Field pea and vetch forage options for low rainfall regions

Michael Lines¹, Larn McMurray¹ and Leigh Davis²

¹SARDI, Clare; ²SARDI, Minnipa Agricultural Centre

Key messages

- Vetches are a versatile break crop in low rainfall areas, offering both grain and ‘forage’ options.
- Dual purpose field pea varieties offer the flexibility of a forage option if grain yield is affected by seasonal stresses such as frost, and more established grain markets than vetch if taken through to harvest.
- The ideal timing of hay cutting is likely to be approximately 7-14 days after commencement of flowering (i.e. at early pod development, prior to grain fill).
- Biomass production averaged 2.8 t/ha at flowering and 3.8 t/ha at maturity across the trial.
- Kaspa, Morgan and PBA Coogee have generally shown similar but variable biomass levels at flowering in 2013, although Kaspa has generally shown higher grain yield.
- PBA Hayman generally shows higher biomass potential than other field pea varieties at flowering, comparison with vetch needs further evaluation.
- Biomass of field pea varieties at flowering was maximised at higher sowing densities, with no negative effect on grain yield.
- Further evaluation of these types is required across seasons varying in climatic conditions to assess their role, fit and management.

Why do the trial?

Pulse Breeding Australia (PBA) is focussed on developing field pea cultivars that will increase and stabilise production in environments characterized by variable soil types and low rainfall. Responding to industry feedback the PBA field pea program instigated a small but targeted program developing field peas for growing either as a forage or a dual purpose (grain or forage) crop. These lines have been characterised by high biomass production, improved bacterial blight resistance and (more recently) comparable grain yield with the straight grain varieties. Two varieties have recently been released: PBA Hayman and PBA Coogee (pronounced “Couldgee”). PBA Hayman was released as the first Australian forage field pea, while PBA Coogee has been released as a dual purpose field pea variety. Work funded by SAGIT has currently been assessing the biomass accumulation and grain yields in comparison with current field pea standards, Kaspa (the predominant grain yield variety in south eastern Australia) and Morgan (a dual purpose field pea variety) as well as several current vetch variety options. Minnipa Agricultural Centre is a key evaluation site of the project.

How was it done?

Two forage trials were set up; one to compare field pea and vetch varieties for biomass and grain yield potential, and the second to determine optimum sowing dates and sowing densities for maximising biomass production of field pea varieties. In the first trial, four field pea varieties (Kaspa, Morgan, PBA Coogee and PBA Hayman) and four vetch varieties (Morava, Rasina, Capello and the imminent new vetch release Volga) were sown on two sowing dates (5 May and 28 May). The second trial included four field pea varieties (Kaspa, Morgan, PBA Coogee and PBA Hayman) sown at four plant densities (25, 50, 75 and 100 plants/m²) at two sowing dates (5 May and 28 May). In both forage trials, biomass measurements were taken during flowering and at maturity. Cuts during flowering were timed to correlate with early pod development (1-2 pods per plant, approximately 10-14 days after commencement of flowering). Final grain yield was also recorded.
All trials were sown with 59 kg/ha of DAP (18:20:0:0). Metribuzin was applied post-sowing pre-emergent at 160 g/ha, and Select @ 300 ml/ha, Targa @ 150 ml/ha and Astound @ 300 ml/ha applied for in-crop grass control. No broadleaf weed control was necessary. Insect sprays were applied as required.

**What happened?**

Annual rainfall (334 mm) and growing season rainfall (237 mm) was close to average at Minnipa in 2013. Grain yields averaged 1.0 t/ha across the trial, buoyed by good winter rainfall and mild spring temperatures despite the dry finish to the season. Early season conditions were very favourable for plant growth, with warmer than average temperatures throughout winter, and yield potential was very high at the start of spring. However yields were limited by late season moisture stress. Low to moderate levels of blackspot were observed in trials in 2013. Some variation in growth was observed due to rhizoctonia infection, and may have suppressed growth and grain yield of field peas in these trials.

**Trial 1 Comparing performance of field pea and vetch cultivars**

Flowering records showed that both Morgan and PBA Coogee commenced flowering at a similar date to Kaspa (Table 1), while PBA Hayman was 13 days later. All field pea varieties except PBA Hayman flowered earlier than all vetch varieties. The common vetch varieties Rasina and Volga were earlier flowering than Morava and the woolly pod vetch type, Capello.

Delayed sowing from early May to late May resulted in reduced biomass yield at flowering and at maturity. This was equal to a 27% reduction in biomass at flowering and a 29% reduction in biomass at maturity (Table 2).

