Southern PULSE Agronomy

2012 Results Summary

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PBA Ace and PBA Bolt Release – Curyo Pulse Field Day 2012

Results from the DPIVic, SARDI, NSW DPI and GRDC funded project: 'Expanding the Use of Pulses in South-Eastern Australia (DAV00113)'.

State Government Victoria Department of Primary Industries
NSW Government Primary Industries
GRDC Grains Research & Development Corporation
SARDI South Australian Research and Development Institute

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INTRODUCTION

The 2012 Southern Pulse Agronomy Program had 44 trials across south-eastern Australia at 18 sites addressing key management issues associated with the 5 pulse crops, lentil, field pea, chickpea, faba bean and lupin.

Field days associated with the project run in collaboration with PBA and Pulse Australia were successful and had significant exposure during 2012 attracting in excess of 400 attendees. At these field days several new PBA varieties were released and agronomic management issues highlighted. The field days are viewed as the key pulse information days for southern Australian growers and have resulted in significant media coverage. An article in the January issue of Groundcover highlighted the importance of these events.

Research personnel presented trials to grower groups, private agronomy groups, field days (e.g Hart, BCG, CWFS) and industry workshops. The strong relationships with commercial and private agronomists also allow maximum exposure of all pulse research work. With each successive year of the pulse project our credibility and reputation builds as leaders in pulse research.

Field Days were held at Curyo (southern Mallee), Rupanyup (Wimmera) and Westmere (South West) sites, Victoria and Arthurton (Yorke Peninsula), SA. Visits from local Ag Bureau groups (Owen and Mallala) were also conducted at the Pinery Pulse Agronomy site in South Australia. At each of the field days, key industry production and marketing issues were highlighted and new varieties released as appropriate from Pulse Breeding Australia. In total, four new varieties were released in 2012 - two lentils, PBA Ace and PBA Bolt; one field pea, PBA Pearl one chickpea, PBA Striker. This program has developed and incorporated all the management related information for these varieties.

About Us

Southern Pulse Agronomy is a tri-state research program lead by DPIVic and funded through GRDC, DPIVic, SARDI and NSW DPI. The current project, from which research results presented here have been generated, is entitled 'Expanding the Use of Pulses in South-Eastern Australia' (DAV00113).

Program Objective: To undertake research aimed at increasing on-farm productivity, reliability and profitability of lentil, field pea, chickpea, faba bean and lupin in south eastern Australia. The program delivers specific crop management practices that optimise yield and quality and minimises production risks of new varieties. Further, new traits are identified and explored for each pulse that will provide future benefits to each breeding node of PBA.

Background: Pulses are an integral part of farming systems in southern Australia, delivering well known and proven rotational, economic and environmental benefits to growers. Despite a wide spread understanding of these benefits in southern region farming systems, pulses are not always profitable in their own right due to higher input costs and lower reliability than cereals. Further to this they are predominately grown on the better soils in the more reliable cropping areas (medium to high rainfall) and are currently poorly represented in lower and higher rainfall growing regions.

Many new varieties will be released over the next 5 years by Pulse Breeding Australia (PBA) offering changes in agronomic traits and improved adaptation. Further and ongoing improvements in matching farming systems and agronomic management practices with the new improved varieties are required to address these issues. The proposed research in this project will improve profitability in the more traditional pulse zones where they currently occupy up to 30-40% of the rotation, while at the same time assist their expansion into the drier and more marginal pulse growing areas as well as the more reliable higher rainfall zones of the cropping belt.

This project will contribute to the expansion of pulses in the southern region through research and development that delivers:
<u>1. Variety specific agronomy packages (VSAP)</u> - delivering benefits of new varieties to growers. Targeted agronomic research to produce data for new pulse varieties which will be synthesised into management packages for the southern Australian cropping regions in collaboration with PBA and other pulse breeding organisations.
<u>2. Profitable pulses for modern farming systems</u> - matching best genotypes to best farming systems. Strategic genotype x management research that provides: direction to PBA on potential genes/traits that confer advantage in new farming systems; information on how to agronomically maximise the benefits of new traits/genes currently recognised in the breeding program and the impacts of the genotype x management interaction on soil moisture. More specifically research will be focussed on 2 areas:
a. Understanding the agronomic importance of traits linked with weed management, eg. early maturity, herbicide tolerance, competitive plant types including forage types.
b. Identification of traits that are required to maximise production in modern minimum or no-till farming systems.

This research draws on the extensive experience of project partners in pulse production and linkages with PBA, grower groups, commercialising companies, advisors and other research projects. Research is conducted on smaller scale detailed trial plots due to limited seed supply. However research sites, where possible, will be located with other pulse research sites and larger scale grower managed demonstration strips of new varieties.

The research addresses traditional and expanding production zones of:
1. The more reliable areas where pulses often stand alone as a cash crop as well as provide break crop benefits (eg Mid North of SA, York Peninsula, Wimmera & parts of the eastern portion of southern NSW);
2. The more marginal areas where the "break crop" effect is often the biggest issue :

- High Rainfall Zones - southern Victoria, South East and parts of the Mid North of SA, and the eastern portion of southern NSW.
- Low Rainfall Zones – Victorian Mallee, parts of the Mid North and Eyre Peninsula of SA, Western NSW.

The delivery of VSAP's and matching genotypes to cropping systems is viewed as an essential ingredient to a vibrant pulse industry and to the development of new varieties by PBA.

In addition, economic analysis of key agronomic treatments x varieties within research trials will occur to assess potential profitability within a farming system context. It is proposed that an initial focus will be on the traits and management associated with weed management. Scoping will occur in year one of the project followed by data collation and preliminary analysis in years 2-3 followed by more detailed economic studies in year 4-5. The economic analysis will provide a fundamental base for growers to identify the best options for their farming systems.

Delivery of the outputs will build towards the common vision we share with PBA for the Australian pulse industry to develop profitable and sustainable pulse crops, to increase their adoption to between 15-20% of total crop area planted, increase their average yields from 1.0 to 1.5 tonnes per hectare and reduce overall input costs. The project maintains close industry links through active participation at field days, with technical publications and grower groups (eg. VNTFA, BCG, SFS, MSFS, CWFS, EP, Farm Link, YPASG, Riverina Plains, Hart, MNHR) and presentations at key industry conferences (i.e GRDC updates and Pulse Australia).

Acknowledgements

Project Staff

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Biometrics

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Industry	Grains Research and Development Corporation
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Co-operators

Curyo, Vic	Peter & Brenda Doran
Rupanyup, Vic	Russell Dunlop
Westmere, Vic	Southern Farming Systems
Cowra, NSW	NSW DPI, Cowra Research and Advisory Station
Yenda, NSW	Nick & Kym Eckermann
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Balaklava, MN, SA	Grant Macfarlane

Tarlee, MN, SA	Pat Connel
Melton, YP, SA	Neil Harrop
Hart, MN, SA	Matt Dare (c/- Hart Field Site)
Turretfield, MN, SA	Government of South Australia
Minnipa, EP, SA	Government of South Australia
Conmurra, SE, SA	Locky Seears
Moyhall, SE, SA	Jack Kay

RESEARCH HIGHLIGHTS

Herbicide tolerance trials in 2012 expanded to focus on identifying the relative tolerance of three imidazolinone (imi) tolerant lentil genotypes to the range of imi chemistries and a number of other Group B herbicides. The results highlighted the importance of testing across a range of chemicals within a herbicide group and not assuming that tolerance will be consistent within a herbicide group. The data showed that PBA Herald XT has good tolerance to imi chemistries, but may not be as tolerant to some chemistries as newer lines in the PBA program. Combining tolerance from the different lines could lead to new genotypes with improved tolerance to the full range imi chemistries. PBA will be using this information to define future breeding directions for herbicide tolerant varieties, following PBA Herald XT. In terms of commercial practice, the ongoing adoption and improvement of these herbicide tolerant lentils could result in significant farming systems benefits through improved weed control. This would apply both to increased control options in lentil crops and in the previous rotation phase. Implementation of this technology would also result in decreased pressure on herbicides currently employed for broadleaf weed control in lentils. However, we need to continuously monitor weed resistance levels and define the optimum methods for maximising the benefits of this herbicide tolerance technology for the whole farming system.

Stubble management trials in 2012 continued to demonstrate benefits of sowing lentils inter-row into retained compared to burnt cereal stubble. Further yield benefits were generated in some circumstances by sowing into retained standing stubble compared to retained slashed stubble. Yield advantages from this practice were up to 38% in 2012 (up to 36% was achieved in 2011) depending on sowing date and variety. Over the past three years of study, yield responses have generally become more prominent at the later sowing date, when yield potential is reduced from moisture stress or reduced biomass. The reasons behind this yield response are not yet fully understood, and are likely due to complex interactions involving timing of moisture stress events and variations in variety maturity timings, plant biomass levels and plant architecture.

Crop Topping/Desiccation research carried out in SA, Vic and southern NSW has shown that yield loss can occur at the recommended application timing depending on variety and sowing date (where applicable). Generally, later maturing varieties have been more prone to yield loss than earlier maturing varieties, however there is not always a direct correlation with maturity and suitability to the practice. Approximate crop maturity ratings that are more suited to the safe practice of this agronomic management have been defined for PBA, but are being validated across seasons and environments. Preliminary data also suggest that crop-topping may be associated with occurrence of mould and reduced germination rate, which will be of particular importance in the sprouting markets. Work is ongoing to measure the effects of crop topping on seed quality, particularly seed size, seed protein % and seed germination.

Investigations into the effects of increasing row widths and subsequent increased fertiliser concentrations in the seed row found highly significant effects on chickpea emergence from a range of rates and fertiliser proximity to seed. This was trialled over 2 sites with different rainfall, soil types and water holding capacities. Extending from the 2011 results, more fertiliser treatments were added and investigated and further grain yield responses were generated. These trials will be continued to establish safe fertiliser rates per metre row for chickpea, irrespective of row spacing.

Southern Pulse Agronomy Trials Sown in 2012

Experiment ID	Page	Rainfall Zone[1] Region (Location), State	Treatments (No. of treatments)	Varieties
LENTIL				
L1	20	MRZ Mid North (Pinery), South Australia	Sowing Date (3) Stubble Management (3)	8
L2	24	MRZ Yorke Peninsula (Arthurton), South Australia	Disease Management (4)	2
L3	26	MRZ Mid North (Pinery), South Australia MRZ Yorke Peninsula (Arthurton), South Australia	Group B Herbicides (20 treatments)	4 5
L4	30	MRZ Yorke Peninsula (Melton), South Australia	Crop-topping/Desiccation (4 timings)	14
L5	33	LRZ Central West (Yenda), NSW	Sowing Time (2)	6
L6	35	H-MRZ(Wagga Wagga), NSW	Sowing Time (2)	8
L7	38	LRZ Southern Mallee (Curyo), Vic	Herbicide Tolerance (20)	5
L8	41	MRZ Wimmera (Rupanyup), Vic	Herbicide Tolerance (20) Stubble (2)	5
L9	43	LRZ Southern Mallee (Curyo), Vic	Sowing Date (3) Variety Mixes (4)	12
L10	47	MRZ Wimmera (Rupanyup), Vic	Sowing Date (3) Variety Mixes (4)	12
FIELD PEA				
F1	53	LRZ Upper Eyre Peninsula (Minnipa), South Australia	Sowing Date (2) Stubble Management (3)	6
F2	55	MRZ Mid North (Pinery), South Australia MRZ Yorke Peninsula (Arthurton), South Australia	Forage production	4
F3	60	LRZ Upper Eyre Peninsula (**Minnipa**), South Australia MRZ Yorke Peninsula (**Kadina**), South Australia MRZ Mid North (**Snowtown**), South Australia MRZ Mid North (**Balaklava**), South Australia HRZ Mid North (**Turretfield**), South Australia	Pea Variety Blends	9
F4	62	MRZ Yorke Peninsula (Melton), South Australia	Crop-topping/Desiccation (4 timings)	14
F5	65	LRZ (Yenda), NSW	Sowing Date (2) Fungicide regimes (2)	6
F6	67	H-MRZ (Wagga Wagga), NSW	Sowing Date (2) Fungicide regimes (2)	8
F7	70	LRZ Southern Mallee (Curyo), Vic	Sowing Date (3) Variety Mixes (2)	13
F8	73	MRZ Wimmera (Rupanyup), Vic	Sowing Date (3) Variety Mixes (2)	13
F9	75	HRZ Southern (Lake Bolac), Vic	Sowing Date (3) Crop Topping (2) Fungicide Regimes (3)	8

1. LRZ – Low rainfall zone; MRZ – Medium rainfall zone; HRZ – high rainfall zone.

Experiment ID	Page	Rainfall Zone[1] Region (Location), State	Treatments (No. of treatments)	Varieties
CHICKPEA				
C1	77	MRZ Yorke Peninsula (Arthurton), South Australia	Sowing Date (2)	8
C2	79	HRZ Mid North (Turretfield), South Australia	Disease Management (4)	7
C3	82	HRZ Mid North (Turretfield), South Australia	Disease Susceptibility	12
C4	84	MRZ Yorke Peninsula (Melton), South Australia	Crop-topping/Desiccation (4 timings)	6
C5	88	LRZ (Yenda), NSW	Sowing Date (2) Plant Population (3)	6
C6	90	LRZ (Yenda), NSW	P Fertiliser rate (4) Fertiliser placement (2)	2
C7	92	LRZ (Yenda), NSW	P Fertiliser rate (4) Fertiliser placement (2)	2
C8	95	LRZ Southern Mallee (Curyo), Vic	Sowing Date (3)	8
C9	98	MRZ Wimmera (Rupanyup), Vic	Disease Management (4)	12
FABA BEAN				
B1	101	HRZ Mid North (Tarlee), South Australia	Sowing Date (2) Plant Density (3)	4
B2	104	HRZ South East (Moyall), South Australia	Sowing Date (2) Plant Density (3)	4
B3	107	HRZ Mid North (Tarlee), South Australia	Disease Management (4)	3
B4	108	MRZ Yorke Peninsula (Maitland), South Australia	Disease Management (3)	3
B5	109	HRZ Lower Eyre Peninsula (Wanilla), South Australia	Disease Management (4)	3
B6	111	HRZ Lower Eyre Peninsula (Wanilla), South Australia	Inoculation (3)	1
B7	113	HRZ Mid North (Tarlee), South Australia	Growth Regulants (10)	1
B8	115	MRZ Yorke Peninsula (Melton), South Australia HRZ South East (Moyall), South Australia HRZ Lower Eyre Peninsula (Yeelanna), South Australia	Crop-topping/Desiccation (4 timings)	3
B9	117	LRZ (Yenda), NSW	Sowing Date (2) Plant Density (3)	4
B10	119	H-MRZ (Wagga Wagga), NSW	Sowing Date (2) Fungicides	4
B11	121	MRZ Wimmera (Rupanyup), Vic	Disease Management (6) Stubble (2)	8
B12	123	HRZ Southern (Lake Bolac), Vic	Disease Management (6)	8
MULTI-CROP				
M1	126	MRZ Mid North (Pinery), South Australia MRZ Yorke Peninsula (Minlaton), South Australia	Stubble Management (3) Field Pea, Lentil and Chickpea (3 each)	
M2	129	MRZ Mid North (Hart), South Australia	Sowing Date (2) Soil Type (2) Lentil and Field Pea (6 Each)	
M3	132	H-MRZ (Wagga Wagga), NSW	Field Peas (3), Lupins (2), Vetch (1) Sowing Date (3)	

Trial Site Locations for the 2012 Southern Pulse Agronomy Trials

NEW VARIETIES 2012 and VARIETY AGRONOMIC TABLES

The following varieties were released during the 2012 cropping season

Lentils: PBA Ace (previously CIPAL0803) and PBA Bolt (CIPAL0801)

Field Peas: PBA Pearl (OZP0815)

Chickpeas: PBA Striker (CICA0603), Ambar and Neelam

Faba Beans: Nil

For variety brochures contained more detailed information please see: http://www.grdc.com.au/director/events/grdcpublications/pba.cfm#brochures

FIELD PEAS

Variety	Plant habit	Plant vigour, Early Season	Flowering time	Maturity time	Plant lodging resistance, at maturity	Pod shattering, at maturity	Blackspot (Ascochyta)	Bacterial blight (Field Rating)	Downy mildew (Kaspa Strain)	Downy mildew (Parafield Strain)	Powdery mildew	PSbMV virus	BLRV virus (Field Rating)	Boron Tolerance	Salinity Tolerance
Kaspa grain type															
Kaspa	SD-SL	High	Late	Mid	Fair-Good	R: SP	MS	S	S	MR	S	S	S	S	S
PBA Wharton	SD-SL	High	Early-Mid	Early	Fair-Good	R: SP	MS	S	S	S	R	R	R	MT	MS
PBA Gunyah	SD-SL	High	Early-Mid	Early	Fair-Good	R: SP	MS	S	S	R	S	S	S	S	S-MS
PBA Twilight	SD-SL	High	Early	Early	Fair-Good	R: SP	MS	S	S	R	S	S	S	S	S
Australian Dun grain type															
Morgan	Tall-SL	High	Late	Late	Poor-Fair	MR: NSP	MS	MS	S	MR	S	S	S*	S	S
PBA Coogee	C	Very high	Mid-Late	Mid	Poor	MR:NSP	MS	MS*	S*	S*	R	R	*	T	MT
Parafield	C	High	Mid	Mid	Poor	MR: NSP	MS	MS	S	S	S	S	S	S	MS
PBA Oura	SD-SL	Moderate	Early-Mid	Early	Fair-Good	MR: NSP	MS	MR-MS	MR-MS	MR-R	S	S	MR-MS*	MS	S
PBA Percy	C	High	Early	Early	Poor	MR: NSP	MS	MR	S	S	S	S	S	S	MR
Yellow Type															
PBA Hayman	Mult-branched	Very High	Very Late	Very late	Fair-Good	MR: NSP	MS	MR*	S*	MS*	R	*	*	MS	MS
PBA Pearl	SD-SL	Moderate	Early-Mid	Early	Good	MR: NSP	MS	MS	MR-MS	R	S	S	R	MS	MS
Sturt	C	High	Early-Mid	Mid	Poor	MR: NSP	MS	MS	S	MS	S	S	MS	S	MS
Pipeline															
OZP0903	SD-SL	Moderate	Early	Early	Fair-Good	MR	MR	MR-MS	MR	MS	S	S	MS	S	MS
OZP1001	SD-SL	Moderate	Late	Mid	Fair-Good	R:SP	>MR	MS	MS-MR	MR	S	S	sw	S	MS
OZP1101	SD-SL	High	Mid-Late	Early-Mid	Good	R:SP	MR	MS	MS-MR	MR	S	S	MS	S	S
OZP1202	SD-SL	Moderate	Late	Mid	Fair - Good	R:SP	MS-MR	MS-MR*	S	S	R	*	S	T	MS

SD=Semi-dwarf, C=Conventional, SL= Semi-leafless, S=susceptible, MS=moderately susceptible, MR=moderately resistant, R=resistant, SP=Sugar pod type pod, NSP=Non sugar pod type.

