Break crop production in southern low rainfall environments

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RESEARCH

Location:
Minnipa Agricultural Centre, paddock N9
Rainfall
Av. Annual: 325 mm
Av. GSR: 241 mm
2018 Total: 269 mm
2018 GSR: 208 mm
Paddock History
2018: Field pea
2017: Oat
2016: Barley
Soil Type
Loam
Plot Size
1.75 m x 10 m x 3 reps
Trial Design
Experimental: Split plot
Yield Limiting Factors
Moisture stress

Key messages

- **Field pea, vetch, faba bean and lentil had 3-125% higher biomass yield and 51-110% higher grain yield than chickpea and canola at Minnipa, 2018.**
- **Current high demand and grain prices for faba bean meant they were the most profitable break crop species.**
- **Low grain yield of canola (0.43 t/ha) and chickpea (0.39 t/ha) resulted in these crop species not being profitable as grain crops.**
- **Field pea and vetch, in particular, have multiple alternative end-use options in dry seasonal conditions that can be utilised to recover crop input costs.**

Why do the trial?

Current farming systems in the low rainfall zone of southern Australia are dominated by cereal production. There is increasing concern about grass weed and soil-borne disease pressure, as well as diminishing soil fertility (particularly nitrogen), and water use efficiency, as a result of continuously cropping cereals. Break crops have a key role to play in addressing these issues, as well as diversifying crop production and economic risk, and maintaining long-term sustainability of the system. However, there remains a lack of information available to growers about choosing the break crop best suited to their situation, as break crop development to date has largely occurred in medium and high rainfall zones. The aim of this research is to identify the best break crop options for different climate, soil type and biotic stress situations within major cropping regions of the southern low rainfall zone. This project builds on previous GRDC and SAGIT funded projects, including DAS00119 (profitable crop sequencing in the low rainfall areas of South Eastern Australia) and MS115 (adopting profitable crop sequences in the SA Mallee).

How was it done?

A break crop species-by-variety trial was conducted at Minnipa Agricultural Centre in 2018, to compare varieties of six break crop species. This trial was part of a wider program, with similar trials undertaken at four locations in 2017 across the southern low rainfall zone, and will be repeated again in 2019. The trials include three to six varieties (to represent major potential options for the low rainfall zone) of canola, lupin, field pea, vetch, lentil, chickpea, and faba bean. Lupin was not included at Minnipa, after consultation with local advisors as they are not suited to the environment. Varietal options included herbicide-tolerant varieties and those with potential for different end-uses. Measurements taken include site soil characteristics, soil moisture, grain yield, biomass yield and gross margin. Plot arrangement was in a split plot randomised design with three replicates, with break crop species assigned as the whole plot and variety as the sub plot. The use of this design ensures each break crop species receives appropriate management.

The trial was sown at Minnipa on 21 June 2018 using an experimental plot seeder with 27 cm row spacing. Biomass measurements were taken in early October at late flowering to early podding growth stage to identify potential use as a hay, forage or manure crop. Harvesting of the trial was conducted on 16 November 2018.

The data was analysed using Genstat 19th Edition, with gross margins calculated using the Rural Solutions 'Farm Gross Margin and Enterprise Planning Guide'. The costs were calculated using actual inputs in the trial and values provided in the gross margin guide.

What happened?

Many cropping regions across South Australia experienced dry seasonal conditions combined with low levels (2-12%) of stored soil moisture in 2018. Minnipa experienced below average rainfall from February to July. For this reason, sowing was delayed until late June, following 28 mm of rainfall in the two weeks prior.

Field pea (2.25 t/ha) had the highest biomass yield compared to other break crop species at Minnipa in 2018 (Figure 1). High biomass potential of field pea, combined with relatively early maturity, opens up potential alternative end-use options other than grain production such as hay, silage, or utilised as green manure in seasons where grain production may not be profitable. Chickpea had the lowest biomass yield compared to other break crop species, 56% lower than field pea. Canola, faba bean, lentil and vetch had similar biomass yields, and were 24-56% lower than field pea, but 36-71% higher than chickpea. Vetch, like field pea, is a versatile crop and has potential to be used for hay, forage, green manure or grain production.

The highest grain yields were from vetch, field pea, faba bean and lentil compared to canola and chickpea at Minnipa, in 2018 (Figure 2). Field pea demonstrates reliability and grain yield stability over variable seasonal conditions in low rainfall environments, compared to alternative break crop species. Canola and chickpea yields were similar, and 42% and 47% lower yielding than field pea, respectively. Canola emergence was poor in 2018 due to dry seasonal conditions. Successful canola establishment is generally achieved following at least 15 mm of rainfall over a three-day period at time of sowing.