Biomass cuts taken at flowering and at maturity showed significant variety responses (Figure 1). At flowering, Morava vetch had higher biomass than all field pea varieties and the earliest flowering vetch Rasina. The higher biomass at flowering in Morava compared to the earlier flowering vetch variety Rasina is likely due to its later flowering time, enabling more biomass accumulation prior to reproductive growth. The dual purpose field pea Morgan produced less biomass than all vetch varieties at flowering, and less than Kaspa but similar to the other two field pea varieties in this trial. PBA Hayman showed only similar biomass production at flowering compared to other field pea varieties at Minnipa in 2013. All previous and concurrent trials in the Mid North have shown that PBA Hayman produces significantly greater biomass than other field pea varieties at this timing. Further work is required to evaluate this result at this site.

At maturity the three common vetch varieties, Morava, Rasina and Volga showed significantly greater biomass (including grain yield) than the wooly pod vetch Capello and all four field pea varieties. Capello and the field pea varieties generally performed similarly, except that PBA Hayman produced less total biomass at maturity than Capello and PBA Coogee.

A significant grain yield response (Figure 1) showed that Volga produced more grain than all other vetch or field pea varieties. Kaspa was the highest yielding field pea, performing significantly better than PBA Coogee and PBA Hayman but only similarly to Morgan. The dual purpose field pea varieties Morgan and PBA Coogee showed similar grain yields. As expected, the forage field pea PBA Hayman produced the lowest grain yield of all field pea varieties, and also showed lower grain yield than all vetch varieties.

<table>
<thead>
<tr>
<th>Field Pea</th>
<th>Variety</th>
<th>Kaspa</th>
<th>Morgan</th>
<th>PBA Coogee</th>
<th>PBA Hayman</th>
</tr>
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<tbody>
<tr>
<td>Flowering Date</td>
<td>11 Aug</td>
<td>12 Aug</td>
<td>9 Aug</td>
<td>24 Aug</td>
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<td>Flowering (days after sowing)</td>
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<table>
<thead>
<tr>
<th>Vetch</th>
<th>Variety</th>
<th>Morava</th>
<th>Rasina</th>
<th>Volga</th>
<th>Capello</th>
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<td>Flowering Date</td>
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<td>23 Sept</td>
<td>20 Aug</td>
<td>2 Sept</td>
<td></td>
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<tr>
<td>Flowering (days after sowing)</td>
<td>119</td>
<td>110</td>
<td>107</td>
<td>120</td>
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**Table 1 Flowering dates of field pea and vetch varieties, Minnipa 2013**

<table>
<thead>
<tr>
<th>Crop stage</th>
<th>Sowing Date</th>
<th>5 May</th>
<th>28 May</th>
<th>LSD (P&lt;0.05)</th>
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<tr>
<td>Flowering Biomass (tDM/ha)</td>
<td>3.19&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2.35&lt;sup&gt;b&lt;/sup&gt;</td>
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<tr>
<td>Maturity Biomass (tDM/ha)</td>
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<td>3.17&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.13</td>
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</tr>
</tbody>
</table>

**Table 2 Effect of sowing date on biomass production (tDM/ha) of field pea and vetch at flowering and maturity, Minnipa 2013**
Trial 2 Maximising biomass potential of field pea varieties through sowing date and plant density

A significant variety response for biomass production at flowering showed PBA Hayman to have higher biomass at flowering than the other three field pea varieties (Figure 2). The result from this trial reflects findings from other experiments in SA where PBA Hayman has shown consistently higher biomass yield than other varieties at flowering. Kaspa, Morgan and PBA Coogee all showed similar biomass at this timing. However, this is in contrast to the result from the previous trial, where PBA Hayman unexpectedly performed only similarly to other field pea varieties at this timing, and indicates variability in the previous trial possibly due to the presence of rhizoctonia.

A sowing date by sowing density interaction was identified for flowering biomass production (Figure 3). The lack of an interaction with variety means that all varieties behaved similarly for varying sowing date and densities. Both sowing dates showed an increase in biomass across all varieties as sowing density was increased, however this was more substantial at the later sowing date. Both sowing dates generally performed similarly at higher densities.

As for biomass production, a sowing date by sowing density interaction was identified for grain yield. The lowest density (25 plants/m²) at the late sowing date yielded lower than all other treatments (Figure 4). All other treatments performed similarly.

What does this mean?

Break crop choice has typically considered more than just profitability, particularly in instances where the primary purpose of the break crop is to improve the performance of the following, more valuable crop. Additional considerations include agronomic (eg. weed or disease control objectives, reduced fertiliser (N) requirements, specific crop requirements) and marketing issues (eg. ease of marketing and access to established markets).