PSbMV = Pea seed borne mosaic virus. BLRV = Bean leaf roll virus.

I=intolerant, MI=moderately intolerant, MT=moderately tolerant, T=tolerant.

*: Requires validation.

LENTILS

Variety	Seed coat colour	Cotyledon colour	Seed size (%) relative to Nugget	Market category	Vigour	Plant height	Flowering time	Maturity time	Lodging resistance	Pod drop	Shattering	Botrytis grey mould	Ascochyta blight		Boron	Salt
													Foliage	Seed		
Medium red																
Nugget	Grey	Red	100	MRS	Moderate	Medium	Mid	Mid/Late	MS/MR	MR	R	MS/MR	MS/MR	MS	I	I
PBA Ace	Grey	Red	100	MRS	Good	Medium	Mid	Mid	MS/MR	R	MS/MR	MR	R	R	I	I
PBA Blitz	Grey	Red	115-120	MRS	Mod/Good	Med/Tall	Early	Early	MR	MR	MR	R	MR	MR	I	I
PBA Bolt	Grey	Red	100	MRS	Mod/Good	Medium	Early/Mid	Early/Mid	R	R	R	MS	MR	R	MI	MI
PBA Flash	Green	Red	100-110	MRS	Moderate	Medium	Early/Mid	Early/Mid	MR	MR	MR	MS	MS	MR	MI	MI
CIPAL0901	Grey	Red	Medium	MRS	Mod/Good	Medium	Early	Early/Mid	MR	MR	MR	MS	MR	MS	MI	MI
CIPAL1001	Grey	Red	Medium	MRS	Moderate	Medium	Mid	Early/Mid	MS	R	R	R	R		I	I
Small red																
PBA Hurricane	Grey	Red	85	SRP	Moderate	Medium	Mid	Mid	MR	MR	R		R		I	I
PBA Herald XT	Grey	Red	75	SRS	Poor/Mod	Short	Mid/Late	Mid/Late	MR	MR	R	MR	R	R	I	I
Nipper	Grey	Red	75-80	SRP	Poor/Mod	Short	Mid/Late	Mid	MR	MR	MR	R	MR	R	I	MT
PBA Bounty	Grey	Red	90	SRP	Moderate	Med/short	Mid/Late	Mid	MS	R	R	MS	MR	MR	I	MI
Northfield	Tan	Red	80	SRP	Poor/Mod	Short	Mid	Mid	MS	MR	MR	S	MR	R	I	I
Large red																
Aldinga	Green	Red	120	LRS	Moderate	Medium	Mid	Mid	S	MR	MR	MS	MR	MS	I	MI
PBA Jumbo	Grey	Red	120	LRS	Moderate	Medium	Mid	Mid	MS	MR	MR	MS	MR	R	MI	I
Large green																
Boomer	Green	Yellow	150	LG	Good	Tall	Mid	Mid/Late	MS	MR	MS	MR	MR	MS	I	I
CIPAL1207	Green	Yellow	150	LG	Good	Tall	Mid	Mid	MS	R	R	MR/MS	MR		I	I

S=susceptible, MS=moderately susceptible, MR=moderately resistant, R=resistant, I=intolerant, MI=moderately intolerant, MT=moderately tolerant, T=tolerant.

CHICKPEAS

Variety	Seed size group	Ave 100 seed wt (g)	Seed Size (mm)	Vigour	Flowering	Maturity	Plant Height	Lodging at maturity	Botrytis grey mould	Ascochyta blight (Foliage/Stem)	Ascochyta blight (Pod)	Growth Habit
Desi's												
Sonali		18		Good	Early	Early			S	MS		stick-like
Howzat	Medium	20		Poor/Mod	Mid	Mid	Mid	MS	MS	S	S	semi erect
Genesis™ 509	Small	16		Mod	Mid	Early/Mid	Mid	MR	MS	R	S	erect
PBA Slasher	Medium	18		Poor/Mod	Mid	Mid	Sht-Mid	MS	S	R	S	semi spread
PBA HatTrick	Medium	19		Mod	Mid	Mid	Tall	MR	S	MR	S	erect
PBA Boundary	Medium	19		Mod	Mid/Late	Mid/Late	Tall	MR	S	MR	S	erect
PBA Striker	Medium	22		Good	Early	Early	Sht-Mid	MS	S	MR	S	semi spread
Ambar	Small									R*	S	
Neelam	Medium									R*	S	
PBA Maiden	Med-Large	24		Mod	Mid	Mid	Sht-Mid	MS	S	MR	S	semi spread
CICA1016	Med-Large	23		Mod	Mid	Mid	Mid	MS	S	MR	S	semi erect
CICA1122	Medium	22		Good	Early	Early	Mid	MR	S	MR	S	semi erect
CICA1229	Medium	18		Good	Early	Early	Sht	MS	S	MR	S	spread
Kabuli's												
Genesis™ 090	Small	31	7-8	Good	Mid	Mid/Late	Mid	MR	S	R	S	semi spread
Almaz	Medium	38	8-9	Mod	Mid/Late	Late	Mid-Tall	MR	S	MS	S	semi erect
Genesis™ 079	Small	24	6-7	Good	Early	Early	Sht	MR	S	R	S	semi spread
Genesis™ 114	Medium	38	8-9	Good	Mid/Late	Late	Tall	R	S	MS	S	erect
Genesis Kalkee	Large	45	8-10	Good	Late	Late	Tall	R	S	MS	S	erect
PBA Monarch	Medium	40	8-9	Poor/Mod	Early	Early	Mid	MS	S	MS	S	semi spread
CICA1152	Medium	36	8	Good	Early	Early	Mid	MR	S	MR	S	semi erect
CICA1156	Medium	36	8	Mod	Mid	Mid	Mid	MR	S	MR	S	semi erect

S=susceptible, MS=moderately susceptible, MR=moderately resistant, R=resistant; * PROVISIONAL RATING SUPPLIED BY COGGO

FABA BEANS

Variety	Maturity	Seed colour	Height	Lodging Resistance	Ascochyta	Chocolate spot	Cercospora	Rust
Nura	Early-Mid	Light brown	Short	MR	MR-R	MS	S	MR
Farah	Early-Mid	Light brown	Medium	MS	MR-R	S	S	S
Fiord	Early	Light brown	Short	MS	S	S	S	S
PBA Kareema	Late	Light brown	Tall	MS	MR-R	MS-MR	S	MR
PBA Rana	Mid	Light brown	Medium-tall	MR	R	MS-MR	S	MS
AF05069	Mid	Light brown	Medium	MR	R	MS	S	MR
AF05069-2	Mid	Light brown	Medium	MR	R	MS	S	MR
AF05073	Mid	Light brown	Medium	MR	MR-R	MS-S	S	S
AF05073-2	Mid	Light brown	Medium	MR	R	MS-S	S	S
AF05095	Mid-late	Light brown	Medium-tall	MR	R	MS	S	MR
AF05095-1	Mid-late	Light brown	Medium-tall	MR	R	MS	S	MR
AF06125	Mid	Light brown	Medium	MR	R	MS-MR	S	MS
AF07125	Early	Light brown	Medium	MR	R	S	R	S
Aquadulce	Late	Light brown	Tall	MS	MS	MS	S	MS

S=susceptible, MS=moderately susceptible, MR=moderately resistant, R=resistant

LUPINS

Variety	Flower	Height	Early vigour	Lodging	Pod loss/ shatter	Anthrac-nose	Brown leaf spot	Pleiocheta root rot	CMV on seed	Phomopsis		Drought tolerance
										Stem	Pod/Seed	
Jenabillup	Early	Tall	Med	MR	R	MS	R	R	MR	MR-MS	R	T
Jindalee	Late	Tall	Med	MR	R	MS	MR	MR	MS	R	R	MI
Mandelup	V early	Tall	Fast	MS	MR	MR	MS	R	MS	MR	R	T
01A012R-67	Early	Med	Med	MR								
Wonga	Early	Med	Med	MR	MS	R	MS-MR	S	MR	R	S	MS

S=susceptible, MS=moderately susceptible, MR=moderately resistant, R=resistant; I=intolerant, MI=moderately intolerant, MT=moderately tolerant, T=tolerant.

CLIMATE

Growing season and annual rainfall was generally 20-30% below average in 2012. Generally there were frequent small events throughout the growing season. High March rainfall triggered the early release of blackspot spores so that blackspot intensity was generally low in field pea crops in 2012. Drier than average spring conditions in 2012 meant that disease intensity was generally low in pulse crops. Moisture stress both pre and post flowering was the single most significant yield limiting factor in 2012, and was observed to some extent at most sites.

Daytime temperatures through the growing season were generally average to above average temperature, promoting rapid growth and high biomass accumulation in 2012. Mean minimum temperatures below average in winter, although there were generally few incidences of frost. However, isolated frost events during early spring caused significant yield loss in some frost-prone regions.

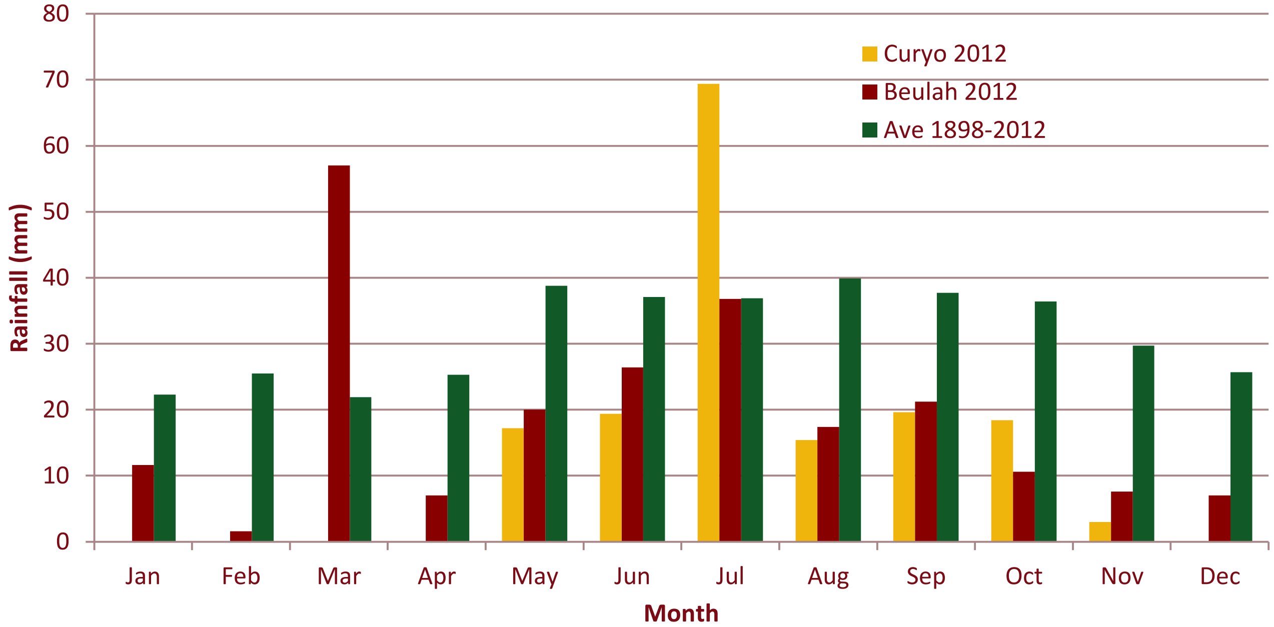

Figure 1. Average monthly rainfall at the Curyo trial site (LRZ, Vic) in 2012 compared with the actual and long term average for Beulah.

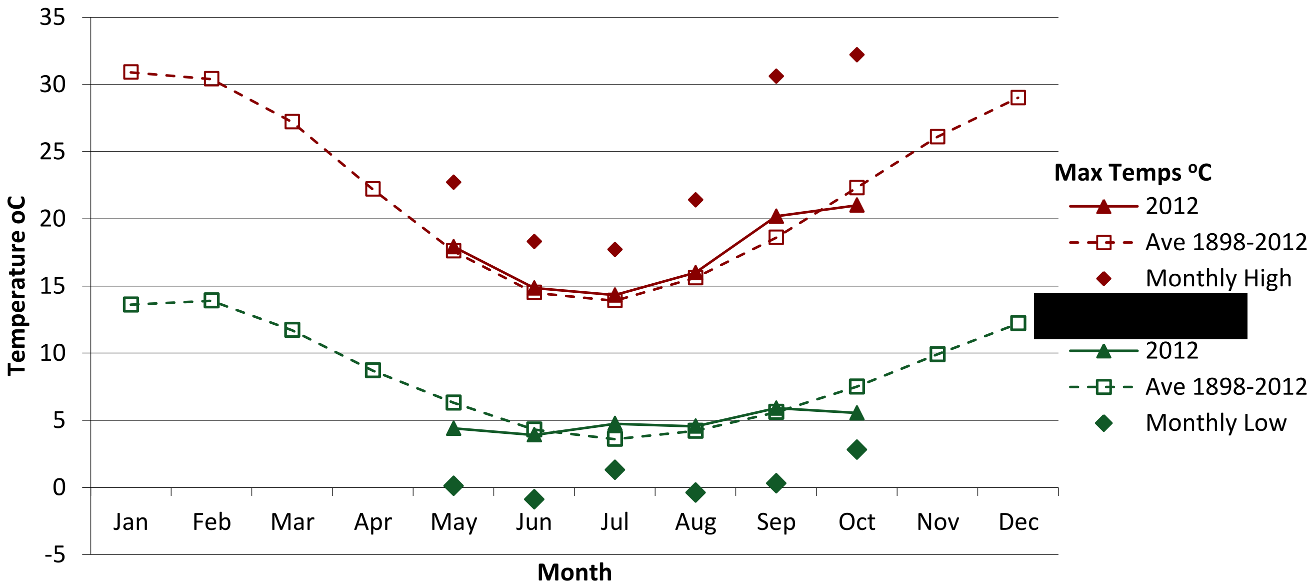

Figure 2. Average monthly maximum and minimum temperatures and absolute maximum or minimum at the Curyo trial site (LRZ, Vic) in 2012 compared with the long term average of Beulah.

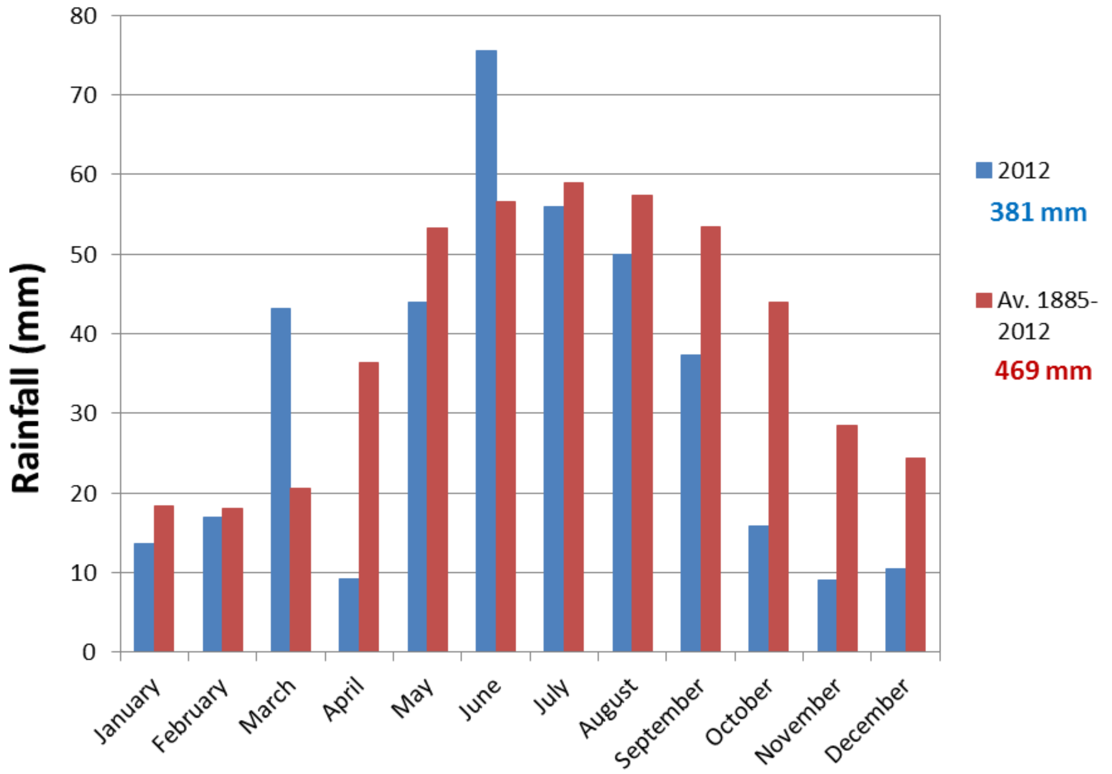

Figure 1. Average monthly rainfall at Turretfield (HRZ of SA) in 2012 compared with the long term average, also showing annual rainfall.

