Forage peas – a potential new break crop option for SA

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Key findings

- Biomass production at Hart in 2013 averaged 4.2 t/ha at the early pod development stage, and 5.0 t/ha at maturity across the trial.
- Kaspa, Morgan and PBA Coogee have generally shown similar biomass levels at flowering in 2013, although Kaspa has shown higher grain yield.
- PBA Hayman produced the highest biomass of all the field pea and vetch varieties at the early pod development stage, particularly when sown early.
- Vetch varieties showed equal or greater biomass to Kaspa, Morgan and PBA Coogee at the early pod development stage, but lower than PBA Hayman.
- Biomass of field pea varieties at flowering was maximised at higher sowing densities (75 and 100 plants/m^2), however this resulted in yield loss at some sites.

Why do the trials?

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. Key trial sites in the Mid-North include Hart and Tarlee.

Break crop choice typically considers more than just profitability. 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.

How was it done?

Plot size	1.75 m x 10 m	**Fertiliser rate**	MAP (10:22) + 2%Zn @ 90 kg/ha

Trial 1: Comparing performance of field pea and vetch cultivars

Varieties	Field peas; Kaspa, Morgan, PBA Hayman and PBA Coogee Vetch; Morava and Rasina (common vetch), Capello and RM1 (woolly pod vetch)
Sowing dates	13th May and 7th June 2013
Sowing Density	Field pea: 50 plants per square metre; vetch: 70 plants per square metre

Trial 2: Maximising biomass potential of field pea varieties through sowing date and plant density

Varieties	Field peas; Kaspa, Morgan, PBA Hayman and PBA Coogee
Sowing dates	13th May and 7th June 2013
Plant densities	25, 50, 75 and 100 plants per square metre
Trial designs	The trials were set up as split plot design with three replicates. The blocking structure was set up with replicates as the main block, sowing date as whole plot, and varieties and treatments randomised in subplots.

Results

Annual rainfall was 377 mm at Hart in 2013, slightly below the long term average (400 mm). Grain yields averaged 1.9 t/ha across the trials, buoyed by good winter rainfall and mild spring temperatures, despite the dry finish to the season. Early season conditions were favourable for plant growth, with warmer than average temperatures throughout winter, with high yield potential at the start of spring. Low levels of ascochyta and botrytis were observed in field pea and vetch respectively.

Biomass at ten weeks after sowing

Trial 1: Comparing performance of field pea and vetch cultivars

Biomass cuts were performed at ten weeks after sowing (10WAS) to compare early (winter) biomass production of field pea and vetch varieties at Hart and Tarlee. Biomass production during winter is considered important for early weed competition.

Dual purpose varieties Morgan and PBA Coogee showed higher early biomass when sown early compared to PBA Hayman and the vetch varieties. The most commonly grown vetch line, Morava, showed similar early biomass to Kaspa peas. All other vetch varieties produced less early biomass compared to the field peas, except for PBA Hayman. At the late sowing date, field peas showed similar biomass levels, together with Rasina and RM1, while Morava and Capello produced less biomass.

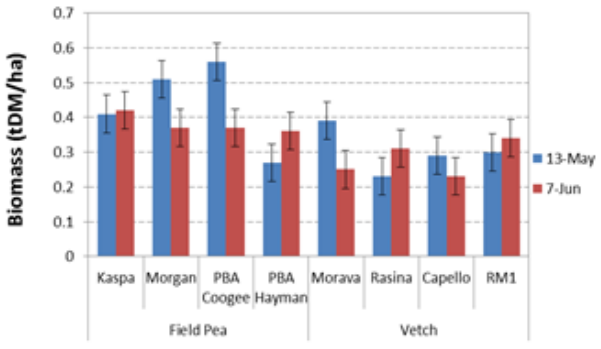

Figure 1. Effect of sowing date on early biomass (10WAS) of field pea and vetch varieties, Hart 2013.

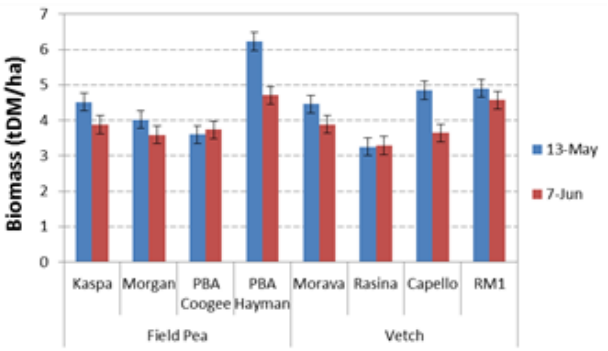

Figure 2. Effect of sowing date on biomass production of field pea and vetch varieties at the early pod development stage (EPDS), Hart 2013.