Some specific considerations when comparing vetch and field pea as break crop options include the end-use goal (i.e. grain yield, brown manure, hay), post-emergent weed control options, hard seededness and potential to carry through to the following crop, and ease of marketing. Vetches are a versatile break crop that can be used for forage (grazing, hay, silage and green/brown manure) or grain production. However they lack a well-established grain market, have generally low biomass production and weed competition through the winter months compared to other break crops, have few post-emergent in-crop weed control options, and have the potential to contribute to weed burdens in paddocks through the production of hard seeds. The development of dual purpose and forage field pea varieties give growers a competitive alternative to vetch and other current break crop options. Dual purpose field pea varieties also give growers the flexibility to react to seasonal conditions eg. frost, drought, or high grain prices for opportunistic grain production.
Vetch and field pea varieties performed relatively well at Minnipa in 2013, despite the dry and rapid finish to the season. This is likely due to high winter rainfall and warm winter temperatures throughout the growing season. The warm winter is likely to have been of particular benefit to vetch, which generally show restricted growth in cool winters. Vetch generally showed equal or greater performance to field pea cultivars at Minnipa in 2013 for the three parameters measured: grain yield and biomass production at flowering and at maturity.

Cuts during flowering were timed to correlate with the development of 1-2 pods per plant (10-14 days after commencement of flowering). This timing is seen as the ideal time for hay cutting to optimise both biomass production and curing time (due to the difficulty of drying down pods). Later flowering varieties have generally shown higher biomass production at this timing than earlier flowering varieties (eg. PBA Hayman and Morava vetch). This characteristic will also promote hay quality by extending the timing of cutting into more favourable (warmer and quicker) curing conditions compared to earlier flowering varieties. This is a significant benefit of the forage field pea variety PBA Hayman, which often flowers 2 or more weeks later than other field pea varieties, and at a similar time to vetch.

PBA Hayman showed similar biomass at flowering to dual purpose (Morgan and PBA Coogee) and grain (Kaspa) field pea varieties in one trial at Minnipa in 2013. However this does not reflect results from the second trial at Minnipa, or trials at other sites in 2012 and 2013, where PBA Hayman showed significantly higher biomass at flowering than other field pea varieties. In trials at Hart and Tarlee in 2013, PBA Hayman showed 38-74% higher biomass than Kaspa at flowering when sown early, and 21-27% higher biomass when sown late. The presence of rhizoctonia in the trials at Minnipa suggest that biomass and grain yield of field pea may have been suppressed, and may be responsible for some unexpected results such as the lower biomass production from PBA Hayman in Trial 1.

At other sites in 2013, PBA Hayman produced significantly greater biomass than vetch varieties at flowering, but similar at later sowing dates. However, vetch varieties generally showed equal or greater biomass than the grain and dual purpose field pea varieties, Kaspa, Morgan and PBA Coogee across the three sites.

Kaspa has generally shown similar biomass production at flowering to the dual purpose field pea varieties (Morgan and PBA Coogee) across trials in 2012 and 2013, and has shown equal or greater grain yield. PBA Coogee has shown variable results across sites to date, ranging from lower grain yield than Morgan to equal grain yield to Kaspa. PBA Coogee showed lower relative grain yield at Tarlee in 2013, where it produced significantly greater biomass than Kaspa or Morgan. Consequently, the dry and rapid season finish in 2013 may have caused this variety to ‘hay off’ (where high biomass production leaves insufficient moisture for grain fill) at this site.
New varieties of field pea and vetch are now available which provide alternative forage opportunities. PBA Hayman is a forage field pea variety, which generally has lower grain yield than Morgan (which has been considered a dual purpose variety) but has higher biomass production. It also has improved bacterial blight resistance compared to most other varieties, but lower grain yield, indicating that grain retrieval may be difficult in low rainfall areas. However, due to its lower seed weight (averages 14 g/100 seeds compared with 20-25 g/100 seeds in other varieties) seed requirements for sowing are significantly lower.

PBA Coogee has been released as a dual purpose field pea variety that provides the flexibility of a forage option if frost or drought limits grain yield potential. PBA Coogee has a conventional plant type similar to the variety Parafield but with increased early season growth, more basal branching, longer vines and higher grain yield. It also shows improved tolerance to soil boron and salinity compared to all other field pea varieties, and is resistant to powdery mildew and moderately resistant to bacterial blight.

Volga is a highly rust resistant common vetch variety with good early establishment and early maturity (7-12 days earlier maturing than Rasina). Volga is early flowering, and will reach full flowering in 90-100 days from sowing. So far it is the best adapted vetch variety for grain and hay production in low/mid rainfall areas such as the SA Mallee, Mid North and Eyre Peninsula. Like other common vetch varieties, grain of Volga can be used to feed ruminant stock, whereas grain of woolly pod varieties such as Capello must not be used to feed livestock. Volga is currently undergoing seed bulk-up.

These SAGIT funded trials will continue in 2014, together with similar trials at Tarlee and Hart in the Mid North, and Lameroo in the Mallee. Additionally, nitrogen fixation and feed quality tests will be conducted on samples from the 2013 and 2014 trials. This will provide additional information to grain yield and biomass data, which will give growers with a holistic comparison of vetch and field pea break crops in South Australia.