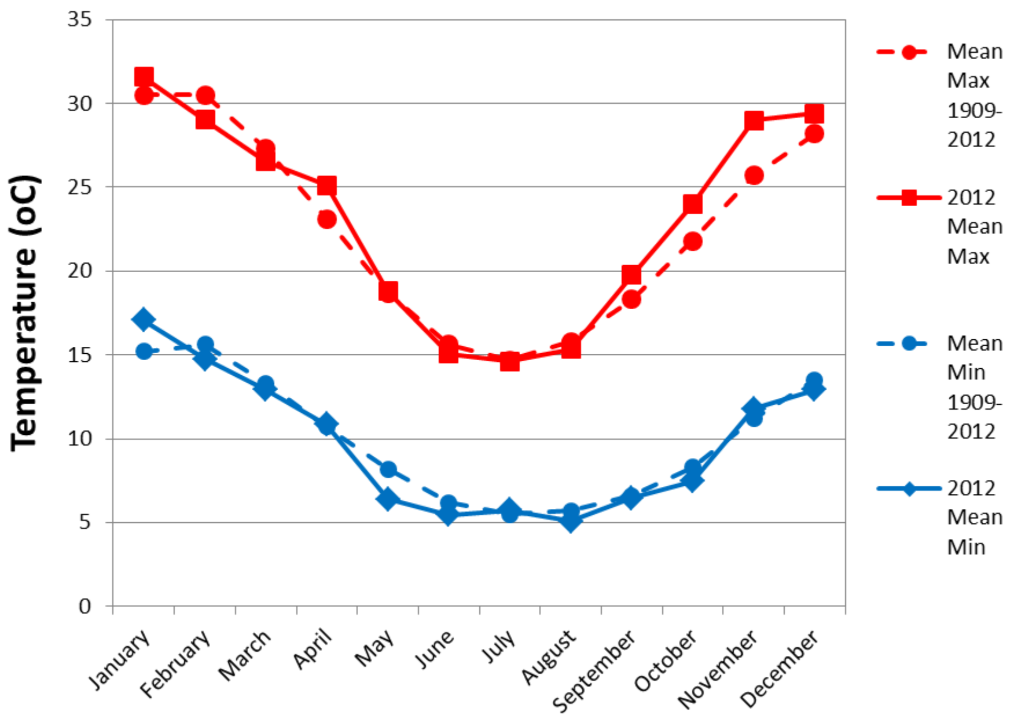

Figure 2. Average monthly maximum and minimum temperatures and absolute maximum or minimum at Turretfield (HRZ of SA) in 2012 compared with the long term average.

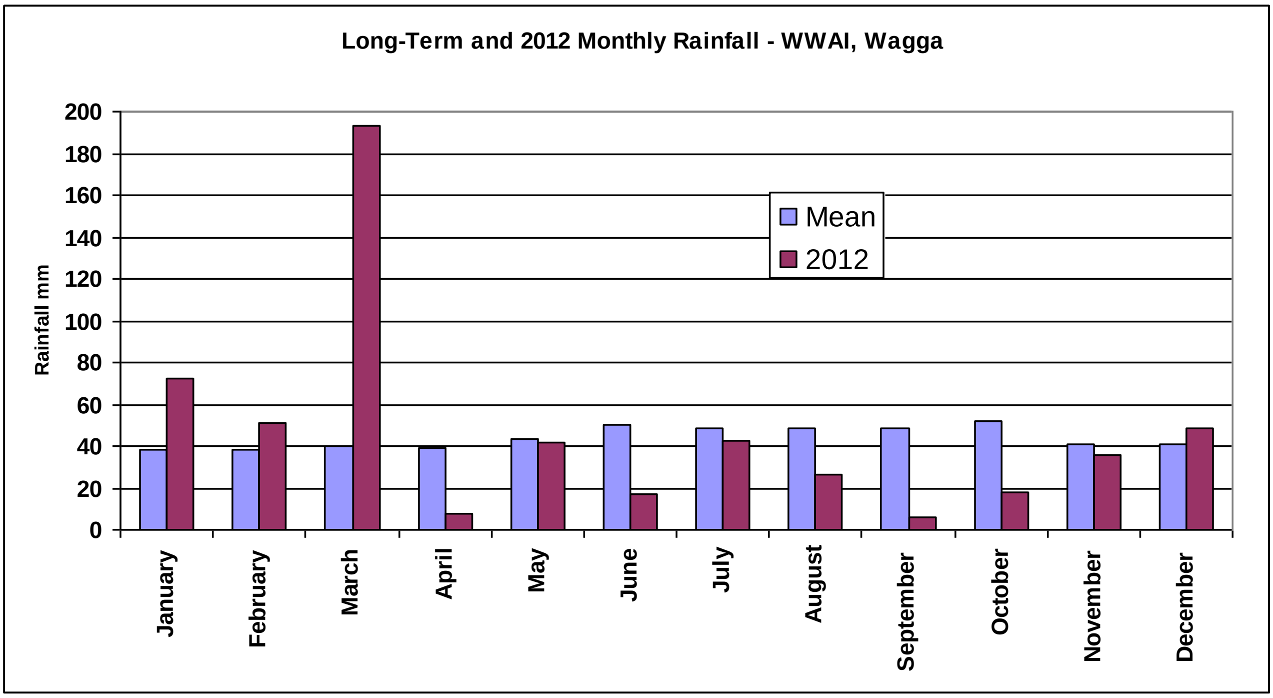

Figure 5. Monthly rainfall incidence in 2012 and long-term averages (114 years), WWAI Wagga Wagga.

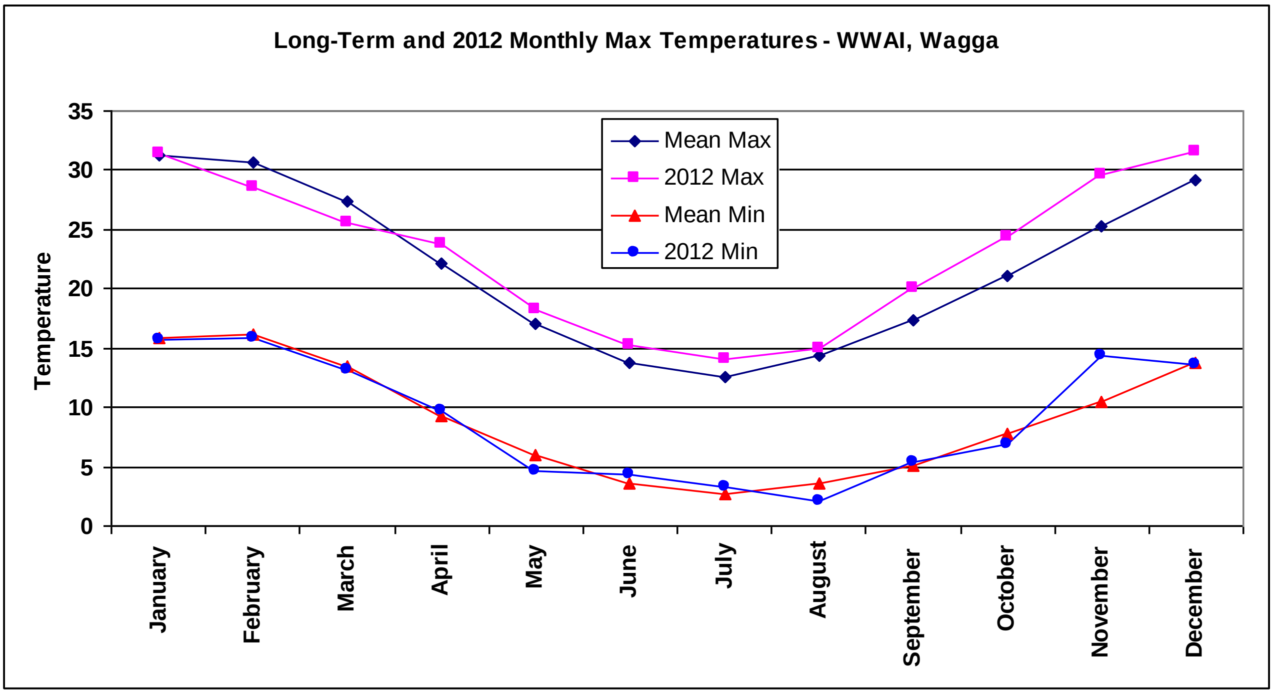

Figure 6. Monthly maximum & minimum temperatures in 2012 and long-term averages, WWAI Wagga Wagga.

TRIAL SUMMARIES

Lentils

L1. Lentil Sowing Time x Stubble Management, Mid North (Pinery), South Australia 2010--2012

This report was published in the Southern Pulse Agronomy Research Snapshot 2012 and the Crop Science Society Newsletter published in May 2012. It includes the results from 2012 summarised along with the key findings from similar experiments held in 2010 and 2011.

Aim

To maximise yield of new lentil varieties through the identification of optimum sowing dates and stubble management strategies.

Treatments

Varieties:	8 varieties per season including Boomer, Nipper, Nugget, PBA Blitz and PBA Flash
Sowing dates:	Break of season, and 2-3 weekly intervals thereafter
Stubble:	1.8-2.2t/ha of barley or wheat stubble (30-35cm standing height)
Treatments:	Removed - cut at ground height and raked bare just prior to sowing
	Slashed - cut at ground height to leave 20-30cm length straw
	Standing - 30cm high
Fertiliser:	MAP + Zn @ 75kg/ha

Background

The benefits of early sowing and stubble retention have been widely discussed in seasons and environments characterised by low growing season rainfall, and/or short, sharp finishes. However the importance of sowing time and stubble retention in relation to increased grain yield has been less evident in recent favourable growing seasons. However this research shows that retained stubble can be important in lentil under both favourable and less favourable growing season conditions.

Lentil sowing date by stubble management trials were set up between 2010 and 2012 in the Mallala district of the lower Mid North of SA in response to poor crop yields in previous low rainfall seasons. The trials aimed to determine whether yield of lentils could be improved by sowing inter-row into standing stubble, compared with retained but slashed stubble or situations where stubble was removed altogether (burnt). Each trial contained eight lentil varieties, three stubble management practices (Removed/burnt stubble, Slashed stubble and Standing stubble) and three sowing dates (break of season and 2-3 weekly intervals thereafter). Stubbles amounts ranged between 1.8-2.2t/ha of barley or wheat stubble, with a 30-35cm standing height.

Summarised Results and Interpretation 2010-2012

- Grain yield – A significant grain yield response was generated from stubble management in each season. Significant two-way (Sowing date x Stubble management and Variety x Stubble management) interactions were generated for yield in 2010, while significant three-way (Sowing date x Variety x Stubble management) responses were generated in 2011 and 2012. A summary of these results is shown in Table 1.

  Results with complex three-way treatment interactions complicate interpretation of the yield data, however trends are apparent across the three years of experiments. Firstly, yields of retained stubble treatments (Slashed and Standing) across all varieties were equal or greater than those from Removed stubble treatments. Secondly, there was generally a greater yield response from the Standing treatment than the Slashed treatment. Thirdly, there was generally a greater yield response from stubble retention at the Late sowing date than the Early or Mid sowing dates. Finally, variety interactions with sowing date and stubble management treatment were apparent but appeared to be seasonally dependent and most significant in 2012 where growing season rainfall was low.

- Varieties: PBA Blitz showed the highest yield response from retained stubble. This may be due to its erect growth habit, which often fails to cover the inter-row soil space with its canopy. It tends to have low amounts of vegetative growth once flowering is initiated unlike other varieties such as Boomer, Nugget or PBA Ace which generally continue to accumulate biomass during flowering and early podding and completely cover the inter-row space. This feature in PBA Blitz may lead to increased soil moisture loss in unprotected (i.e. Removed stubble) treatments and hence a greater benefit is achieved from retaining stubble in this variety. In some seasons, PBA Blitz may also benefit from the delayed maturity which occurs in retained stubble systems by being able to respond to late rains which would normally only be of benefit to later maturing varieties.

  By contrast Boomer showed the least response from stubble management. It is thought that it's higher and more vigorous biomass production allows it to close the inter-row earlier and more regularly than other varieties thus aiding it in conserving moisture, regardless of the presence of stubble. Further to this Boomer is more indeterminate in its flowering pattern than other varieties and often has the latest maturity date of the varieties tested.
- Lodging – A significant stubble treatment response was generated for lodging in two of the three seasons (Table 2). In 2010 lodging increased in standing and slashed stubble treatments compared to the removed stubble treatment. In 2012 lodging was higher in the Slashed stubble treatment compared with the Removed and Standing stubble treatments. There was no significant response in 2011.
- Maturity – A significant stubble treatment response was generated for maturity in all three seasons (Table 3). In all three seasons maturity was delayed in the Standing stubble treatment compared to the Removed treatment, while in two of the three seasons (2010 and 2011) maturity was delayed in the Slashed stubble treatment compared to the Removed treatment. In two of the three seasons (2010 and 2012) maturity was also delayed in the Standing stubble treatment compared to the Slashed stubble treatment.
- Soil moisture – Soil moisture was measured in September in the 2010 trial (data not shown), and Slashed and Standing stubble treatments showed increases in soil moisture by 3 and 12% respectively compared to the Removed treatment. This result was also evident through a delay in plant maturity timing in retained stubble treatments compared to Removed treatments in this year (Table 3).
- Pre-harvest grain loss – trials were scored for shattering and pod loss prior to harvest. Due to timely harvest practice pre-harvest losses were generally minimal, and there were no treatment responses observed.

Table 1: Summary of grain yield improvement (% of Removed stubble yield) from Slashed and Standing stubble treatments compared to the Removed treatment for six varieties and three sowing dates across three seasons in the Mallala region.

Variety	Variety Characteristics	2010		2011		2012	
		Slashed	Standing	Slashed	Standing	Slashed	Standing
Boomer	Late, high EV, high BM, prostrate	0	0	0-16% (M)	0-27% (L)	0-16% (E, L)	0-29% (E, L)
Nipper	Mid-Late, erect, low BM	11	12	0%	0%	0%	13-34% (E, M, **L**)
Nugget	Late, industry standard	17	11	0%	0-21% (M)	0-33% (M)	0-38% (M, **L**)
PBA Blitz	Early, erect, low BM	12	**22**	0%	0-36% (**E**, L)	0-33% (M)	0-28% (E, M)
PBA Bounty	Mid-Late, prostrate	0	11	0%	0-20% (**E, M**)	n/a	n/a
PBA Flash	Early-Mid, erect	9	9	0-34% (M)	0-26% (E, M)	0%	0-30% (E, L)
Average stubble treatment response (all sowing dates and varieties) P<0.05		7	**10**	8	**11**	11	**18**
Season summary		Average start Wet finish		Wet start Average finish		Average start Dry finish	
Site mean yield (t/ha)		3.8		2.0		1.4	

Bracketed treatments denote which sowing date (Early (E), Mid (M) or Late (L)) yielded higher than the Removed stubble treatment.
Bolded treatments denote the sowing date (E, M or L) where the Standing stubble treatment yielded higher than the Slashed stubble treatment.

Table 2: effect of stubble management on lodging (1-9 score) of lentil, Mallala Region 2010-2012.

Stubble treatment	Removed	Slashed	Standing	LSD (P<0.05)
2010	6.1 ^{a}	5.7 ^{b}	5.8 ^{b}	0.30
2011	5.4	5.3	5.5	ns
2012	7.8 ^{S}	7.3 ^{T}	7.8 ^{S}	0.34

Lodging score: 1= prostrate, 9 = erect

Table 3: effect of stubble management on maturity (1-9 score) of lentil, Mallala Region 2010-2012.

Stubble treatment	Removed	Slashed	Standing	LSD (P<0.05)
2010	3.0 ^{a}	3.22 ^{b}	3.56 ^{c}	0.30
2011	3.0 ^{l}	4.0 ^{m}	4.0 ^{m}	ns
2012	5.06 ^{S}	5.13 ^{S}	5.75 ^{T}	0.34

Maturity score: 1 = dead, 9 = healthy

Key Findings and Comments

- Average grain yields across all varieties in retained stubble treatments (Slashed and Standing) were equal or greater than Removed stubble treatments in all years of testing.
- There was generally a greater yield response from the Standing treatment than the Slashed treatment.
- The yield response from stubble retention was generally the greatest at the Late sowing date.
- Several possible reasons may explain why Standing stubbles generated the greatest yield increase:
    - Soil moisture retention: differences in soil moisture were measured in 2010 and evident in the form of delayed maturity in all three seasons.
    - Altering the micro-climate: previous research conducted in Canada has attributed changes in the “microclimate” at the plant level in standing stubble systems to increased soil moisture and subsequent yield. Soil temperature, solar radiation and wind speed

were all reduced in standing stubble systems, which was thought to reduce evapotranspiration during the lifecycle of the crop (Cutforth et al, 2002).
  - Wind protection: protection from buffeting winds afforded by standing stubbles means that plants are able to divert more carbohydrates into the photosynthetic development and flower production, rather than into stem development for wind resistance. The costs of stem development in response to stimuli like wind (a process called thigmomorphogenesis) has been documented in a number of plants (eg Jaffe, 1993; Cipollini, 1999).
- Stubble management has produced a varied response to lodging across seasons. Retained stubble systems consistently showed equal or greater lodging than Removed stubble, likely due to the increased biomass levels that occur in these treatments.
- These results show that stubble management improves yield stability in lentil across seasons varying in rainfall and length. However a larger yield response was observed from retained stubbles in the driest season (2012). The importance of conserving soil moisture, even in favourable seasons, is significant and the advent of modern farming systems such as minimum tillage and GPS guidance will facilitate this practice. However, growers looking to implement this practice should also be aware of the potential negative issues associated with stubble retention in their particular farming system e.g. seed placement, herbicide and pest management issues. Stubble management may also be more important in lentils than in other break crops due to their smaller canopy size.

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L2 Lentil Disease Management, Yorke Peninsula (Arthurton), South Australia

Co-authored by Jenny Davidson, South Australian Research & Development Institute

Aim

To identify the optimum ascochyta blight (AB) management strategy for PBA Flash (rated moderately susceptible (MS) to foliar infections of AB).

Treatments

Varieties: Nipper (R), PBA Flash (MS) and a blend of 50% Nipper / 50% PBA Flash
Sowing date: 15 May
Treatments: Nil – no fungicide applied
Early Asco – 2L/ha Chlorothalonil during early August (1 Aug), during flowering (20 Sept) and early podding (9 Oct)
Normal Asco – 2L/ha Chlorothalonil during flowering (20 Sept) and early podding (9 Oct)
Complete – 2L/ha Chlorothalonil fortnightly from August 1st.
Note: Botrytis Grey Mould was controlled using district practice of 500ml/ha Carbendazim pre canopy closure.
Fertiliser: MAP + Zn @ 90kg/ha

Background

The current recommended practice for the management of AB in lentils varieties with a foliar disease rating of moderately susceptible through to moderately resistant involves the application of foliar fungicide (chlorothalonil) at the flowering and podding stages. This provides protection of flowers (to prevent yield loss) and pods (to prevent seed staining, and some yield loss).
PBA Flash, a well-adapted red lentil with high yield potential in lower yielding lentil growing areas, has a low level of resistance of both foliar and seed AB (currently rated MS) compared to many other common commercial varieties. It is possible that this variety will require additional (earlier) fungicide applications to manage AB on both the plants and seed, particularly in areas where lentil intensity in high and short lentil rotations are frequent.
Work conducted on cereals has shown that blending varieties with different disease resistances can improve grain yield by limiting the spread of disease through the crop. It is possible that blending varieties with different levels of resistance to AB can likewise limit disease, and improve grain yield. Nipper (rated R) and PBA Flash (MS) were selected due to their difference in AB ratings, and seed size and colour, which would allow separation of parental proportions if desired.

