PULSE VARIETY AND SOWING TIME IN NORTH CENTRAL VICTORIA

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TAKE HOME MESSAGES

- With a strong hay market this year, field pea and vetch hay proved the most economical.
- Field peas were the best performing grain crop.
- Sowing date has had a big impact on yields (hay or grain) in this season.

BACKGROUND

As farming systems in the North Central region evolve, the need for a profitable break crop in the farming rotation is increasing. Traditionally, this has existed in the form of vetch and canola however higher global demand for pulses for human consumption has resulted in an increase in production. With this comes a shift to sowing these crops in areas that are not as well adapted. It is important to understand the suitability of certain varieties to these newer, non-traditional areas and the soil constraints they face. Moreover, it is important to understand where the various crops fit into the sowing program and overall farming system to maximise the opportunities they present.

AIM

To compare the performance of a range of pulse varieties and sowing dates in two contrasting soil types in North Central Victoria.

PADDOCK DETAILS

Location:	Pyramid Hill East	Pyramid Hill West
Crop year rainfall (Nov-Oct):	218mm	273mm
GSR (Apr-Oct):	158mm	158mm
Starting soil PAW (0-70cm):	0mm	9mm
Paddock history:	2018 Barley	2018 Barley
pH $CaCl_2$ (0-10cm):	5.1	5.7
EC ds/m (40-70cm):	0.3	3.6
Chloride mg/kg (40-70cm):	18	1200

TRIAL DETAILS

Crop types:	Refer to Tables 2-10
Treatments:	Refer to Tables 2-10
Seeding equipment:	Knife points, press wheels, 30cm row spacing
Sowing date:	12 April 2019 14 May 2019 5 June 2019
Replicates:	Three
Harvest date:	12 and 13 November 2019

TRIAL INPUTS

Nutrition, weeds, insects and disease were managed as per best practice.

METHOD

A series of replicated field trials was established on two contrasting soil types to compare the performance of a range of varieties at three sowing dates. The two sites were chosen to be representative of the varying soil types within the region, with the major difference being high salinity at the Pyramid Hill West site. Hay yield estimates were undertaken through biomass cuts as the varieties reached the flat pod growth stage.

RESULTS AND INTERPRETATION

Overall

The 1 May break and good growing conditions in the early part of the season resulted in good crop growth and biomass production. Tough spring conditions experienced in 2019 prevented the increased biomass from translating into higher grain yields and, in some instances, resulted in lower grain yields due to moisture depletion. In a Decile 1 season, vetch and pea hay were the most profitable crops, but all commodities proved profitable when sown in the optimum window.

Vetch

Vetch hay yields ranged from 4.9t/ha when sown at the earliest sowing time to as low as 1.9t/ha when sown at the latest (Table 2). Given the good early growing conditions and tough spring conditions, earlier sowing of all vetch varieties resulted in significantly higher yields when compared to the latest sown. Differences between the first two sowing times varied with variety, particularly maturity – yields of longer season varieties fell more dramatically with later sowing dates than the quicker maturing varieties. Volga looks to be a versatile variety, performing reasonably well across the range of sowing dates and soil types. When considering vetch variety choice, yield is the most important factor, however also consider logistics around sowing, cutting, bailing and grain harvest.

Table 2. Hay yield (t/ha) of vetch varieties across three times of sowing (TOS) and two sites.

	Pyramid Hill East				Pyramid Hill West				Average
Variety	**TOS1**	**TOS2**	**TOS3**	**Average**	**TOS1**	**TOS2**	**TOS3**	**Average**	
Volga	4.9	4.6	3.1	4.2	4.3	3.8	3.1	3.7	*3.9*
Timok	4.9	4.1	2.5	3.8	3.9	3.5	2.9	3.4	*3.5*
Morava	4.5	4.0	2.8	3.7	3.5	3.0	2.3	2.9	*3.2*
RM4	3.9	3.6	2.2	3.2	4.5	3.2	2.5	3.4	*3.2*
Rasina	4.3	3.6	2.2	3.4	4.0	2.9	2.3	3.0	*3.1*
Popany	4.3	3.1	1.9	3.1	4.1	3.6	1.9	3.2	*3.0*
Average	*4.5*	*3.9*	*2.4*	*3.6*	*4.0*	*3.3*	*2.5*	*3.3*	
Sig. diff.									
Variety		**0.014**				**0.007**			
TOS		**<.001**				**<.001**			
Variety x TOS		**NS**				**NS**			
LSD (P=0.05)									
Variety		**0.7**				**0.4**			
TOS		**0.5**				**0.3**			
Variety x TOS		**NS**				**NS**			
CV%		**19.0**				**13.6**			