Biomass at the early pod development stage (EPDS)

Trial 1: Comparing performance of field pea and vetch cultivars

Biomass cuts were taken at early pod development (1-2 flat pods per plant, occurring approximately 10-14 days after flower commencement) as an indication of potential hay production. Biomass averaged 4.2 t/ha at Hart and 5.0 t/ha at Tarlee across all varieties at the early pod development stage (EPDS).

At both sites, PBA Hayman produced significantly higher biomass compared to all other field pea and vetch varieties when sown early. When sowing was delayed PBA Hayman produced substantially less biomass than when it was sown early, producing similar biomass to some vetch varieties but more biomass than other field pea varieties (Figure 2).

PBA Hayman showed the largest response to sowing date, with 24% and 30% reductions in biomass from delayed sowing at the EPDS at Hart and Tarlee, respectively. Kaspa, Morgan and PBA Coogee showed some variability across sites, but generally showed relatively similar biomass at the EPDS. Early sown Kaspa produced more biomass than Morgan and PBA Coogee at the EPDS at Hart, while early sown PBA Coogee showed higher biomass than the other grain varieties at Tarlee.

Trial 2: Maximising biomass potential of field pea varieties through sowing date and plant density

Field peas showed significant variety and sowing density responses for biomass at the EPDS, but no significant response to sowing date (Table 1). The grain and dual purpose pea varieties Kaspa, Morgan and PBA Coogee showed similar biomass at the EPDS at Hart and Tarlee in 2013 (Table 1). As in Trial 1, PBA Hayman showed significantly greater biomass than the other three varieties at the EPDS, ranging from 27-55% greater biomass at this timing.

Sowing density had a significant effect on biomass at the EPDS at Hart and Tarlee (Table 2). The lack of an interaction with variety means that all varieties behaved similarly at the different density treatments. Sowing field peas at 25 plants/m^2 (half the recommended sowing rate for grain production) reduced biomass by 18% at both Hart and Tarlee (Table 2).

Table 1. Biomass production (t/ha) of field pea varieties at the early pod development state (EPDS), Hart and Tarlee, 2013. Significantly different treatments are followed by a different letter.

Site	Kaspa	Morgan	PBA Coogee	PBA Hayman	LSD (P≤0.05)
Hart	3.61 [a]	3.30 [a]	3.60 [a]	5.11 [b]	0.40
Tarlee	3.98 [l]	3.81 [l]	3.67 [l]	5.06 [m]	0.53

Table 2. Effect of sowing density (plants per square metre) on biomass production (t/ha) of field peas at the early pod development state (EPDS), Hart and Tarlee, 2013. Significantly different treatments are followed by a different letter.

	Plant Density (plants/m^2)				
Site	**25**	**50**	**75**	**100**	**LSD (P≤0.05)**
Hart (both sowing dates)	3.44 [a]	3.95 [b]	4.02 [b]	4.20 [b]	0.36
Tarlee (both sowing dates)	3.66 [l]	4.17 [m]	4.21 [m]	4.49 [m]	0.32

Biomass at maturity

Trial 1: Comparing performance of field pea and vetch cultivars

At Hart for each sowing date (Figure 3), biomass of all field pea varieties except Morgan was maximised by early sowing. Capello was the only vetch variety to show a sowing date response, where biomass at maturity was maximised from delayed sowing. Field pea varieties showed equal or higher biomass from early sowing, while vetch varieties showed equal or higher biomass from delayed sowing.

Despite showing significantly greater biomass at the EPDS, PBA Hayman showed similar biomass to other field pea varieties at maturity, likely due to its significantly lower grain yield. Kaspa showed equal or greater biomass than all other varieties at maturity, except when sown late at Hart.

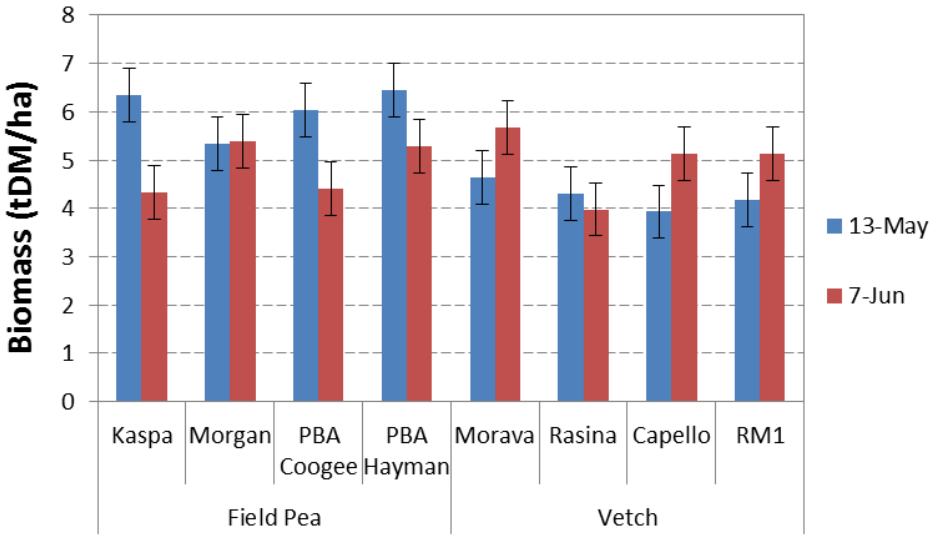

Figure 3. Effect of sowing date on biomass production of field pea and vetch varieties at maturity, Hart 2013.