Results and Interpretation

- Foliar disease – a low level of AB infection was observed early in the growing season, however due to the below average winter and spring rainfall this did not develop. As a result fungicide treatments had no effect on grain yield.
- Grain yield – grain yield averaged 2.5t/ha across the trial, and a variety response for grain yield was generated (Table 1). PBA Flash was the highest yielding variety, outperforming Nipper by 23% in this trial. The blend of PBA Flash and Nipper showed intermediate yield between the two parent varieties.

Table 1. Grain yield of lentil varieties at Arthurton, 2012.

Variety	Nipper	PBA Flash	Nipper / PBA Flash Blend	LSD (P<0.05)
Yield (t/ha)	2.2 ^{a}	2.7 ^{c}	2.5 ^{b}	0.13

Key Findings and Comments

- A drier than average growing season in 2012 meant that there was minimal disease in this trial, and grain yield was lower than in previous seasons.

- PBA Flash outyielded Nipper by 23% in this trial, demonstrating its better suitability in shorter seasons and more marginal growing areas compared to Nipper.

L3 Lentil Group B Herbicide Tolerance, Yorke Peninsula (Arthurton) and Mid North (Pinery), South Australia

This report was published in the Yorke Peninsula Alkaline Soils Group trial results book.

Aim

To identify levels of tolerance to a range of Group B herbicides in lentil cultivars which have been selected from the Pulse Breeding Australia (PBA) program for improved tolerance to Group B herbicides.

Treatments

Varieties:	Nipper, PBA Herald XT, CIPAL1101, CIPAL1208 and CIPAL1209
Sowing date:	7 June (Arthurton), 27 May (Pinery)
Treatments:	See Table 1. Twenty one herbicide treatments (Group B; ALS inhibitors) including a range of imidazolinones, sulfonylureas and triazolopyrimides were applied at various application rates in comparison with an untreated control. There were some differences in treatments applied between the two sites. Rates of off-label herbicides are experimental rates only, and product identification has been with-held.
Timing:	All herbicides were applied at the 4-5 node stage of crop growth except for imazethapyr which was also applied at the post-sowing pre-emergent (PSPE) stage (Table 1).
Fertiliser:	MAP + Zn @ 90kg/ha (Arthurton); MAP + Zn @ 75kg/ha (Pinery)

Results and Interpretation

- Plant Mortality - mortality was observed in Nipper at Arthurton in all herbicide treatments except Flumetsulam and Imazethapyr applied PSPE (Table 1). Single rate applications of Imazethapyr and Imi-2 generated lower levels of plant mortality than the other imidazolinone chemistries.

  There were fewer incidences of plant mortality in the tolerant lentil lines compared to the intolerant check line Nipper at Arthurton. Imi-4 applied at the x4 rate (4 times experimental rate) was the only imidazolinone treatment to cause significant plant mortality in the herbicide tolerant lines. However the herbicide tolerant lines CIPAL1208 and CIPAL1209 showed no plant mortality from this treatment. CIPAL1208 was the only tolerant line to show significant plant mortality from application of SU-1, which was applied at a rate to simulate carryover residues. Applications of SU-2 caused significant plant mortality in all lines, but lower levels were recorded in PBA Herald XT and CIPAL1101 while Tri-1 led to mortality in all lines except CIPAL1101.

  Nipper at Pinery showed high plant mortality from most herbicide chemistries, similarly to Arthurton. The only Group B chemistry which showed no plant mortality in this variety was Flumetsulam. Imazethapyr and Imi-2 were again less damaging than the other imidazolinone chemistries, Imi-3 and Imi-4. The sulfonyl-urea treatment SU-2 was the only treatment to generate plant mortality in PBA Herald XT and CIPAL1101 at Pinery.

Table 1: The effect of various Group B herbicide treatments on plant survival (% of untreated) of selected Group B tolerant lentil lines and PBA Herald XT in comparison with Nipper, Arthurton and Pinery 2012.

Chemical	Rate*	Arthurton Nipper	Arthurton PBA Herald XT	Arthurton CIPAL1101	Arthurton CIPAL1208	Arthurton CIPAL1209	Pinery Nipper	Pinery PBA Herald XT	Pinery CIPAL1101
Nil (plants/m2)		110	112	106	110	108	103	112	114
Triazolopyrimidines									
Flumetsulam 800	25g/ha	92	93	104	90	96	106	97	95
Flumetsulam 800	50g/ha	95	87	103	93	102	109	103	94
Tri-1	x	3	68	90	10	48	83	100	100
Imidazolinones									
Imazethapyr 700	100g/ha	71	96	99	102	101	83	96	92
Imazethapyr 700	200g/ha	10	92	98	100	109	68	97	99
Imazethapyr 700	400g/ha	0	95	99	101	91	13	97	95
Imazethapyr 700	100g/ha PSPE	95	96	104	97	96	-	-	-
Imazethapyr 700	200g/ha PSPE	89	99	104	91	95	-	-	-
Imi-2	x	68	97	97	102	93	92	93	99
Imi-2	x2	10	95	106	97	99	72	105	98
Imi-2	x4	0	92	103	93	100	21	97	93
Imi-3	x	3	98	103	102	101	102	101	97
Imi-3	x2	0	99	97	100	91	7	96	98
Imi-3	x4	0	99	103	95	95	0	106	99
Imi-4	x	4	99	99	101	106	14	97	93
Imi-4	x2	0	96	99	100	98	0	99	95
Imi-4	x4	0	41	40	96	96	0	85	88
Sulfonylureas									
SU-1	Res	24	97	97	49	99	83	96	97
SU-2	x	0	74	74	0	7	3	89	90
SU-3	x	-	-	-	-	-	98	100	103
SU-4	x	-	-	-	-	-	4	91	91

Shaded figures denote significant difference to the corresponding Nil treatment
PSPE = post-sowing pre-emergent. PE = post- emergent (4-5 node stage)
* x = Off label product and rate – experimental rate only. Res = very low rate simulating soil residuals.

- Grain Yield – Nipper incurred higher yield losses from herbicide treatments than other varieties at Arthurton (Table 2). Nipper showed yield loss from all herbicide chemistries except Flumetsulam, which caused no yield loss in any variety. All other herbicide treatments led to yield loss in Nipper except the single rate of Imi-2, and the single rate of Imazethapyr at both pre and post emergent timings. Imi-3 and Imi-4 were the most damaging imidazolinone chemistries, causing over 90% yield loss at the single rate. Tri-1 and SU-2 treatments also resulted in over 90% yield loss in this trial.
  As was observed in the plant mortality findings, Imi-4 applied at the quadruple rate was the only imidazolinone treatment to cause significant yield loss in the tolerant lentil lines, and again this only occurred in PBA Herald XT and CIPAL1101. SU-1, SU-2 and Tri-1 caused yield loss in the tolerant lines CIPAL1208 and CIPAL1209, but caused no yield loss in PBA Herald XT and CIPAL1101.
  All herbicide treatments generated high yield losses in Nipper at Pinery in 2012. Flumetsulam caused the lowest yield loss, followed by single rates of Imazethapyr, Imi-2 and SU-3. As at Arthurton, higher plant mortalies in Imi-3 and Imi-4 resulted in higher yield losses in these treatments than in the Imazethapyr and Imi-2 treatments.

A low number of incidences of yield loss were observed in the tolerant lines PBA Herald XT and CIPAL1101 at Pinery, but in all of these cases they were significantly lower than the yield loss caused in Nipper. Imi-4 generated a 24% yield loss in CIPAL1101 while SU-2 and Tri-1 generated yield losses in both varieties.

Table 2: The effect of various Group B herbicide treatments on grain yield (% of untreated) of selected Group B herbicide tolerant lentil lines and PBA Herald XT, in comparison with Nipper, Arthurton and Pinery 2012.

		Arthurton					Pinery		
Chemical	**Rate***	**Nipper**	**PBA Herald XT**	**CIPAL1101**	**CIPAL1208**	**CIPAL1209**	**Nipper**	**PBA Herald XT**	**CIPAL1101**
Nil (t/ha)		2.06	1.89	2.23	1.91	2.45	1.25	1.03	1.31
Triazolopyrimidines									
Flumetsulam 800	25g/ha	108	111	101	105	101	79	104	98
Flumetsulam 800	50g/ha	102	95	92	99	102	65	85	94
Tri-1	x	9	93	97	13	55	22	76	71
Imidazolinones									
Imazethapyr 700	100g/ha	94	105	102	119	117	54	112	110
Imazethapyr 700	200g/ha	19	108	114	117	105	30	105	105
Imazethapyr 700	400g/ha	2	105	111	118	112	6	107	110
Imazethapyr 700	100g/ha PSPE	94	111	97	112	108	-	-	-
Imazethapyr 700	200g/ha PSPE	56	104	96	111	98	-	-	-
Imi-2	x	95	98	109	114	101	57	110	99
Imi-2	x2	24	127	115	108	112	26	104	98
Imi-2	x4	0	109	102	118	104	7	90	94
Imi-3	x	5	95	108	124	113	32	104	99
Imi-3	x2	0	111	122	130	103	2	112	96
Imi-3	x4	0	125	110	122	104	1	104	95
Imi-4	x	1	122	105	113	109	4	98	95
Imi-4	x2	0	136	104	118	106	2	88	90
Imi-4	x4	0	44	52	117	105	1	81	76
Sulfonylureas									
SU-1	Res	44	100	104	69	83	38	103	101
SU-2	x	2	95	91	2	12	2	78	88
SU-3	x	-	-	-	-	-	57	105	103
SU-4	x	-	-	-	-	-	2	96	91

Shaded figures denote significant difference to the corresponding Nil treatment
PSPE = post-sowing pre-emergent. PE = post- emergent (4-5 node stage)
* x = Off label product and rate – experimental rate only. Res = very low rate simulating soil residuals.

Key Findings and Comments

- A high level of crop safety exists in PBA Herald XT to both post-sowing pre-emergent (PSPE) and post-emergent (PE) applications of imazethapyr. This high level of crop safety was shown to most but not all of the group B herbicides (e.g. Imi-4).
- Nipper showed up to 100% yield loss in some treatments where tolerant lines showed no yield loss. Nipper incurred yield losses from all herbicide treatments at Pinery but not all at Arthurton. Flumetsulam and single rates of Imazethapyr and Imi-2 were less damaging at Arthurton, but other treatments generally caused similar yield losses between the two sites.

These differences are probably due to increased recovery at Arthurton due to the more favourable conditions at this site, eg longer growing season and heavier soil.

- All tolerant lines, PBA Herald XT, CIPAL1101, CIPAL1208 and CIPAL1209, showed improved tolerance to the range of group B herbicides compared to Nipper. However some variability in tolerance between these lines to the different herbicide families within the Group B herbicides trialled was identified. Tolerant lines showed no yield loss from all imidazolinone chemistries in this trial at both sites except for PBA Herald XT and CIPAL1101 at the highest rate of Imi-4.PBA Herald XT and CIPAL1101 showed no yield loss to the varying rates of sulfonyl-urea and the Tri-1 chemistries at Arthurton, demonstrating better tolerance to sulfonylurea chemistries than Nipper and the imazethapyr tolerant lines CIPAL1208 and CIPAL1209. However they did incur yield loss from SU-2 and Tri-1 at Pinery indicating low safety margins with these products. Plant survival measurements showed that plant mortality was higher at Arthurton than Pinery, indicating again that recovery from damage may be better under more favourable growing conditions.
- Yield losses were closely associated with plant mortality levels, where treatments with high plant mortality also generated high yield loss. However in some treatments (eg Imazethapyr PSPE x2 at Arthurton, and Imi-2 and Imi-3 at Pinery) showed no significant plant mortality but incurred a significant yield loss of up to 50%. Biomass cuts (data not shown) showed significant reductions in biomass of Nipper from these treatments, therefore yield loss caused by this treatment is likely due to the inability to recover from the severe biomass reduction due to the dry season finish, and the effect of delayed flowering. This effect, where a herbicide causes yield loss without causing mortality, has been previously observed with high rates of Flumetsulam or Metribuzin in trials and broadacre crops.
- While a range of Group B chemistries may appear safe for post-emergent use on particular herbicide tolerant varieties in this research the current permitted herbicide is Spinnaker on PBA HeraldXT and PBA Hurricane XT (CIPAL1101) only. Future agronomic research in conjunction with Pulse Breeding Australia may be able to develop lines with improved levels of herbicide tolerance to other Group B chemistries.

L4 Lentil Crop-topping/Desiccation, Yorke Peninsula (Melton), South Australia

Aim

To determine the correct maturity timing required in lentils for successful crop-topping practice.

Treatments

Varieties: Table 1
Sowing date: 6 June
Treatments: see tables for dates
Nil - no desiccant applied
Early - applied 13 days pre ryegrass milky dough stage (12 Oct)
Recommended - applied at ryegrass milky dough stage (25 Oct)
Fertiliser: MAP + Zn @ 90kg/ha

Results and Interpretation

- Significant two way interactions (Timing x Variety) were observed for grain yield and grain weight (Table 1).
- Grain Yield – yield of all varieties in this study was reduced by crop-topping 2 weeks prior to the Recommended timing (ryegrass milky dough stage). Grain yield was also reduced at the Recommended timing in the later maturing varieties Boomer and Nugget. Later maturing varieties tended to show higher levels of yield loss compared to earlier maturing varieties, particularly at the earlier treatment timing. As in previous seasons, PBA Jumbo showed improved suitability to crop-topping than a number of others with a similar maturity profile. Long term summary of selected variety response to crop-topping (Table 2) shows Nugget has the highest average yield loss from crop-topping at both Early and Recommended timings. PBA Blitz and CIPAL0901, the earliest maturing varieties, show the lowest level of yield loss from crop-topping, and are therefore considered better suited to this practice. PBA Jumbo, and the 2012 variety releases PBA Ace and PBA Bolt have shown better suitability to crop-topping than the commercial varieties Nugget and Nipper. The earliest maturing variety evaluated, CIPAL901, shows a lower average long term yield loss (in fewer trials, Table 2) but has shown no significant improvement in suitability to crop topping over PBA Blitz in three years of testing.
- Grain weight - a similar trend was observed for grain weight as for grain yield. All varieties showed reduced grain weight from crop-topping 2 weeks prior to the Recommended timing (Table 1). Three varieties (PBA Bounty, CIPAL0607 and CIPAL0501) also showed reduced grain weight from crop-topping at the Recommended timing, while earlier maturing varieties PBA Blitz, CIPAL0901 and CIPAL0902 showed the least effect on grain weight from crop-topping at this timing.

Table 1. Effect of crop-top timing on grain yield and grain weight of lentil varieties, Melton 2012. Varieties are ranked according to their visual maturity rating from earliest to latest (E = Early, M = Mid, L = Late)

Variety	Maturity Profile		Yield (t/ha)	Yield (% of Nil)		Grain Wt. (g/100)	Grain Weight (% of Nil)	
	Flower Timing	Maturity Timing	Nil	Early (12-Oct)	Recommended (25-Oct)	Nil	Early (12-Oct)	Recommended (25-Oct)
CIPAL0901	E-M	E	1.63	74	103	4.8	83	100
PBA Blitz	E-M	E	1.55	75	88	5.2	87	100
CIPAL0802	E-M	E-M	1.47	66	99	4.4	82	97
PBA Flash	E-M	E-M	1.58	72	91	5.0	80	96
CIPAL902	M	E-M	1.6	71	97	4.3	85	103
PBA Bolt	E-M	M	1.59	72	87	4.7	82	98
PBA Jumbo	M	M	1.46	75	109	5.4	80	98
PBA Bounty	M-L	M	1.49	63	95	4.1	78	93
Nipper	M-L	M	1.54	64	86	3.6	81	95
PBA Ace	M	M-L	1.66	50	87	4.6	80	95
CIPAL607	M-L	M-L	1.6	63	86	3.7	84	93
Boomer	E-M	M-L	1.67	58	64	6.5	88	96
Nugget	M	M-L	1.51	68	78	4.3	87	98
CIPAL0501	M	L	1.61	55	87	5.3	76	93
Mean			**1.57**	**1.04**	**1.41**	**4.5**	**3.4**	**4.4**

lsd(P<0.05)timing.var = 0.47, (Grain Yield), 0.25 (Grain Weight)

NB: Shading denotes significant difference from the Nil treatment.

Table 2: Long term summary (2008-2012) of grain yield response of selected lentil cultivars to crop-topping, Early and Recommended timings.
Varieties are ranked according to their visual maturity rating from earliest to latest

Variety	Incidence of significant yield losses (# trials)		Average Yield [Range] (% of Control)	
	Early	Recommended	Early	Recommended
CIPAL0901	3 (3)	0 (3)	63 [34-82]	106 [100-115]
PBA Blitz	4 (5)	1 (5)	56 [25-82]	94 [89-101]
PBA Flash	5 (5)	2 (5)	49 [30-70]	92 [80-112]
PBA Bolt	4 (4)	0 (4)	51 [35-72]	91 [86-101]
PBA Jumbo	4 (4)	1 (4)	52 [33-82]	98 [92-102]
Nipper	5 (5)	2 (5)	47 [34-65]	89 [80-98]
PBA Ace	3 (3)	1 (3)	58 [50-74]	87 [75-100]
CIPAL0607	5 (5)	3 (5)	47 [27-70]	86 [76-93]
Nugget	5 (5)	2 (5)	39 [28-63]	84 [75-95]

Key Findings and Comments

- There was a strong crop-top timing response, but limited variation between varieties from crop-topping in 2012. This may be due to below average end-season rainfall, suppressing some yield potential of untreated plots, particularly in later maturing varieties.
- All varieties showed yield loss from crop-topping two weeks prior to the recommended timing. A link between plant maturity and reduced yield was observed at the Early crop topping timing, with earlier maturing varieties showing the least effect and later maturing varieties presenting the greatest effect. At the Recommended timing only two of the later maturing varieties showed any yield loss.