Field pea

Field peas are a versatile pulse within the farming system as they can be grown for grain, hay, grazing, or as a green/brown manure crop. They also are suited to a wide range of soil types and environments, offering flexibility within the farming system. PBA Wharton and PBA Butler were the better performing varieties in these trials (Table 3). Some of the breeding lines showed potential as emerging varieties, particularly two Kaspa seed types OZP1603 and OZP1408 (Table 4). OZP1408 looks to have increased tolerance to salinity which may present an opportunity in years to come.

Bacterial blight was not an issue in these trials, but it has been a challenge for many field pea growers in 2019. PBA Butler has the highest level of genetic resistance of the current commercial varieties and may be a favourable option for managing this risk. In terms of sowing dates, there's an opportunity to move field peas slightly earlier in the sowing program – the earlier sowing times resulted in significantly higher yields at the western site. The highest yields at the eastern site were achieved with the middle sowing date, followed by the earliest, indicating a far greater penalty from sowing late.

Table 3. Grain yield (t/ha) of field pea varieties across the three sowing dates and two sites.

	Pyramid Hill East				Pyramid Hill West				*Average*
Variety	**TOS1**	**TOS2**	**TOS3**	**Average**	**TOS1**	**TOS2**	**TOS3**	**Average**	
PBA Wharton	1.39	1.46	0.88	1.24	1.99	1.78	1.46	1.74	*1.45*
PBA Butler	1.08	1.26	0.75	1.03	2.08	1.83	1.39	1.76	*1.34*
PBA Coogee	0.77	0.84	0.89	0.83	1.96	1.62	1.61	1.73	*1.24*
PBA Hayman	0.25	0.43	0.43	0.37	1.20	1.29	0.91	1.13	*0.74*
Average	*0.87*	*1.00*	*0.74*	*0.87*	*1.81*	*1.63*	*1.34*	*1.59*	
Sig. diff.									
Variety			**<.001**				**0.004**		
TOS			**<.001**				**0.021**		
Variety x TOS			**<.001**				**NS**		
LSD (P=0.05)									
Variety			**0.09**				**0.37**		
TOS			**0.08**				**0.32**		
Variety x TOS			**0.15**				**NS**		
CV%			**10.4**				**23.8**		

Table 4. Grain yield (t/ha) of field pea varieties and breeding lines across the two sites sown 14 May (TOS2).

Variety	**Pyramid Hill East**	**Pyramid Hill West**	***Average***
OZP1603	1.41	1.96	*1.69*
OZP1408	1.27	2.01	*1.64*
OZP1702	1.40	1.80	*1.60*
OZP1604	1.27	1.54	*1.41*
PBA Wharton	1.46	1.78	*1.62*
PBA Butler	1.26	1.83	*1.54*
PBA Coogee	0.84	1.62	*1.23*
PBA Hayman	0.43	1.29	*0.86*
Sig. diff.	**<.001**	**NS**	
LSD (P=0.05)	**0.20**	**NS**	
CV%	**9.7**	**19.4**	

Pea hay yields were generally good, ranging from 2.2t/ha to 5.3t/ha (Table 5 and Table 6). PBA Butler appears an adaptable option with steady grain and hay yields across a range of sowing dates and environments. PBA Hayman has not displayed any major yield benefits in comparison to the dual-purpose types in terms of hay yield. As is the case with vetch hay, the earlier sown treatment performed significantly better than the later sown.