With a gross margin of $300/ha, faba bean was the most profitable species at Minnipa in 2018 (Figure 3). This high return is in concurrence with current high demand and high grain prices for faba bean, and is unlikely to be sustained. If faba bean grain price is averaged over five years (2014-2018), faba bean remain profitable, with a gross margin of $85.26/ha. Field pea, lentil and vetch all had similar gross margins as grain crops, although relatively low at $24-$65/ha. Chickpea and canola were not profitable at Minnipa in 2018.

What does this mean?

Biomass and grain yield for field pea and vetch was higher than for other break crop species at Minnipa in 2018. Although faba bean grain yield was similar to field pea and vetch, current high demand and grain prices resulted in faba bean being the more profitable species. These high prices are unlikely to be sustained. However, faba bean remain profitable if grain price is averaged over five years.

Field pea continues to express its yield and biomass stability at Minnipa when compared to alternative break crop species. High biomass potential of field pea, as well as vetch, can provide potential end-use options and, in particular, have potential to salvage a financial return if a crop is frost or drought affected. Replicated trials will be sown in 2019 at multiple locations in order to further validate this research across the southern low rainfall zone.

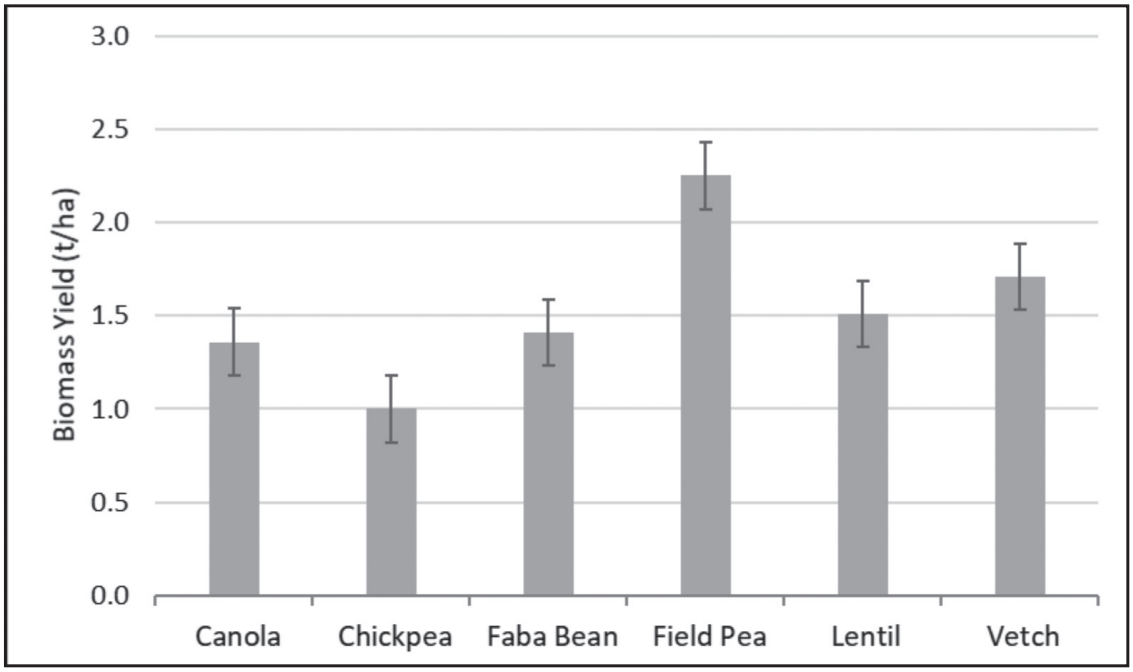

Figure 1 Biomass yield response of break crop species at Minnipa, 2018. Error bars represent least significant difference (0.238 t/ha).