- Previous seasons have also shown a strong link between yield loss from crop-topping and variety maturity. Long term summary of selected varieties showed the widely grown commercial variety Nugget to be less suited to crop-topping than other commercial cultivars, with PBA Blitz best suited. PBA Jumbo also showed lower yield loss than other varieties in a similar maturity bracket, further research is required to understand this result.
- No variety improvements on suitability to crop-topping over PBA Blitz have been identified to date.

L5 Sowing Time, LRZ Yenda, NSW

Aim

To maximise yield of lentils by identifying superior varieties and optimising sowing date.

Treatments

Varieties:	PBA Blitz, PBA Herald XT, PBA Bolt, CIPAL0802, PBA Ace and CIPAL0901
Sowing dates:	18th May (Early), 20th June (Late)
Fertiliser:	Legume Starter @ 115 kg/ha at sowing banded below the seed
Plant population:	120pl/m2 target
Herbicides:	Pre-sowing; Glyphosate @ 1.5 l/ha and Terbyne® at 1 kg/ha.

Results and Interpretation

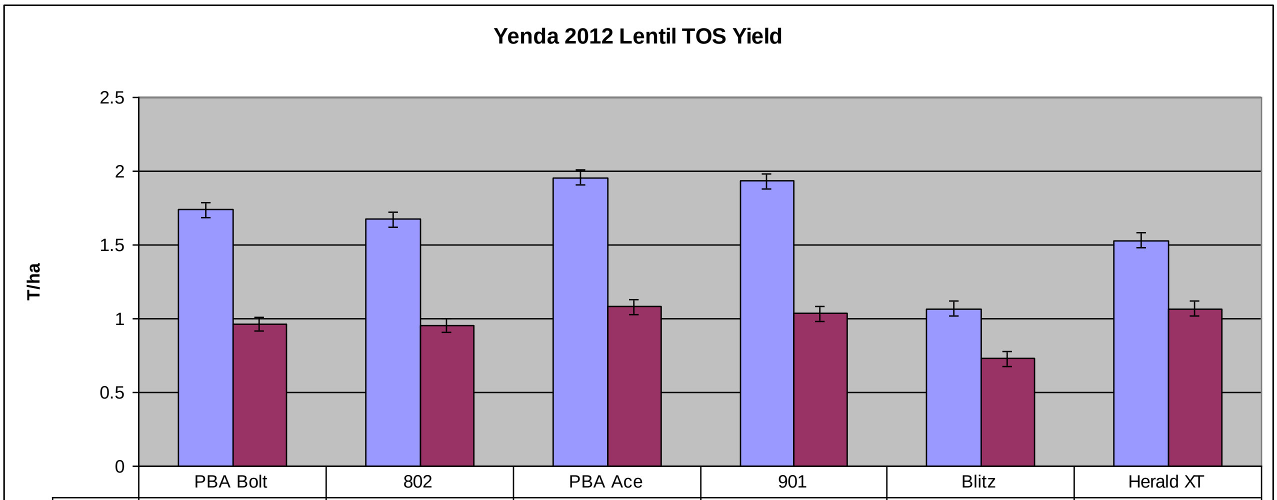
In the 2012 season at Yenda, lentil variety choice and time of sowing significantly influenced grain yield, Figure 1. The two emerging PBA lentil breeding lines PBA Ace and CIPAL0901 yielded higher than current commercial varieties.

The yields achieved would suggest lentil production within the southern NSW cropping zone could be highly profitable, given average cropping season rainfall.
Yields generally trended lower with delayed sowing time, with significant yield reductions in all varieties. Spring growth conditions were warmer and thus less favourable, compared to Wagga Wagga resulting in yield penalties for all species from delayed sowing.

Establishment management changes (separation of seed and fertilizer and eliminating/minimising herbicide damage) also had positive impact on emergence and plot vigour.

Weed burdens within the site were low and weed growth was minimal and not sufficient to affect crop yields. There was some crop damage from a late post emergent application of Brodal.

Figure 1. Effect of variety and sowing date (18 May & 20 June) on grain yield (t/ha) of 6 lentil varieties at Yenda in 2012.



	PBA Bolt	802	PBA Ace	901	Blitz	Herald XT
May-18	1.738	1.673	1.955	1.931	1.068	1.529
Jun-19	0.963	0.954	1.08	1.034	0.727	1.068

Key Findings and Comments

- PBA Ace and CIPAL0901 were the highest yielding varieties and show great potential for future lentil production in this region.

- Delayed sowing reduced yields in 2012 at Yenda by an average of 40%
- Established human consumption markets and yields over two tonnes per hectare suggest that lentil production could be profitable in southern NSW cropping zone
- This trial should be repeated in future seasons in order to compare and validate the 2011 and 2012 findings across variable growing seasons.

L6 Sowing Time, H-MRZ Wagga Wagga, NSW

Aim

To maximise yield of new lentil varieties through the identification of optimum variety and sowing dates.

Treatments

Varieties: Boomer, Nipper, PBA Blitz, PBA Flash, CIPAL0801, CIPAL0802, CIPAL0803 and CIPAL0901

Sowing dates: 10th May (Early), 14th June (Late)

Row spacing: 300mm

Fertiliser: Legume Starter @ 115 kg/ha at sowing banded below the seed

Plant population: 120pl/m2 target

Herbicides: Pre-sowing Glyphosate application @ 2.0 l/ha and Stomp® at 2.0 l/ha. PSPE Sencor @ 200ml/ha.

Results and Interpretation

In the 2012 season, lentil variety choice significantly influenced grain yield, Figure 1, while sowing time and variety by sowing time effects were not significant, Figure 2. The two emerging PBA lentil varieties CIPAL0803 and CIPAL0901 yielded higher than current commercial varieties, with CIPAL0803 significantly higher yielding than all commercial varieties. The yields achieved would suggest lentil production within the southern NSW cropping zone could be highly profitable.

While yields generally trended lower with delayed sowing time, yield effects were not significant in any variety. Spring growth conditions and water supply were favourable for continued spring growth and in this season later sown crops were able to fulfil most of the plants yield potential.

Management significantly affects plot emergence and subsequent growth

For many years at Wagga, we have experienced emergence problems, patchy uneven growth and low yields across our lentil trials, often attributing much of this to an unfavourable southern NSW environment, and in particular our acidic soils. However, we altered some of our management practices in 2012 and this resulted in significantly better emergence, establishment and even growth across our trials -

The sowing boots were modified to separate seed and fertiliser within the sowing row, placing fertiliser approximately 20mm below the seed. This minimised fertiliser toxicity.

We increased sowing depth from 25mm to 40mm. This assisted separation of seed and herbicide.

Row spacing was increased from 200mm to 300mm to adopt more of an industry practice and conform to most growers' machinery.
Herbicide damage from Metrabuzin was reduced by reducing post sowing rate of from maximum to minimum label rates.
Overall, these changes resulted in improved emergence, more even and vigorous crop growth, less variable trials and higher yields. Identifying roles of each factor in improving crop establishment and growth could guide direction for future agronomy investigations. Weed control during the preceding years becomes even more paramount for lentils.

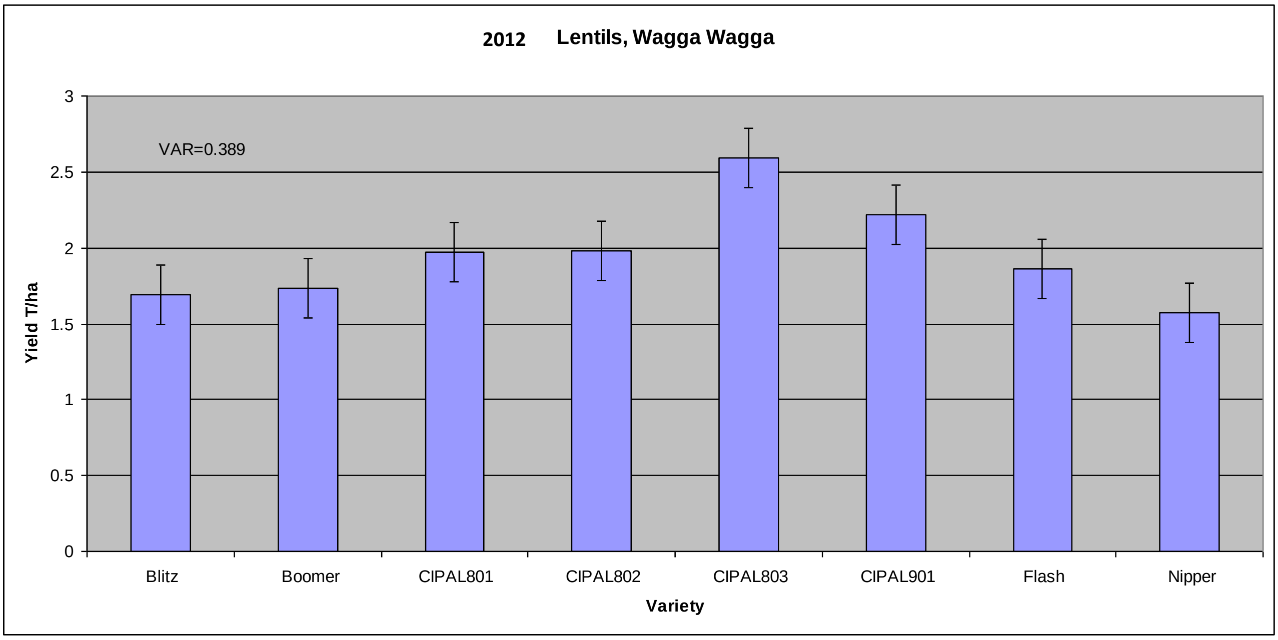


Figure 1. Effect of variety on grain yield (t/ha) of 8 lentil varieties, Wagga Wagga 2012

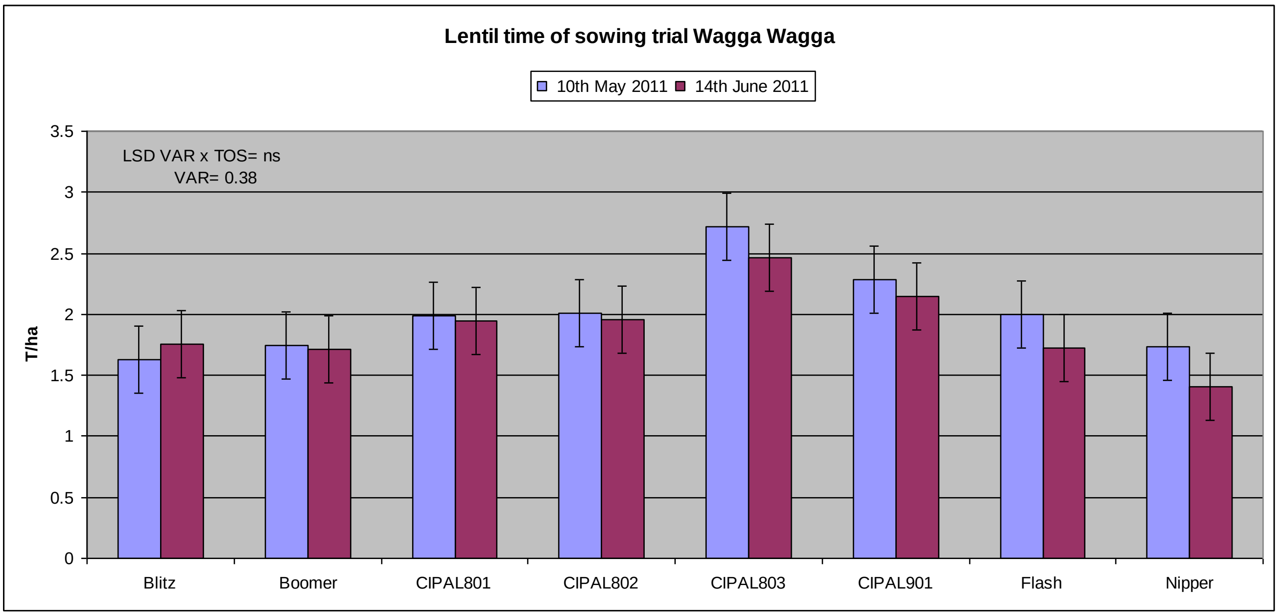


Figure 2. Effect of sowing date on grain yield (t/ha) of 8 lentil varieties, Wagga Wagga 2012 at two times of sowing.

Key Findings and Comments

CIPAL0803 and CIPAL0901 out yielded all commercial varieties.

The favourable 2012 growing season conditions facilitated high yields at both sowing times.

Established human consumption markets and yields over two tonnes per hectare suggest that lentil production could be profitable in southern NSW cropping zone

This trial should be repeated in future seasons in order to compare and validate the 2011 findings across variable growing seasons.

Lentils are more sensitive to commonly used herbicides and considerable care must be taken.

L7 Sowing Time, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the adaptability of a range of lentil varieties and variety mixes to varying sowing dates.

Treatments

Varieties:	Boomer, Nipper, Northfield, Nugget, PBA Blitz, PBA Flash, PBA Jumbo, PBA HeraldXT, PBA Bolt, PBA Ace, CIPAL0901, CIPAL1101.
Variety Mixes:	PBA Flash:Nipper, PBA Flash:Nugget, PBA Flash:PBABlitz, PBA Flash:CIPAL0901. All sown with a 50:50 ratio based on targeted plants/m^2.
Sowing dates:	4 May (Early), 5 June (Mid), 26 June (Late).

Other Details

Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble.
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing.
Plant Density:	120 plants/m^2.

Results and Interpretation

- Key Message: When sown early, grain yields of PBA Ace were significantly greater than all released varieties except Nugget. Earlier maturing varieties like PBA Flash, CIPAL0901 and PBA Blitz, generally have less yield decline at the later sowing dates, but this did not result in higher yields than PBA Ace at the later dates.

- Plant establishment – Emergence for the early sowing date was delayed due to a dry period during May and growth throughout the season was generally slow for all sowing dates. Establishment for all lentil varieties was below targets in 2012. Generally densities ranged between 60 and 100 plants/m^2 (data not shown).

- Pod Drop and Shattering – A moderate level of pod drop and shattering was observed at maturity in the lentils at Curyo in 2012. Generally, pod drop and shattering was worst in the earlier sown plots and at very low levels in the later sown plots (Data not shown). Among the varieties Nipper, PBA Blitz, PBA Flash and Nugget had the lowest level of pod drop and Boomer highest (Table L7.1). Boomer was the only variety to show a significant level of pod shattering.

Table L7.1. Pod drop and Shattering scores (1 = no pod loss or shattering; 9 complete pod loss and shattering) of lentil varieties sown May 4 and variety mixes at Curyo in 2012.

Variety / Variety mix	Pod Drop	Shattering
Boomer	3.3	5.3
PBA Ace	3.3	1.3
CIPAL0901	3.3	1.0
CIPAL1101	3.3	1.0
Northfield	3.3	1.3
PBA HeraldXT	3.3	1.7
PBA Bolt	3.0	1.3
PBA Flash:CIPAL0901	3.0	1.0
PBA Flash:Nipper	3.0	1.0
PBA Jumbo	3.0	1.0
PBA Flash:Nugget	2.7	1.0
Nugget	2.3	1.0
PBA Blitz	2.3	1.3
PBA Flash:PBA Blitz	2.3	1.3
PBA Flash	2.0	1.0
Nipper	1.7	2.0

lsd(P<0.05)pod drop = 0.5; lsd(P<0.05)shattering = 0.19.

- Grain Yield – Despite the relatively low biomass production at all sowing dates, grain yields were excellent, ranging between 1.4 and 2.6 t/ha (Table L7.2). For all varieties and variety mixes the May 4 sowing date had the highest yield and the June 22 sowing date the lowest yield. However, there was a significant interaction between sowing date and variety, meaning that the relative yield of varieties and mixes across sowing dates differed. In the May 4 sowing date, PBA Ace and PBA Bolt were the highest yielding varieties producing 2.6 and 2.5 t/ha, respectively. PBA Blitz was lowest with 1.9 t/ha. At the June 5 sowing date, the yield of PBA Ace and PBA Bolt dropped by 20% compared with the May 5 sowing, however varieties such as PBA Flash and CIPAL0901 (and the mixes containing these varieties) dropped by only 5-10% (Table L7.2). This meant that, while PBA Ace was significantly higher yield than PBA Flash and CIPAL0901 at the May 5 sowing date, at the June 6 sowing date, PBA Flash and CIPAL0901 were slightly higher yielding (not statistically different) than PBA Ace. Similar trends occurred at the June 22 sowing date (Table L7.2). PBA Blitz, which is a relatively early flowering, lower biomass variety, released for adaption to shorter seasons and the practise of crop-topping was generally one of the lower yielding varieties at all sowing dates.

Table L7.2. The effect of sowing date on grain yield (t/ha) of lentil varieties and variety mixes at Curyo in 2012.

Variety / Variety mix	4 May	27 May	22 June	*Average*
PBA Ace	2.62	2.06	1.73	2.13
PBA Bolt	2.50	1.95	1.77	2.07
CIPAL1101	2.39	1.83	1.70	1.97
Nugget	2.37	1.94	1.54	1.95
PBAFlash:CIPAL0901	2.30	2.16	1.64	2.03
CIPAL0901	2.26	2.07	1.76	2.03
PBA Flash	2.26	2.13	1.70	2.03
PBA Flash:Nugget	2.26	2.12	1.63	2.00
Northfield	2.24	1.84	1.53	1.87
PBA Jumbo	2.22	1.99	1.35	1.85
PBA Flash:Nipper	2.14	1.67	1.60	1.80
Boomer	2.13	1.83	1.72	1.89
Nipper	2.10	1.80	1.36	1.75
PBA Flash:PBA Blitz	2.07	1.86	1.64	1.86
PBA HeraldXT	2.00	1.48	1.40	1.63
PBA Blitz	1.94	1.73	1.51	1.73
Average	2.24	1.90	1.60	1.91

lsd(P<0.05)SDxVar = NS; lsd(P<0.05)SD = 0.21; lsd(P<0.05)Var = 0.19.

Key Findings and Comments

These results confirm that the two newly released varieties PBA Ace and PBA Bolt have excellent yield potential in the Mallee. When early sown in 2012, grain yields of PBA Ace were significantly greater than all released varieties except Nugget. Despite the season being significantly drier than average, a mild spring was experienced, meaning that higher biomass and mid maturing varieties, like PBA Ace, were likely to be favoured. This also explains why early maturing, more determinate varieties like PBA Blitz were lower yielding in this season.