Table 5. Hay yield (t/ha) of field pea varieties across times of sowing (TOS) and two sites.

	Pyramid Hill East				Pyramid Hill West				
Variety	**TOS1**	**TOS2**	**TOS3**	**Average**	**TOS1**	**TOS2**	**TOS3**	**Average**	***Average***
PBA Butler	4.9	4.3	2.9	4.0	4.1	4.4	3.0	3.8	*3.9*
PBA Hayman	4.9	4.2	2.2	3.7	5.3	4.4	3.0	4.2	*3.8*
PBA Coogee	4.9	4.6	2.5	4.0	5.0	2.8	2.9	3.6	*3.6*
PBA Wharton	4.4	3.7	2.3	3.4	4.0	3.5	2.9	3.5	*3.4*
Average	*4.8*	*4.2*	*2.5*	*3.8*	*4.6*	*3.8*	*3.0*	*3.8*	
Sig. diff.									
Variety			**NS**				**NS**		
TOS			**<.001**				**<.001**		
Variety x TOS			**NS**				**0.028**		
LSD (P=0.05)									
Variety			**NS**				**NS**		
TOS			**0.4**				**0.5**		
Variety x TOS			**NS**				**1.0**		
CV%			**13.1**				**15.1**		

Table 6. Hay yield (t/ha) of field pea varieties and breeding lines across the two sites sown 14 May (TOS2).

Variety	**Pyramid Hill East**	**Pyramid Hill West**	***Average***
PBA Butler	4.3	4.4	*4.3*
PBA Hayman	4.2	4.4	*4.3*
OZP1408	3.9	3.6	*3.8*
OZP1702	4.0	3.3	*3.7*
PBA Coogee	4.6	2.8	*3.7*
PBA Wharton	3.7	3.5	*3.6*
OZP1603	3.8	3.3	*3.5*
OZP1604	3.8	2.3	*3.0*
Sig. diff.	**NS**	**0.008**	
LSD (P=0.05)	**NS**	**1.0**	
CV%	**15.1**	**17.1**	

Lentil

The two lentil varieties in these trials performed much the same, providing some opportunities for flexibility in weed management and crop rotation decisions (Table 7). The middle sowing time was the best performer across the two sites. The imi tolerant PBA HallmarkXT presents a good opportunity for paddocks with heavy weed burdens, or those with Group B herbicide residues.

Table 7. Grain yield (t/ha) of lentil varieties across the three sowing dates and two sites.

	Pyramid Hill East				Pyramid Hill West				*Average*
Variety	**TOS1**	**TOS2**	**TOS3**	**Average**	**TOS1**	**TOS2**	**TOS3**	**Average**	
PBA Bolt	0.47	0.90	0.77	0.71	0.79	1.12	0.90	0.94	*0.85*
PBA Hallmark XT	0.61	0.81	0.68	0.70	0.75	1.16	0.90	0.94	*0.85*
Average	0.54	0.85	0.73	0.71	0.77	1.14	0.90	0.94	
Sig. diff.									
Variety			**NS**				**NS**		
TOS			**<.001**				**0.003**		
Variety x TOS			**0.012**				**NS**		
LSD (P=0.05)									
Variety			**NS**				**NS**		
TOS			**0.08**				**0.18**		
Variety x TOS			**0.11**				**NS**		
CV%			**8.6**				**14.7**		

Chickpea

Chickpeas performed poorly this season with yields ranging from 0.24t/ha to 0.48t/ha (Table 8). High salinity at the western site was a major limiting factor. With such low yields no significant differences were observed between sowing dates.

Table 8. Grain yield (t/ha) of PBA Striker chickpeas across the three sowing dates and two sites.

	Pyramid Hill East				Pyramid Hill West				*Average*
Variety	**TOS1**	**TOS2**	**TOS3**	**Average**	**TOS1**	**TOS2**	**TOS3**	**Average**	
PBA Striker	0.36	0.48	0.40	0.41	0.24	0.28	0.24	0.26	*0.34*
Sig. diff.			**NS**				**NS**		
LSD (P=0.05)			**NS**				**NS**		
CV%			**12.8**				**8.0**		

Lupin

Lupins performed poorly in this environment, however the earlier sowing dates appeared to perform better (Table 9). Similar to chickpeas, high salinity at the western site was a major limiting factor for production.

