and pastures as components of risk minimisation cropping strategies:

1. An opportunistic combination of crops, cereals, canola, pulses and pastures, and crop sequences, based on soil and seasonal variables.
2. Integrating grain legume or oilseed varieties better suited to dry climates into crop sequences.
3. Growing crop or pasture mixtures such as a legume and an oilseed may increase benefits to subsequent cereals over that expected of component species. In addition, mixtures could have higher combined yields than component crops through more efficient partitioning of resources through space and time.
4. Multipurpose use of broad-leaf crops as grain, hay or forage based on seasonal and enterprise requirements.

Five major experiments are being undertaken in this project, one in each region of the five collaborating farming systems groups, but all combining the following features:

1. Located on long term wheat paddocks with a major problem (eg grassy weed (barley, brome or rye-grass), low N, high disease load (crown rot, rhizoctonia), resistant weeds).
2. Include break phases of 2 years in duration.
3. Include double plots as the basic experimental unit (one for grain yield, one for sacrificial monitoring and alternative end use – grazing, hay, brown manure)
4. In years 3 and 4, wheat will be seeded over the whole site – using early seeding, no till, inter-row in year 4.
5. All plots to be established with no-till, stubble retained, even if grazed or cut.
6. Two continuous wheat treatments will be maintained in each experiment. This will be the benchmark against which all break options will be compared.

All sites have been extensively characterised for initial soil fertility to depth, water holding characteristics, disease inoculum and microbial activity and weed seed banks. All break phase treatments are being monitored for establishment, early growth, peak biomass production and grain yield. In addition, dry matter cuts will be taken in appropriate subplots for simulated early grazing or hay cuts.

In the final two years of cereal production, not only will crop performance be monitored but also impacts of previous break phases on weed seed banks, soil fertility including microbial activity and disease inoculum loads.

Data will be used to calibrate APSIM modules for break crops under local conditions, so that performance of break phases can be simulated in seasons and soil types different to those experienced in these experiments.

Another separate activity in the project is that two commercial paddocks per targeted region will also be monitored. These paddocks will already be addressing a problem from a continuous cereal phase with at least 2 break options being tested in the same paddock. Similar protocols to those being used for monitoring in the five replicated field experiments will be undertaken in these commercial paddocks but with revised sampling intensities. Monitoring will be extended into the following cereal crops.

Agronomic outcomes from this project will be examined for their economic and risk impacts through existing activities of each group.

Extension of project outcomes will be achieved via the existing activities, networks and infrastructure of the 5 farming systems groups and the Low Rainfall Collaboration Project (another GRDC initiative) partnering in this project. A guide for improved decision making for the implementation and management of break phases in low rainfall south-eastern Australia will be developed and promoted to the regional communities as part of this project.

RESULTS

All five replicated experiments are now in place and commercial paddocks selected in each region (see Table 1 for experiment locations). Only initial baseline data and establishment of the first year of each break phase have been completed so far. Table 2 summarises the treatments from one field experiment as an example of the range of break options and end uses being investigated in this project.

Table 1. Locations and characteristics of five field experiments in south eastern Australia investigating break options for cereals.

Location	Region	Annual rainfall (mm)	Soil type	Paddock history	Emerging problem
Condobolin	Central NSW	457	Deep red earth	Legume based pasture followed by two wheat crops	Grassy weeds (mostly wild oats, rye-grass)
Birchip	Vic Mallee	328	Mallee sandy loam	At least 4 previous wheat crops	Brome grass
Mildura	Vic Millewa	273	Deep red sandy loam	At least 7 previous wheat crops	Brome grass, low N
Appila	Upper North, SA	384	Red brown earth	Droughted peas followed by 3 cereals	Rye grass, wild oats
Minnipa	Upper Eyre Peninsula, SA	345	Red brown earth	At least 5 previous wheat crops	Rye grass, low soil fertility, rhizoctonia

CONCLUSIONS

A successful conclusion to this project will result in more reliable and more productive low rainfall farming systems through the increased use of less risky broad leaved break phases. These breaks will increase subsequent cereal production, improve the economic impact of the break in those years of production and diversify farm incomes. Although more cereal crops will be replaced by break phases, the increased productivity of the cereals produced by the breaks will more than compensate for these replaced hectares.

The immediate beneficiaries will be growers whose farm businesses will become more sustainable and profitable. The landscape will also be less exposed to erosion risks because cereal breaks will be more viable. Farm biodiversity will also improve due to the more diversified crop sequences.

Local communities and businesses will receive flow on benefits from the improved outlook and profitability of farm businesses.

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Table 2. Break options for wheat under investigation at Mildura in a replicated field experiment.

Name of break option	Phase in year 1	Phase in year 2	End use option A	End use option B
Canola/Peas	Canola, TT	Peas	Grain	Hay
Canola/Chickpea	Canola, TT	Chickpea	Grain	Hay
Canola/Vetch	Canola, TT	Vetch	Grain	Hay
Peas/Canola	Peas	Canola, TT	Grain	Hay
Peas/Vetch	Peas	Vetch	Grain	Hay
Vetch/Canola	Vetch	Canola, TT	Grain	Hay
Vetch/Peas	Vetch	Peas	Grain	Hay
Chickpea/Canola	Chickpea	Canola, TT	Grain	Hay
Fallow/Canola	Fallow	Canola, CL	Grain	Hay
Fallow/Peas	Fallow	Peas	Grain	Hay
Fallow/Fallow	Fallow	Fallow	-	-
Improved Pasture/Pasture	Pasture, High seed bank	Pasture, volunteer	Graze	Hay
Pasture/Pasture	Pasture, Low seed bank	Pasture, volunteer	Graze	Hay
Wheat/Peas	Wheat	Peas	Grain	Hay
Wheat/Peas	Wheat	Canola CL	Grain	Hay
Canola+Peas/Wheat	Canola/Pea Mix	Wheat	Grain	Hay
Barley/Wheat	Barley (IT)	Wheat	Grain	Hay
Fallow/Fallow	Fallow	Fallow	-	-
Oats/Wheat	Oats	Wheat	Grain	Hay
Wheat/Wheat	*Wheat*	*Wheat*	*Grain*	*Hay*
Wheat/Wheat	*Wheat*	*Wheat*	*Grain*	*Hay*