Similar to previous trials in the southern Mallee, earlier sowing is either highest or equal highest yielding. In most instances delaying sowing into June will result in yield declines. This trial showed that the earlier maturing varieties like PBA Flash, CIPAL0901 and PBA Blitz, generally have less yield decline at the later sowing dates, meaning that yields were similar too or higher than PBA Ace and PBA Bolt at the later dates. Where possible, it may be desirable for producers to grow two varieties to further minimise production risks. A mid maturing type such as PBA Ace sown early, will maximise grain yield in ‘normal’ or ‘mild’ seasons, while an earlier maturing erect variety such as PBA Bolt or PBA Flash will continue to produce excellent yields in ‘shorter’ seasons with more extreme events though flowering and podding.

L8 Sowing Time, MRZ Wimmera (Rupanyup), Victoria

Aim

To investigate the adaptability of a range of lentil varieties and variety mixes to varying sowing dates.

Treatments

Varieties:	Boomer, Nipper, Northfield, Nugget, PBA Blitz, PBA Flash, PBA Jumbo, PBA HeraldXT, PBA Bolt, PBA Ace, CIPAL0901, CIPAL1001.
Variety Mixes:	PBA Flash:Nipper, PBA Flash:Nugget, PBA Flash:PBABlitz, PBA Flash:CIPAL0901. All sown with a 50:50 ratio based on targeted plants/m^2.
Sowing dates:	15 May (Early), 13 June (Mid), 18 June (Late).

Other Details

Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble.
Fertiliser:	MAP + Zn @ 80 kg/ha at sowing.
Plant Density:	120 plants/m^2.

Results and Interpretation

- Key Message: Delays in harvest, due to weather condition particularly for early sown treatments, is likely to have resulted in significant yield loss. Despite these limitations, the results indicate the relative yield benefit of the newer varieties across a range of sowing dates and environments.

- Plant establishment – Emergence for the early sowing date was delayed due to a dry period during May and growth throughout the season was generally slow for all sowing dates. Establishment for all lentil varieties was below targets in 2012. Generally densities ranged between 60 and 100 plants/m^2 (data not shown).

- Grain Yield – Grain yields were generally lower than expected, particularly at the early sowing date, due to the dry start of the season and rainfall events during harvest that resulted in losses due to pod drop and shattering. Unfortunately it was impossible to estimate pod loss and shattering, effectively, due to the high stubble loads. However the results from Curyo (Trial L7) can be used as a potential guide. Grain yields ranged from 0.9 t/ha for Boomer sown May 15 to 2.2 t/ha for CIPAL0901 sown June 13 (Table L8.1). Generally, the mid sowing date was highest yielding, 10% and 20% greater than the early and late dates, respectively. However, similar to Curyo, there was a significant interaction between sowing date and variety, meaning that the relative yield of varieties and mixes across sowing dates differed.

  In the May 15 sowing date, the PBA Flash:Nugget mix was highest yielding producing 2 t/ha, while Boomer was lowest with 0.9 t/ha. The low yields of Boomer sown early are reflective of its susceptibility to pod drop and shattering, as this sowing date was harvest 7-10 days later than optimum due to rain during harvest. At the June 13 and July 18 sowing dates, the ranking of varieties remained similar to early sown treatment, however CIPAL0901 and PBA Flash produced the greatest yields, respectively. PBA Blitz and Boomer were the lowest yielding varieties, similar to observations at Curyo. The new varieties PBA Ace and PBA Bolt displayed yields similar to the highest yielding variety at each of the sowing dates.

Table L8.1. The effect of sowing date on grain yield (t/ha) of lentil varieties and variety mixes at Rupanyup in 2012.

Variety / Variety mix	15 May	13 June	18 July	*Average*
CIPAL0901	1.86	2.17	1.50	1.84
PBA Flash:Nugget	2.01	2.01	1.47	1.83
PBA Ace	1.68	2.08	1.57	1.78
PBA Bolt	1.75	1.96	1.56	1.75
PBA Flash	1.71	1.95	1.58	1.75
PBA Flash:Nipper	1.76	1.96	1.51	1.74
CIPAL1001	1.83	1.93	1.40	1.72
PBAFlash:CIPAL0901	1.58	2.17	1.41	1.72
Nugget	1.89	1.62	1.51	1.68
Nipper	1.62	1.85	1.39	1.62
Northfield	1.69	1.70	1.38	1.59
PBA Jumbo	1.79	1.69	1.27	1.58
PBA Flash:PBA Blitz	1.51	1.81	1.30	1.54
PBA HeraldXT	1.41	1.56	1.30	1.42
PBA Blitz	1.22	1.39	1.22	1.28
Boomer	0.93	1.38	1.18	1.16
Average	1.64	1.83	1.41	1.62

lsd(P<0.05)SDxVar = 0.32; lsd(P<0.05)SD = 0.16; lsd(P<0.05)Var = 0.18.

Key Findings and Comments

The general ranking of varieties at Rupanyup was relatively similar to Curyo, although the improvements in yield of PBA Ace and PBA Bolt sown early were not shown in this trial. The delay in harvest, particularly for early sown treatments, is likely to have resulted in significant yield loss, however it is difficult to quantify for individual varieties. Despite these limitations, the results indicate the relative yield benefit of the newer varieties across a range of sowing dates and environments.

L9 Herbicide Tolerance, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the adaptability of a range of new herbicide tolerant lentil varieties to a range of Group B herbicides.

Treatments

Varieties:	PBA HeraldXT, CIPAL1101, CIPAL1208, CIPAL1209 (all tolerant), PBA Flash (Control, Intolerant).
Herbicides:	Nineteen herbicide treatments (Group B; ALS inhibitors) encompassing a range of imidazolinones, triazolopyrimides and sulfonylureas were applied at various application rates in comparison with an untreated control (Table L11.1).

Other Details

Sowing date:	4 May.
Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble (ST30).
Fertiliser:	MAP + Zn @ 40 kg/ha at sowing.
Plant Density:	120 plants/m^2.
Soil Type	Alkaline Sandy Loam over a heavy clay at about 40-60cm (pH_{H20} (0-10cm): 7.8; pH_{H20} (40-60cm): 9.1)

Results and Interpretation

- Key Message: PBA HeraldXT and CIPAL1101 have good tolerance to imidazolinone chemicals, but may not be as tolerant to Imi-3 as the lines CIPAL1208 and CIPAL1209. Conversely, PBA HeraldXT and CIPAL1101 have improved tolerance to the Sulfonylurea herbicides relative to the control and CIPAL 1208 and CIPAL 1209, indicating potential benefits where residues may be an issue in cropping systems.

- Herbicide Damage - Visual herbicide damage symptoms were observed for all treatments applied to the intolerant genotype PBA Flash (Table 1). Varying levels of damage were observed among the four tolerant lines. CIPAL1101 showed no significant damage symptoms from all imidazolinone herbicide treatments except ‘imi-3’ applied at the highest rate. It also showed no damage from flumetsulam 800 within the Triazolopyrimidine group and SU-3 within the Sulfonylurea group. PBAHerldXT, which is a sister line with similar genetic background, but less vigour, showed similar trends, however it also showed slightly great symptoms for imi-3 applied at the x2 rate and SU-3 (Table 1). The line CIPAL1208 appeared to have slight significant damage from imazethapyr and Imi-4 at the highest rates, while the line CIPAL1209 was damaged by Imi-2 at the highest rates. In addition CIPAL1209 showed significant damage from flumetsulam 800 at the highest rate and was completely killed by most Sulfylurea treatments. Both of the lines, CIPAL1208 and CIPAL1209, were significantly more damaged by the Sulfonylurea treatments than CIPAL1101 and PBA HeraldXT (Table 1).

Table 1. The effect of various Group B herbicide treatments on visual damage score (1 – no damage, 9 – complete plant death) recorded August 22 of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Curyo, 2012. Significant damage scores have been shaded.

Chemical[1]	**Rate**	**CIPAL1101**	**CIPAL1208**	**CIPAL1209**	**PBA Flash**	**PBA HeraldXT**
Nil		1.0	1.0	1.0	1.0	1.0
Imidazolinones						
Imazethapyr 700	100g/ha	1.0	1.0	1.3	7.0	1.0
Imazethapyr 700	200g/ha	1.0	1.0	1.0	7.0	1.3
Imazethapyr 700	400g/ha	1.0	2.0	1.7	8.7	1.0
Imi-2	x1	1.0	1.0	1.0	8.0	1.0
Imi-2	x2	1.0	1.3	1.3	7.3	1.3
Imi-2	x4	1.0	1.7	2.3	8.7	1.3
Imi-3	x1	1.0	1.3	1.0	9.0	1.0
Imi-3	x2	1.0	1.7	1.0	9.0	2.7
Imi-3	x4	4.3	1.3	1.3	9.0	4.0
Imi-4	x1	1.0	1.3	1.3	9.0	1.3
Imi-4	x2	1.0	1.3	1.0	9.0	1.3
Imi-4	x4	1.0	2.3	1.7	9.0	1.7
Triazolopyrimidines						
Flumetsulam 800	25g/ha	1.0	1.7	1.0	2.3	1.0
Flumetsulam 800	50g/ha	1.0	3.0	1.3	4.3	1.0
Tri-1	x1	6.7	9.0	8.0	8.7	6.7
Sulfonylureas						
SU-1	x1	8.0	9.0	9.0	9.0	8.7
SU-2	x1	6.7	9.0	9.0	9.0	7.0
SU-3	x1	1.7	7.3	6.0	8.0	3.3
SU-4	x1	7.3	9.0	9.0	9.0	8.0

1. Herbicide active ingredient or code for unregistered products.

- Biomass - Similar to visual damage symptoms biomass production varied among the genotypes that were compared in this trial (Table 2). For the intolerant genotype PBA Flash, all herbicide treatments, including that which is registered (Flumetsulam 800 applied at 25g/ha), caused significant reduction in biomass, with many treatments resulting in death. Within the tolerant lines, only minor significant reductions in yield in the imidazolinone chemical group were recorded for CIPAL1208 at the highest rate of Imazethapyr and the mid and low rate of Imi-2 and Imi-4 for PBA HeraldXT, respectively. CIPAL1208 showed significant biomass decline with the application of Flumetsulam, while no other lines were affected. Within the Sulfoylureas the only unaffected treatment was SU-3 applied to PBA HeraldXT and CIPAL1101.

Table 2. The effect of various Group B herbicide treatments on biomass production (t/ha) of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Curyo, 2012. Significant yield loss has been shaded

Chemical[1]	**Rate**	**CIPAL1101**	**CIPAL1208**	**CIPAL1209**	**PBA Flash**	**PBA HeraldXT**
Nil		5.37	5.36	5.08	4.92	5.28
Imidazolinones						
Imazethapyr 700	100g/ha	5.42	4.58	4.85	2.07	4.71
Imazethapyr 700	200g/ha	5.37	4.49	4.39	0.95	4.58
Imazethapyr 700	400g/ha	5.10	4.26	4.89	0.50	5.33
Imi-2	x1	5.70	4.63	4.80	1.25	5.04
Imi-2	x2	4.40	4.75	4.73	2.33	3.90
Imi-2	x4	4.99	5.41	5.12	0.29	5.11
Imi-3	x1	4.77	4.56	5.42	0.20	4.76
Imi-3	x2	4.50	5.16	5.60	0.00	5.03
Imi-3	x4	4.45	4.46	4.35	0.00	4.33
Imi-4	x1	5.14	4.49	4.88	0.47	4.03
Imi-4	x2	5.59	4.62	5.20	0.08	4.66
Imi-4	x4	4.56	4.83	5.20	0.00	4.55
Triazolopyrimidines						
Flumetsulam 800	25g/ha	5.23	3.87	4.82	3.18	4.49
Flumetsulam 800	50g/ha	4.50	1.93	4.19	1.87	5.25
Tri-1	x1	4.55	1.46	3.26	2.11	3.33
Sulfonylureas						
SU-1	x1	1.93	0.00	0.54	0.00	1.58
SU-2	x1	3.79	0.00	0.18	0.00	3.56
SU-3	x1	5.11	3.77	4.10	2.80	4.84
SU-4	x1	2.20	0.00	0.56	0.00	2.08

1. Herbicide active ingredient or code for unregistered products.

- Grain Yield - Similar to visual damage symptoms and biomass production, grain yields varied among the genotypes that were compared in this trial (Table 2). For the intolerant genotype PBA Flash, all herbicide treatments, including that which is registered (Flumetsulam 800 applied at 25g/ha), caused significant yield loss, with many treatments resulting in death. Within the tolerant lines, only imi-3 and imi-4 at the highest rates caused significant yield loss in the lines, CIPAL1101 and CIPAL1208, respectively within the imidizolinone chemical group. CIPAL1208 showed significant yield loss with the application of Flumetsulam, while no other lines were affected. Within the Sulfoylureas the only unaffected treatment was SU-3 applied to PBA HeraldXT and CIPAL1101.

Table 3. The effect of various Group B herbicide treatments on grain yield (t/ha) of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Curyo, 2012. Significant yield loss has been shaded

Chemical[1]	Rate	CIPAL1101	CIPAL1208	CIPAL1209	PBA Flash	PBA HeraldXT
Nil		2.40	1.99	2.19	2.52	1.78
Imidazolinones						
Imazethapyr 700	100g/ha	2.07	1.93	2.10	0.80	1.81
Imazethapyr 700	200g/ha	2.31	1.69	2.16	0.00	1.69
Imazethapyr 700	400g/ha	2.10	1.81	2.22	0.00	1.57
Imi-2	x1	2.46	1.81	1.90	0.00	1.84
Imi-2	x2	2.07	1.96	2.13	0.74	1.57
Imi-2	x4	2.19	1.84	2.19	0.00	1.78
Imi-3	x1	2.25	1.90	2.31	0.00	1.69
Imi-3	x2	2.34	1.78	2.04	0.00	1.66
Imi-3	x4	1.48	1.87	2.28	0.00	1.42
Imi-4	x1	2.37	1.87	2.16	0.00	1.51
Imi-4	x2	2.13	1.93	2.28	0.00	1.87
Imi-4	x4	2.25	1.54	2.25	0.00	1.69
Triazolopyrimidines						
Flumetsulam 800	25g/ha	2.40	1.48	2.02	1.33	1.81
Flumetsulam 800	50g/ha	2.34	0.86	1.99	0.89	1.84
Tri-1	x1	1.99	0.42	1.51	0.83	1.69
Sulfonylureas						
SU-1	x1	0.65	0.00	0.00	0.00	0.33
SU-2	x1	1.27	0.00	0.00	0.00	1.24
SU-3	x1	2.04	1.69	1.63	1.07	1.63
SU-4	x1	0.92	0.00	0.00	0.00	0.42

1. Herbicide active ingredient or code for unregistered products.

- Grain Weight and Germination – Within the tolerant lines there were no major impacts of the various herbicide treatments on grain weight or germinability of that grain (dat not showm).

Key Findings and Comments

This data highlights the importance of testing across a range on chemicals within a herbicide group and not assuming that tolerance will be consistent within a herbicide group. This data highlighted that PBA HeraldXT has good tolerance to imidazolinone chemicals, but may not be as tolerant to Imi-3 as the lines CIPAL1208 and CIPAL1209. Combining lines like CIPAL1101 and CIPAL1209 could lead to new genotypes with tolerance to the full range imidazolinone chemicals. Pulse Breeding Australia will be utilising this information to define future breeding directions for herbicide tolerant varieties, following PBA HeraldXT.

The ongoing introduction and improvement of these herbicide tolerant lentils could result in significant farming systems benefits through improved weed control, increased control options in lentil crops and in the previous rotation phase, and decreased pressure on herbicides currently employed for broadleaf weed control in lentil. However we need to continuously monitor weed resistance levels and discuss define the optimum methods for maximising the benefits of this herbicide tolerance technology for the whole farming system.

L10 Herbicide Tolerance, MRZ Wimmera (Rupanyup), Victoria

Aim

To investigate the adaptability of a range of new herbicide tolerant lentil varieties to a range of Group B herbicides in standing and burnt stubbles.

Treatments

Stubble:	Burnt or Standing (approximately 40cm high)
Varieties:	Standing stubble - PBA HeraldXT, CIPAL1101, CIPAL1208, CIPAL1209 (all tolerant), PBA Flash (Control, Intolerant). Burnt stubble - PBA HeraldXT, CIPAL1101, CIPAL1102 (all tolerant), PBA Flash, Nipper (Controls, Intolerant).
Herbicides:	Nineteen herbicide treatments (Group B; ALS inhibitors) encompassing a range of imidazolinones, triazolopyrimides and sulfonylureas were applied at various application rates in comparison with an untreated control (Table Lxx.1).

Other Details

Sowing date:	4 May.
Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble (ST30).
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing.
Plant Density:	120 plants/m^2.
Soil Type	Alkaline Black cracking clay (pH$_{H20}$ (0-10cm): 8.3; pH$_{H20}$ (40-60cm): 9.0)

Results and Interpretation

➢ Key Message: . PBA HeraldXT and CIPAL1101 have s good tolerance to imidazolinone chemicals, but may not be as tolerant to Imi-3 as the lines CIPAL1208 and CIPAL1209. Conversely, PBA HeraldXT and CIPAL1101 have improved tolerance to the Sulfonylurea herbicides relative to the control and CIPAL 1208 and CIPAL 1209, indicating potential benefits where residues may be an issue in cropping systems.

- Herbicide Damage – In the *standing stubble*, visual herbicide damage symptoms were observed for all treatments applied to the intolerant genotype PBA Flash (Table 1a). Varying levels of damage were observed among the four tolerant lines. CIPAL1101 showed no significant damage symptoms from all imidazolinone herbicide treatments except 'imi-2' applied at the highest rate and imi-3 at the x2 and x4 rates. It also showed no damage from flumetsulam 800 at the x1 rate within the Triazolopyrimidine group and SU-3 within the Sulfonylurea group. PBAHeraldXT, showed similar trends, however it also showed slightly greater symptoms for imi-3 applied at all rates and recorded significant damage at the x1 rate (Table 1a). The line CIPAL1208 had no significant damage from any of the Imidazolinone, except imi-4 at the highest rate, while the line CIPAL1209 was damaged by Imi-2 at the highest rates. In addition, CIPAL1208 was significantly damaged by both rates of Flumetsulam and had significantly more symptoms than other tolerant lines, while both of the lines, CIPAL1208 and CIPAL1209, were significantly more damaged by the Sulfonylurea treatments than CIPAL1101 and PBA HeraldXT (Table 1).
  In the *burnt stubble*, symptoms were generally less in the tolerant lines than observed in the *standing stubble* (Table 1b). This may have occurred as the early growth in standing stubble was erect with more spindly plants (i.e plants were 'softer') compared with the more prostrate spreading growth observed in the burnt stubble. It was also observed that the herbicide symptoms in the standing stubble caused more leaf burning/necrosis than that on the burnt stubble. Similar to the cite at Curyo, CIPAL1101 showed no significant damage symptoms from all imidazolinone herbicide treatments except 'imi-3' applied at the highest rate. It also

showed no damage from flumetsulam 800 within the Triazolopyrimidine group and SU-3 within the Sulfonylurea group. CIPAL1102, which is a sister line to CIPAL1101 and PBA HeraldXT, showed the same trend. PBA HeraldXT was also similar however it also showed slightly greater symptoms for imi-3 applied at the x2 rate (Table 1b).