Table 9. Grain yield (t/ha) of Mandelup lupins across the three sowing dates and two sites.

	Pyramid Hill East				Pyramid Hill West				*Average*
Variety	**TOS1**	**TOS2**	**TOS3**	**Average**	**TOS1**	**TOS2**	**TOS3**	**Average**	
Mandelup	0.35	0.32	0.17	0.28	0.19	0.19	0.08	0.15	*0.21*
Sig. diff.			**<.001**				**NS**		
LSD (P=0.05)			**0.04**				**NS**		
CV%			**8.9**				**65.6**		

Faba bean

Given the seasonal conditions, faba bean yields were reasonable, ranging from 1.25t/ha to 0.41t/ha (Table 10). Earlier sowing and biomass production have been major advantages in improving yields.

Table 10. Grain yield (t/ha) of PBA Marne faba beans across the three sowing dates and two sites. *Yield for PBA Samira was deduced from corresponding treatment in adjacent inoculant performance trial.*

	Pyramid Hill East				Pyramid Hill West				*Average*
Variety	**TOS1**	**TOS2**	**TOS3**	**Average**	**TOS1**	**TOS2**	**TOS3**	**Average**	
PBA Marne	1.02	0.90	0.41	0.77	1.01	0.97	0.53	0.84	*0.78*
PBA Samira						*1.25**			
Sig. diff.			**0.014**				**0.021**		
LSD (P=0.05)			**0.23**				**0.24**		
CV%			**7.0**				**6.6**		

*From adjacent inoculant trial

COMMERCIAL PRACTICE AND ON-FARM PROFITABILITY

Given excellent early growing conditions and strong demand for hay, resulting in above average prices, vetch and field pea hay proved to be the most profitable approach in this season (Table 11). This depends on capital investment in machinery – the upside is greater if you already own the equipment. The best performing grain crop was field peas followed by faba beans. Due to the multiple options possible from field peas, they present a slightly lower risk profile than some other pulse crops.

Table 11. Partial gross margin from the highest yielding varieties/treatments in these trials.

	Lentil	Vetch Hay	Field Pea	Field Pea Hay	Chickpea	Faba Bean	Lupin
Variety **TOS** **Location**	Hallmark TOS2 West	Volga TOS1 East	Butler TOS1 West	Hayman TOS1 West	Stricker TOS2 East	Samira TOS2 West	Mandelup TOS1 East
Yield (t/ha)	1.16	4.9	2.08	5.3	0.48	1.25	0.35
Price ($/t)	496	315	421	315	776	478	538
Income ($/ha)	575	1544	876	1670	373	598	188
Input Costs ($/ha)	200	166	194	194	270	183	183
Gross Margin ($/ha)	375	1378	682	1476	103	415	5

When managed appropriately – with timely sowing and variety choice – all crops achieved break even yields. In a season like this, the impact of sowing outside the optimum window resulted in significant yield penalties. Delayed sowing should generally be avoided, unless there is a strategic reason to do so (disease, weed, frost management, etc.). The detrimental impacts of late sowing, caused by heat stress and low spring rainfall, will generally be more pronounced than frost-related penalties from earlier sowing.

When making crop rotation decisions, it is important to consider a range of factors, including logistics. Small areas of pulses sown in the overall farming system may allow for some risk to be spread as well as providing some flexibility in logistics. The potential benefits from a pulse crop on the following crop, while difficult to quantify, should not be dismissed, particularly for managing weeds and diseases. In addition, the residual soil nitrogen (N) provided by these pulse crops should be considered, with faba beans, field peas and vetch generally contributing more to soil N than chickpeas and lentils (Seymour *et al.* 2018).

REFERENCES

Seymour N., McKenzie K., Krosch S., 2018, *GRDC update papers* 'How much nitrogen is fixed by pulse crops and what factors affect fixation'.

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