Grain yield

Trial 1: Comparing performance of field pea and vetch cultivars

Kaspa was the highest yielding variety at both Hart and Tarlee in 2013 (Table 3). Morgan and PBA Coogee produced higher grain yield at Hart and Tarlee than all vetch varieties except Rasina.

Rasina was the highest yielding vetch variety at both Hart and Tarlee, producing 14-28% higher grain yield than Morava. Grain yield of the woolly pod vetches Capello and RM-1 (which should not be used for feeding livestock) was generally lower than common vetches, and similar to PBA Hayman.

Trial 2: Maximising biomass potential of field pea varieties through sowing date and plant density

There was no significant sowing date response on grain yield at Tarlee in 2013. At Hart, Kaspa and Morgan were the only varieties to display a sowing date response, showing higher grain yields from earlier sowing. All other varieties performed similarly at both sowing dates.

At both sites sowing density had a significant effect on grain yield (Table 4). Sowing field peas at 75 plants/m^2 and greater resulted in an 8-10% yield loss at Hart, while the highest density (100 plants/m^2) resulted in a 13% yield loss at Tarlee.

Table 3. Grain yield (t/ha) of field pea and vetch varieties at Hart and Tarlee, 2013. Significantly different treatments are followed by a different letter for each site.

Site	Crop	Field Pea				Vetch				LSD (P≤0.05)
	Variety	Kaspa	Morgan	PBA Coogee	PBA Hayman	Morava	Rasina	Capello	RM1	
Hart	**13 May**	2.71 [a]	2.23 [bcd]	2.08 [def]	1.49 [ij]	1.72 [h]	2.12 [cde]	1.68 [hi]	1.42 [j]	0.19
	7 June	2.32 [b]	1.92 [fg]	2.03 [ef]	1.34 [j]	1.78 [gh]	2.28 [bc]	1.63 [hi]	1.4 [j]	
Tarlee (both sowing dates)		3.74 [a]	2.98 [b]	2.66 [c]	1.24 [e]	2.28 [d]	2.61 [c]	1.15 [e]	1.05 [e]	0.28

Table 4. Effect of sowing density (plants per square metre) on grain yield (t/ha) of field peas at Hart and Tarlee, 2013. Significantly different treatments are followed by a different letter for each site.

	Plant Density (plants/m^2)				LSD (P≤0.05)
Site	**25**	**50**	**75**	**100**	
Hart	1.89 [AB]	1.97 [A]	1.81 [B]	1.78 [B]	0.12
Tarlee	2.31 [A]	2.38 [A]	2.21 [AB]	2.08 [B]	0.20

Discussion

The warm winter in 2013 was favourable for early biomass production, and high levels of biomass were measured. This is likely to have been of particular benefit to vetch, which generally show restricted growth in cool winters. Field pea varieties at Hart and Tarlee in 2013 showed equal or greater performance to vetch cultivars for the three parameters measured; grain yield and biomass production at flowering and at maturity. In another trial at Minnipa (Upper Eyre Peninsula), vetch showed equal or greater performance to field pea cultivars for these three parameters. Hence, further comparison is required in seasons with closer to average temperatures.

Field peas displayed a substantially larger canopy at ten weeks after sowing compared to vetch, but only showed equal or slightly greater early biomass due to higher moisture content (data not shown). It is possible that the larger canopy and the generally larger biomass of field peas may provide increased competition with weeds compared to vetches.

Later flowering varieties have generally shown higher biomass production at the EPDS 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 significantly higher biomass at flowering than other field pea varieties at Hart and Tarlee in 2013, producing 38-74% greater biomass than Kaspa at flowering when sown early, and 21-27% higher biomass when sown late. Early sown 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.

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. The performance of PBA Coogee has been variable 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. 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.

Biomass production of field peas at flowering time was maximised by sowing at 50 plants/m^2 (the recommended density for grain production) and greater at Hart and Tarlee. In a trial at Minnipa, increasing the sowing density was required to avoid biomass loss caused by delayed sowing, and late sown plots with high sowing densities were able to achieve biomass yields similar to early sown plots. This information is valuable in situations where sowing is delayed due to either a late season break or where blackspot risk is high due to low summer rainfall. Grain yield was generally not compromised by increasing sowing density at Minnipa, however sowing at 75 plants/m^2 and greater resulted in yield losses at Hart and Tarlee compared to sowing at 50 plants/m^2. Further validation across seasons is required.

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. PBA Hayman 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 a holistic comparison of vetch and field pea break crops in South Australia.