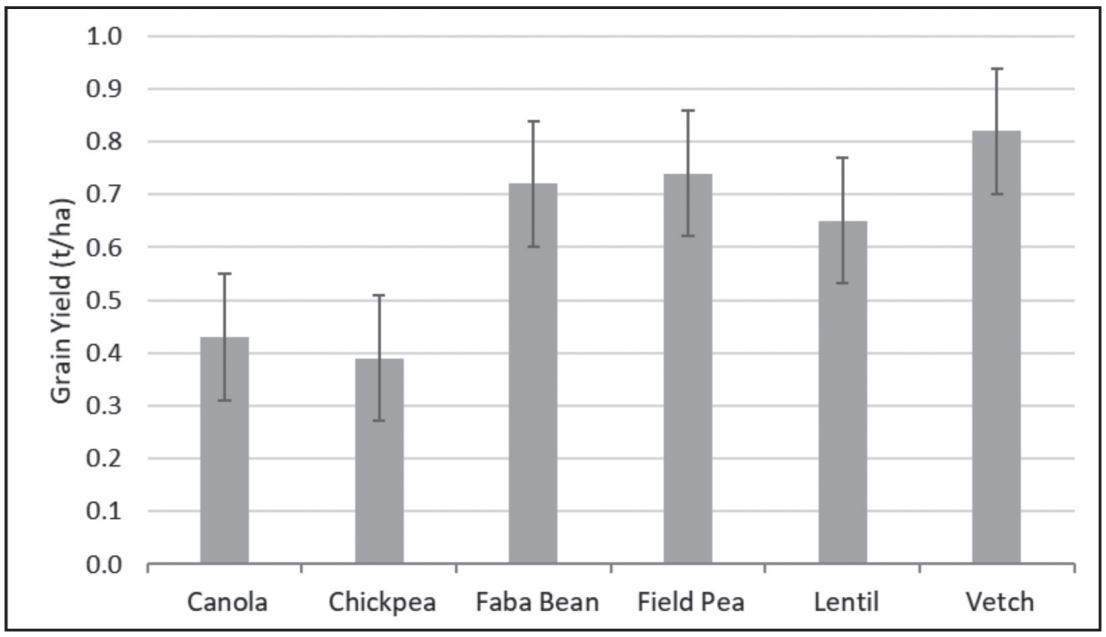

Figure 2 Grain yield response of break crop species at Minnipa, 2018. Error bars represent least significant difference (0.356 t/ha).

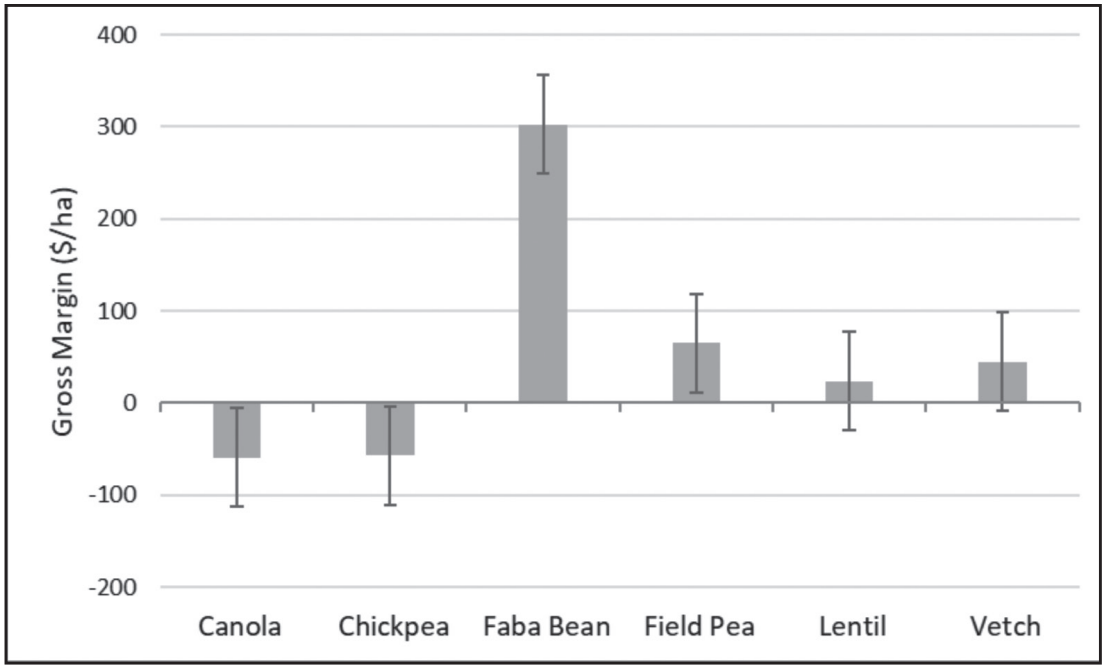

Figure 3 Gross margin response of break crop species at Minnipa, 2018. Error bars represent least significant difference ($107.50/ha).

**Note that gross margins represent average case scenarios and should be used as a guide only.*

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