Table 1. *Standing Stubble.* The effect of various Group B herbicide treatments on visual damage score (1 – no damage, 9 – complete plant death) recorded August 29 of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Rupanyup, 2012. Significant damage scores have been shaded.

Chemical[1]	**Rate**	**CIPAL1101**	**CIPAL1208**	**CIPAL1209**	**PBA Flash**	**PBA HeraldXT**
Nil		1.0	1.0	1.0	1.0	1.0
Imidazolinones						
Imazethapyr 700	100g/ha	1.0	1.0	1.0	6.7	1.0
Imazethapyr 700	200g/ha	1.0	1.0	1.0	8.0	1.0
Imazethapyr 700	400g/ha	1.3	2.0	1.3	9.0	1.0
Imi-2	x1	1.0	1.0	1.3	8.0	1.3
Imi-2	x2	1.0	1.0	1.0	8.0	1.0
Imi-2	x4	4.7	2.0	4.0	8.7	4.7
Imi-3	x1	1.3	1.3	1.0	8.3	2.3
Imi-3	x2	4.0	1.5	1.0	9.0	6.0
Imi-3	x4	7.3	1.7	1.0	9.0	7.7
Imi-4	x1	1.0	1.0	1.0	8.7	1.0
Imi-4	x2	na	na	na	na	na
Imi-4	x4	1.7	2.7	1.0	9.0	3.0
Triazolopyrimidines						
Flumetsulam 800	25g/ha	1.7	3.3	2.0	4.7	2.3
Flumetsulam 800	50g/ha	2.3	5.0	2.0	4.3	2.7
Tri-1	x1	7.0	8.3	8.0	8.3	7.0
Sulfonylureas						
SU-1	x1	8.0	9.0	8.7	9.0	7.7
SU-2	x1	3.7	9.0	8.3	9.0	5.7
SU-3	x1	2.0	6.7	4.7	7.7	1.0
SU-4	x1	8.0	9.0	9.0	9.0	8.0

1. Herbicide active ingredient or code for unregistered products. na – data not available.

Table 1.b. *Burnt Stubble.* The effect of various Group B herbicide treatments on visual damage score (1 – no damage, 9 – complete plant death) recorded August 29 of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Rupanyup, 2012. Significant damage scores have been shaded.

Chemical[1]	Rate	CIPAL1101	CIPAL1102	Nipper	PBA Flash	PBA HeraldXT
Nil		1.0	1.0	1.0	1.0	1.0
Imidazolinones						
Imazethapyr 700	100g/ha	1.0	1.0	7.0	6.7	1.0
Imazethapyr 700	200g/ha	1.0	1.0	7.7	7.7	2.0
Imazethapyr 700	400g/ha	1.0	1.0	8.3	8.3	1.0
Imi-2	x1	1.0	1.0	7.3	7.0	1.0
Imi-2	x2	1.0	1.0	7.3	8.0	1.0
Imi-2	x4	2.0	1.0	8.0	8.0	1.0
Imi-3	x1	1.0	1.0	8.0	8.0	1.0
Imi-3	x2	1.7	1.7	9.0	9.0	3.0
Imi-3	x4	7.0	7.3	9.0	9.0	6.7
Imi-4	x1	1.0	1.0	8.0	8.3	1.0
Imi-4	x2	na	na	na	na	na
Imi-4	x4	1.0	1.0	9.0	9.0	1.7
Triazolopyrimidines						
Flumetsulam 800	25g/ha	1.0	1.0	3.3	3.7	1.0
Flumetsulam 800	50g/ha	2.0	1.3	4.7	3.7	1.3
Tri-1	x1	6.7	7.3	8.0	8.0	7.0
Sulfonylureas						
SU-1	x1	7.0	7.3	9.0	9.0	7.3
SU-2	x1	3.7	4.0	9.0	9.0	3.3
SU-3	x1	1.0	2.0	7.3	7.0	1.0
SU-4	x1	6.7	7.3	9.0	9.0	7.0

1. Herbicide active ingredient or code for unregistered products. na – data not available.

- Biomass – Biomass data was only recorded for the standing stubble trial. Similar to visual damage symptoms biomass production varied among the genotypes that were compared in this trial (Table 2). For the intolerant genotype PBA Flash, all herbicide treatments, except Flumetsulam 800 and Imazethapyr at the x1 rate, caused significant reduction in biomass, with many treatments resulting in death. Within the tolerant lines, only minor significant reductions in yield in the imidazolinone chemical group were recorded for the x4 rate of Imi-2 and Imi-3 for PBA HeraldXT and the x4 rate of Imi-3 for CIPAL1101. Within the Sulfoylureas CIPAL1101 ahowed no significant reduction in biomass to any treatment, while PBA HeraldXT and CIPAL 1208 were unaffected by SU-3. PBA Herald was also unaffected by SU-2, while CIPAL 1209, has significant biomass reductions in all Sulfonylurea treatments (Table 2).

Table 2. *Standing Stubble* - The effect of various Group B herbicide treatments on biomass at maturity (t/ha) of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Rupanyup, 2012. Significant biomass reductions have been shaded.

Chemical[1]	Rate	CIPAL1101	CIPAL1208	CIPAL1209	PBA Flash	PBA HeraldXT
Nil		5.02	5.05	4.59	5.78	5.05
Imidazolinones						
Imazethapyr 700	100g/ha	7.10	5.41	6.21	4.04	3.71
Imazethapyr 700	200g/ha	6.34	6.33	5.30	1.37	5.17
Imazethapyr 700	400g/ha	6.56	4.68	5.35	0.00	5.41
Imi-2	x1	6.23	4.14	6.67	2.26	5.46
Imi-2	x2	7.36	4.54	4.68	2.15	4.17
Imi-2	x4	4.31	4.50	4.91	0.00	2.76
Imi-3	x1	5.68	5.10	6.13	0.04	3.83
Imi-3	x2	4.41	4.64	7.31	0.11	4.86
Imi-3	x4	2.78	5.01	5.66	0.00	1.14
Imi-4	x1	5.35	4.76	5.48	0.09	5.53
Imi-4	x2	na	na	na	na	na
Imi-4	x4	5.97	4.66	5.26	0.00	5.68
Triazolopyrimidines						
Flumetsulam 800	25g/ha	5.27	3.72	4.96	5.68	4.79
Flumetsulam 800	50g/ha	5.81	3.98	4.68	4.32	5.09
Tri-1	x1	4.23	0.68	2.98	0.77	4.28
Sulfonylureas						
SU-1	x1	3.52	0.00	0.78	0.68	1.07
SU-2	x1	5.37	0.58	2.65	0.17	3.86
SU-3	x1	6.39	2.68	3.92	1.96	4.95
SU-4	x1	3.46	0.00	1.01	0.00	2.37

1. Herbicide active ingredient or code for unregistered products.

- Grain Yield – Grain yields were generally higher in the plots sown on burnt stubble than the slashed stubble. This was primarily due to a significant rain event that occurred between harvest of plots on the burnt stubble compared with the standing stubble. The rain event resulted in significant lodging and pod drop on the trial in the standing stubble. Maturity on the standing stubble was up to a week later than the burnt stubble which meant that trials were not able to be harvested on the same day.
  Despite the difference in grain yields, the trends in response to herbicides was relatively similar across the stubble treatments and in comparison to the site at Curyo. For the intolerant variety, PBAFlash, all herbicide treatments, except, Flumetsulam 800 resulted in a significant grain yield loss, up to 100% for several treatments (Table x.3a). The tolerant varieties, despite showing significant crop damage in many cases, had no significant yield loss to the imidazolinone herbicides, except Imi-3 applied at the x4 rate for PBA HeraldXT and CIPAL1101 and Imi-4 applied at the x4 rate for CIPAL1209. In addition, SU-3 caused no significant yield loss in all tolerant varieties, whileSU-2 did not affect PBA HeraldXT and CIPAL1101. Conversely CIPAL1208 displayed almost complete yield loss whn SU-2 was applied.

Table 3a. *Standing Stubble:* The effect of various Group B herbicide treatments on grain yield (t/ha) of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Rupanyup, 2012. Significant yield losses have been shaded.

Chemical[1]	Rate	CIPAL1101	CIPAL1208	CIPAL1209	PBA Flash	PBA HeraldXT
Nil		1.98	1.48	2.04	2.08	1.43
Imidazolinones						
Imazethapyr 700	100g/ha	2.21	1.40	2.15	1.54	1.63
Imazethapyr 700	200g/ha	1.83	1.80	1.98	0.51	1.68
Imazethapyr 700	400g/ha	1.92	1.55	2.06	0.00	1.78
Imi-2	x1	2.03	1.36	2.14	0.87	1.63
Imi-2	x2	2.39	1.40	1.74	0.76	1.79
Imi-2	x4	1.98	1.40	1.68	0.03	1.35
Imi-3	x1	2.25	1.51	1.94	0.00	1.53
Imi-3	x2	2.04	1.59	2.05	0.07	1.39
Imi-3	x4	1.09	1.34	2.04	0.00	0.47
Imi-4	x1	2.08	1.32	1.84	0.00	1.72
Imi-4	x2	na	na	na	na	na
Imi-4	x4	2.05	1.18	1.56	0.00	1.57
Triazolopyrimidines						
Flumetsulam 800	25g/ha	1.92	1.41	1.81	1.70	1.75
Flumetsulam 800	50g/ha	2.23	1.19	1.86	1.61	1.62
Tri-1	x1	1.62	0.10	1.41	0.28	1.28
Sulfonylureas						
SU-1	x1	1.31	0.00	0.42	0.22	0.71
SU-2	x1	2.21	0.09	1.13	0.00	1.84
SU-3	x1	2.04	1.27	1.91	1.51	1.77
SU-4	x1	1.41	0.00	0.63	0.00	1.16

1. Herbicide active ingredient or code for unregistered products.

Table 3b. *Burnt Stubble:* The effect of various Group B herbicide treatments on grain yield (t/ha) of the new imidazolinone lentil genotype, PBA HeraldXT in comparison with an intolerant genotype, PBA Flash and 3 new lines differing in tolerance at Rupanyup, 2012. Significant yield losses have been shaded.

Chemical[1]	Rate	CIPAL1101	CIPAL1102	Nipper	PBA Flash	PBA HeraldXT
Nil		2.60	2.68	2.00	2.38	2.15
Imidazolinones						
Imazethapyr 700	100g/ha	2.31	2.36	1.62	**1.84**	1.80
Imazethapyr 700	200g/ha	2.74	2.46	**1.00**	**1.09**	2.02
Imazethapyr 700	400g/ha	2.58	2.53	**0.28**	**0.32**	2.08
Imi-2	x1	2.32	**2.00**	**1.08**	**1.39**	2.03
Imi-2	x2	2.74	**2.29**	**1.19**	**1.15**	1.78
Imi-2	x4	**2.24**	2.41	**0.25**	**0.38**	2.17
Imi-3	x1	**2.60**	2.37	**0.25**	**0.29**	2.04
Imi-3	x2	**2.50**	**2.03**	**0.00**	**0.00**	1.79
Imi-3	x4	**2.04**	**1.36**	**0.00**	**0.00**	**1.60**
Imi-4	x1	2.54	2.44	**0.24**	**0.26**	1.97
Imi-4	x2					
Imi-4	x4	2.51	2.37	0.00	0.00	2.07
Triazolopyrimidines						
Flumetsulam 800	25g/ha	2.41	2.50	1.82	2.29	2.08
Flumetsulam 800	50g/ha	2.43	2.28	1.66	2.02	1.92
Tri-1	x1	1.98	1.46	0.44	0.32	1.38
Sulfonylureas						
SU-1	x1	1.98	1.74	0.00	0.00	1.28
SU-2	x1	2.45	2.45	0.28	0.13	2.11
SU-3	x1	2.52	2.68	1.33	1.42	1.92
SU-4	x1	2.40	1.72	0.26	0.00	1.54

1. Herbicide active ingredient or code for unregistered products.

Key Findings and Comments

Similar to Curyo, this data highlights the importance of testing across a range on chemicals within a herbicide group and not assuming that tolerance will be consistent within a herbicide group. This data highlighted that PBA HeraldXT has good tolerance to imidazolinone chemicals, but may not be as tolerant to Imi-3 as the lines CIPAL1208 and CIPAL1209. Conversely, PBA HeraldXT and CIPAL1101 have improved tolerance to the Sulfonylurea herbicides relative to the controla dna CIPAL 1208 and CIPAL 1209, indicating potential benfits where residues may be an issue in cropping systems. Combining tolerances in lines like CIPAL1101 and CIPAL1209 could lead to new genotypes with tolerance to the full range imidazolinone chemicals. Pulse Breeding Australia will be utilising this information to define future breeding directions for herbicide tolerant varieties, following PBA HeraldXT.

The ongoing introduction and improvement of these herbicide tolerant lentils could result in significant farming systems benefits through improved weed control, increased control options in lentil crops and in the previous rotation phase, and decreased pressure on herbicides currently employed for broadleaf weed control in lentil. However we need to continuously monitor weed resistance levels and discuss define the optimum methods for maximising the benefits of this herbicide tolerance technology for the whole farming system.

Field Peas

F1. Field Pea Sowing Date x Stubble Management, Upper Eyre Peninsula (Minnipa), South Australia

Co-authored by Tony Leonforte, formerly VicDEPI, and Leigh Davis, SARDI
This report was published in the Eyre Peninsula Farming Systems Summary.

Aim

To compare and identify optimum sowing times of 6 field pea varieties to maximise grain yield and agronomic performance.
To investigate whether field pea production in low rainfall areas is improved through stubble management in terms of grain yield, disease infection or harvestability.

Treatments

Varieties: Kaspa, Parafield, PBA Gunyah, PBA Twilight, PBA Oura, and PBA Pearl
Sowing dates: 27 May (April), 1 June (Late)
Stubble type: 1.7 t/ha Wheat stubble (25cm high)
Stubble management treatments: Burnt pre-sowing
Slashed (cut at ground height to leave ~20cm length straw)
Standing (25cm high)
Fertiliser: DAP + Zn @ 62kg/ha

Results and Interpretation

- Plant Height – stubble management showed a significant effect on pre-flowering vegetative height of field pea where peas sown into standing stubble showed a 14% increase in plant height compared to those sown into burnt and standing stubble (Table 1). However there were no differences between standing plant height at physiological maturity.
- Lodging – unlike in 2011, stubble management had no influence on lodging of pea varieties in 2012, however a sowing date x variety response was evident. All varieties except Kaspa and Parafield showed reduced plant lodging by delayed sowing. Parafield showed increased plant lodging from delayed sowing (possibly due to increased biomass), while Kaspa showed no significant difference.
- Grain Yield – there was no significant grain yield response for either sowing date or stubble management in this trial in 2012. The absence of a sowing date response is surprising given the extent of the delay in sowing (35 days) and the rapid season finish. It is possible that the early sown peas may have hayed off due to the favourable early conditions, high early biomass production and a rapid season finish, negating a sowing date response. A significant variety response was noted in this trial. Kaspa significantly outyielded all other varieties by 8-19%, with Parafield and PBA Oura lowest yielding (Table 1). Recent releases PBA Gunyah, PBA Twilight and PBA Pearl (white) all performed similarly, but behind Kaspa.

Table 1: Grain yield of field pea varieties at Minnipa, 2012.

Variety	Kaspa	Parafield	PBA Gunyah	PBA Oura	PBA Pearl	PBA Twilight	LSD (P<0.05)
Yield (t/ha)	1.51 [e]	1.23 [a]	1.39 [cd]	1.24 [ab]	1.33 [bc]	1.35 [cd]	0.099

Key Findings and Comments

- Field peas performed exceptionally well at Minnipa in 2012, despite a decile 3 growing season and a rapid season finish. This is likely due to good stored soil moisture levels, good early winter rainfall amounts and generally mild winter temperatures.
- The lack of sowing date response is particularly surprising given the seasonal conditions and magnitude of sowing delay. It is likely that the early sown peas may have hayed-off due to the combination of favourable early conditions, high biomass and a rapid season finish.

- Stubble management produced differences in early vegetative plant height, where standing was higher than slashed and burnt, however these differences were not evident in at plant maturity.
- Stubble management produced no difference in plant lodging in 2012.
- Previous work conducted by this project in South Australia's Mid North has shown that sowing pulses into standing cereal stubble can benefit yield. However, no yield response has yet been generated from stubble management in trials at Minnipa to date.
- Substantial differences in growth (measured through plant height) were achieved from stubble management in the 2011 trial and plant height in 2012 at Minnipa. It is thought that the increased growth and height may aid harvestability of field pea, particularly in shorter seasons with low plant vine length.
- Regardless of the perceived yield or harvestability benefits, retaining standing cereal stubble is still seen as having benefits in reducing damage from wind erosion in regions characterised by light textured soils and where sheep are still a common part of the farming system. However, growers looking to implement this practice should also be aware of the potential negative issues associated with stubble retention in their particular farming system e.g. seed placement, herbicide and pest management issues.

F2. Field Pea Forage Production, Yorke Peninsula (Arthurton) and Mid North (Pinery), South Australia

Aim

To compare grain yield and biomass potential of current and potential field pea varieties.

Treatments

Varieties: Table 1
Sowing dates: see Table 2
Biomass cut timings: see Table 2
Fertiliser: MAP + Zn @ 90kg/ha

Table 1: characteristics of lines in forage trials, Arthurton and Pinery 2012

Variety	Growth Habit	Seed type	Early season vigour	Flowering time	Maturity time
Kaspa	Semi-dwarf, semi-leafless	"Kaspa type" Dun	High	Late	Mid
Morgan	Tall, semi-leafless	Dun	High	Late	Late
PBA Hayman	Conventional	White	Moderate	Very Late	Very Late
OZP1103	Conventional	Dun	High	Mid-Late	Mid

Table 2: sowing dates and biomass cut timings of forage trials, Arthurton and Pinery 2012

Site	Sowing Date	Cut 1	Cut 2	Cut 3	Cut 4	Cut 5
Arthurton	7-Jun	7-Aug	2-Oct	17-Oct	26-Oct	4-Nov
Pinery	27-May	14-Aug	20-Sep	17-Oct	1-Nov	-

Background

Two breeding lines have been identified for release for suitability to forage (hay/silage) or green/brown manuring. PBA Hayman was released in February 2013 as a late maturing, forage pea, with very high biomass potential but low grain yields. OZP1103 is as a dual purpose forage/grain field pea offering the flexibility of a forage option if grain yield is affected by seasonal stresses such as frost.

This trial aims to compare biomass accumulation and grain yield of these genotypes with current standards, Kaspa (predominant grain yield variety in SA) and Morgan (a dual purpose field pea variety).

Results and Interpretation

- Trials were sown late May and early June at the earliest available sowing window as predicted by "Blackspot Manager" to reduced blackspot risk while still maximising biomass production and grain yield potential. Seed was treated with P-Pickel T (active ingredients thiram and thiabendazole) and Apron XL (a.i. metalaxyl) to reduce blackspot and downy mildew infections.
- Flowering is likely to be the ideal time for hay cutting in field pea due to the difficulty of drying down pods, particularly those which have begun filling. No cut was done at this timing, however start flower dates have been marked on Figure 1 and Figure 3 (red checkpoints) which may enable for some extrapolation of data at this timing.

Arthurton:

- OZP1103 showed the highest early biomass at Arthurton (measured on August 7th), while there was no difference between the other three varieties at this timing (Figure 1). By early October (Oct 2) OZP1103 still showed greater biomass than all other varieties except Morgan, while Kaspa, Morgan and PBA Hayman performed similarly.
- PBA Hayman was much later to commence flowering than the other varieties (Table 3). Biomass of PBA Hayman at commencement flowering was plotted to be approximately 5.5t/ha,

compared with approximately 1.5-2t/ha in other varieties at this timing (Figure 1, red checkpoints).
- Kaspa was the earliest variety to reach physiological maturity (Table 3), and produced less total biomass than the other four varieties at physiological maturity (Figure 2). Morgan and OZP1103 reached physiological maturity approximately 7 days after Kaspa and had approximately 20% greater biomass than Kaspa.
- PBA Hayman was the last variety to reach physiological maturity, approximately 15 days after Kaspa (Table 3). It produced 36% greater biomass than Kaspa and 13% greater than Morgan/OZP1103 (Figure 2).
- Grain yield of Kaspa and OZP1103 at Arthurton was higher than Morgan and PBA Hayman (Figure 2). PBA Hayman had the lowest grain yield, yielding 45% lower than Kaspa.
- PBA Hayman had the highest total biomass (9.1t/ha) and lowest grain yield, giving it the lowest harvest index at only 20%. Kaspa had the highest grain yield and lowest total biomass, producing a 50% harvest index.

Pinery:
- PBA Hayman showed some transient chlorosis (suspected to be iron deficiency) early in the season at this site. Plants recovered and grew away from these symptoms, however early season biomass production of PBA Hayman is likely to have been limited by this factor. This effect was also noted at other sites in SA in 2012 and 2013 where PBA Hayman was grown and work is in progress to identify the exact reason for this effect.
- Kaspa showed significantly greater early biomass (measured August 14th) than the other three lines (Figure 3), which all performed similarly. By late September (September 20) Kaspa and OZP1103 both showed significantly higher biomass than Morgan and PBA Hayman.
- There was less biomass at start of flowering at Pinery (Figure 3, red checkpoints) than at Arthurton, and extrapolated growth curves also show less difference in biomass between the four varieties at this timing.
- PBA Hayman was again later to commence flowering (Table 3) than the other varieties, and yielded approximately 2t/ha compared to approximately 1-1.5t/ha in other varieties (Figure 3).
- Physiological maturity (Table 3) of Kaspa, Morgan and OZP1103 occurred at a similar timing at Pinery, and all showed similar levels of biomass production at this timing. PBA Hayman showed significantly less biomass than the other three varieties at their physiological maturity dates, but it showed greater total biomass than the other three varieties at its physiological maturity date (15 days later than the other varieties).
- Similarly to the findings at Arthurton, grain yield of Kaspa and OZP1103 were higher than Morgan (Figure 4). PBA Hayman was the lowest, yielding line 26% lower than Kaspa.
- PBA Hayman again produced the highest total biomass (Figure 4), yielding over 10t/ha, 40% greater than Kaspa and 70% greater than Morgan. It also had the lowest harvest index (13%).
- Kaspa, Morgan and OZP1103 showed no difference in total biomass accumulation at Pinery.

Table 3: start flower and physiological maturity dates, Arthurton and Pinery forage field pea trials, 2012

Variety	Arthurton (6 June)		Pinery (27 May)	
	Start Flower	Physiological Maturity	Start Flower	Physiological Maturity
Kaspa	19-Sep	18-Oct	9-Sep	12-Oct
Morgan	20-Sep	25-Oct	8-Sep	15-Oct
PBA Hayman	20-Oct	2-Nov	1-Oct	1-Nov
OZP1103	20-Sep	26-Oct	8-Sep	17-Oct

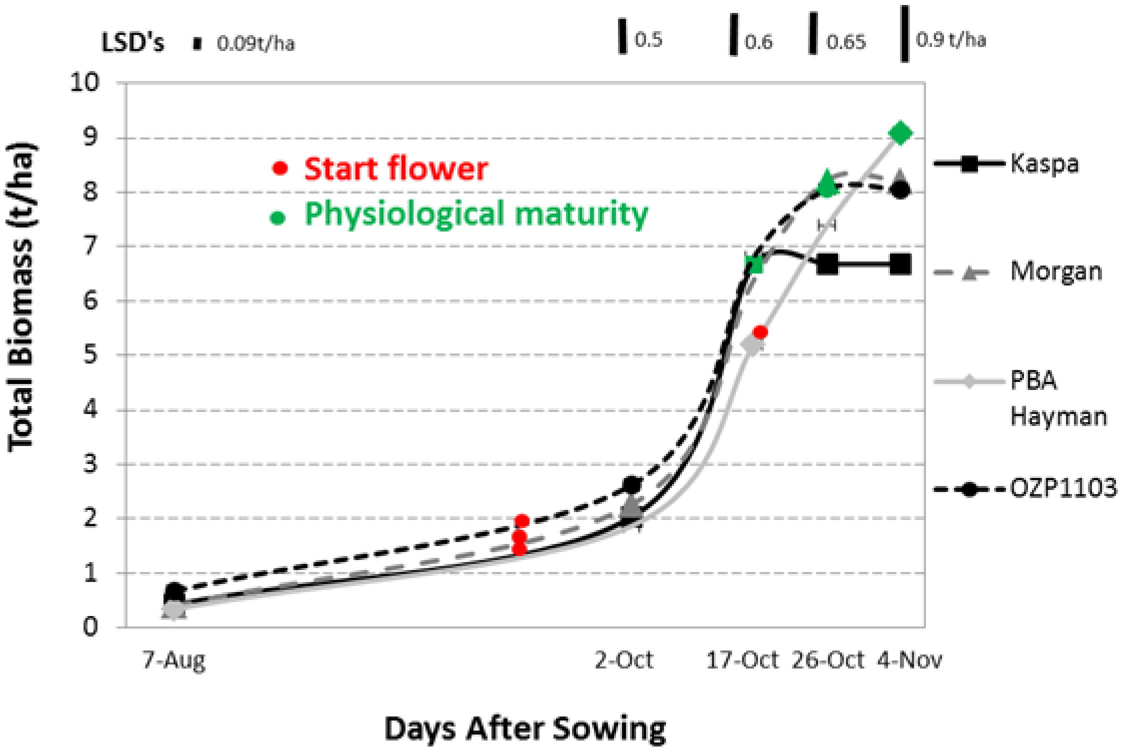


Figure 1: Biomass accumulation of four field pea varieties, showing mid flower and physiological maturity checkpoints, at Arthurton 2012. LSD’s are shown as bars above the graph.

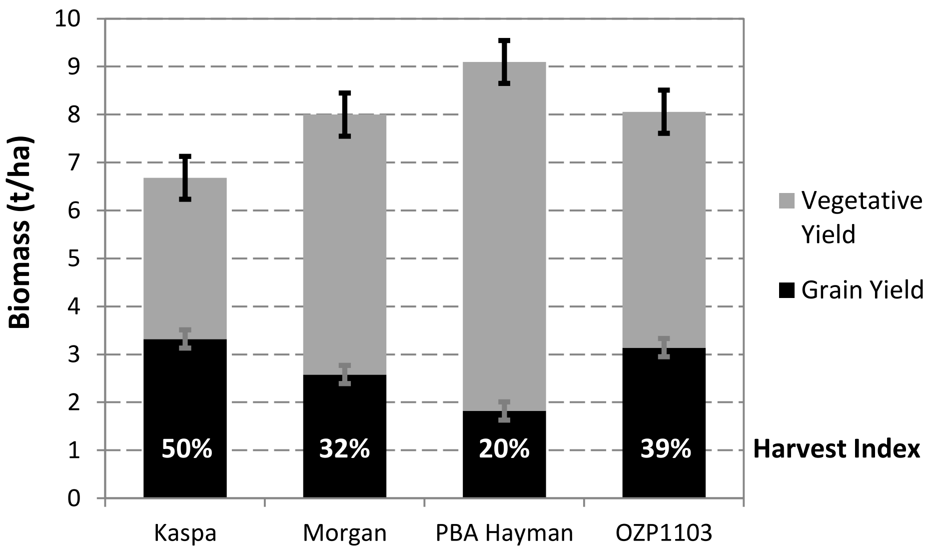


Figure 2: Biomass partitioning (vegetative and grain yield) of four field pea varieties at Arthurton, Yorke Peninsula, 2012.

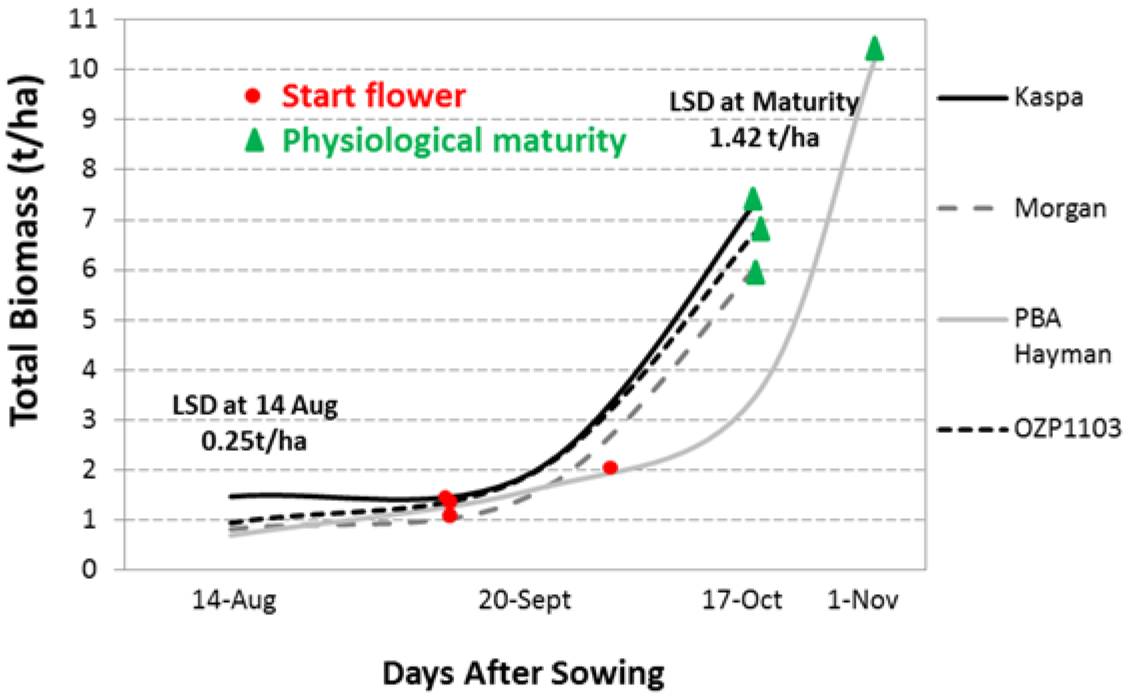


Figure 3: Biomass accumulation of four field pea varieties, showing mid flower and physiological maturity checkpoints, at Pinery 2012. LSD's are shown as bars above the graph.

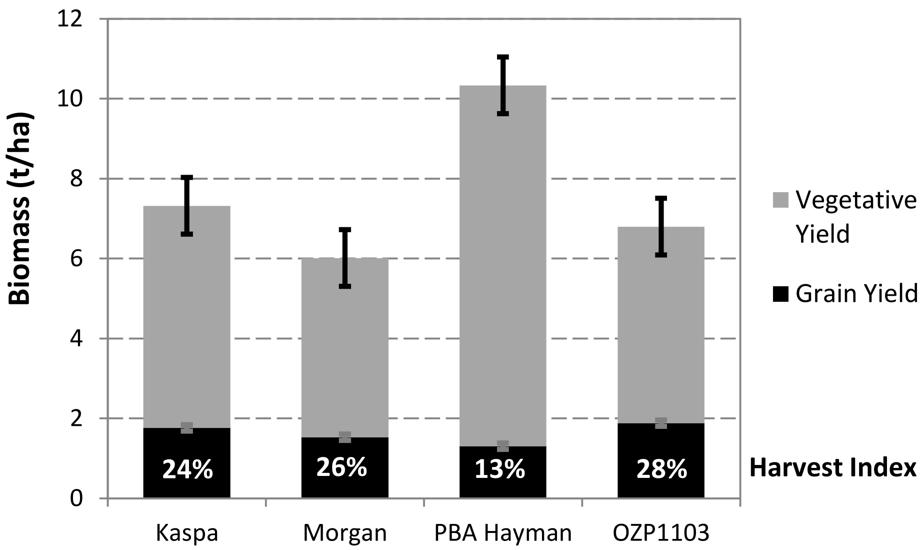


Figure 4: Biomass partitioning (vegetative and grain yield) of four field pea varieties at Pinery, Mid North, 2012.

Key Findings and Comments

- The optimum hay cut timing for both maximum biomass production and ease of drying (i.e. before pod set) is likely to be approximately 7-14 days after commencement of flowering.
- Varieties with later flowering and pod set are likely to be better suited to hay production as this allows maximum vegetative growth prior to cutting, and extends hay cut timing into more favourable (warmer and quicker) drying conditions.
- PBA Hayman produced slower early growth than other varieties, but later flowering and maturity timings led to it producing the most biomass at flowering and physiological maturity at both sites. Early growth may have been retarded by transient chlorosis at Pinery.
- Kaspa produced similar biomass to the two dual purpose forage/grain field pea lines (Morgan and OZP1103) at Pinery, but less biomass at Arthurton.

- Kaspa and OZP1103 produced the equal highest grain yield at both sites, while PBA Hayman produced the least at both sites and had the lowest harvest index. These results indicate grain retrieval of PBA Hayman may be difficult in low rainfall areas. In low rainfall environments new seasons seed for sowing may need to be sourced from elsewhere.
- PBA Hayman and OZP1103 offer improvements in biomass potential and biomass/grain yield stability (i.e. risk management), respectively.
- These trials have enabled the development of appropriate management strategies for further forage field pea studies.
- Work funded by SAGIT in 2013 and 2014 will aim to identify optimum management strategies for maximising biomass production of new varieties of forage field peas (eg sowing date, sowing density, disease management). Future work will focus more specifically on flowering/early pod development as an important timing for hay production in field pea.

F3. Field Pea "Kaspa type" variety mixtures, various sites, South Australia

Aim

To provide a long term yield evaluation of "Kaspa type" field pea varieties and their self-regenerating blends in five key field pea production regions across the state.

Treatments

Sites details: trials were conducted at the five Pulse Breeding Australia field pea breeding sites in South Australia. Sites are listed in order of increasing growing season rainfall.

Variety	Date sown	Soil type	Rainfall (mm) J-M / A-O	pH (H_2O)
Snowtown	3/6	Sandy Loam / Light-medium Clay	87/178	8.4
Minnipa	27/4	Loam	63/185	8.6
Balaklava	5/6	Sandy Loam / Light-medium Clay	53/188	8.1
Kadina	22/5	Sandy clay loam	62/212	8.5
Turretfield	15/6	Light clay / Light-medium Clay	74/288	6.8

Variety and mixture details:

Variety / Blend	Year 1 Percentage Component		
	PBA Twilight	PBA Gunyah	Kaspa
Kaspa	0	0	100
Kaspa Mix	25	25	50
KasLight	50	0	50
PBA Gunyah	0	100	0
PBA Gunyah Mix	25	50	25
PBA Twilight	100	0	0
PBA Twilight Mix	50	25	25
TwiKasYah (2011 carryover)	33	33	33
TwiKasYah (2012 remix)	33	33	33
Flower Timing ^	Early	Early-Med	Late
Flowering Period ^	Medium	Long	Short
Maturity ^	Early	Early-Med	Medium

Background

- The variety Kaspa, which has a number of production and marketing advantages compared to other varieties, is the most significant field pea variety in South Australia. Its round seed shape (referred to as 'Kaspa type') is preferred by export markets for its high milling quality, and its excellent standing ability and pod shatter resistance traits are favoured by growers. However it is relatively late flowering and maturing, and often does not perform well in shorter seasons or short season environments.
- Two recently released "Kaspa type" field pea varieties with earlier flowering and maturity profiles offer growers improved yield stability across variable seasons and are better suited to lower rainfall areas and short seasons with rapid finishes compared to Kaspa. These varieties are also better suited to late season breaks or where delayed sowing for blackspot control is practised.
- Since all three varieties can be marketed together as "Kaspa type" grain, growers have the opportunity to blend varieties to create a population that provides an extended flowering period. This strategy may provide risk mitigation against frost and heat events during the vulnerable flowering period. It also may produce a continuously adapting population that may

convey a production advantage in the target production area over time. Long term field trials may assist growers with identification of optimum seed blends and for maximum adaptation and yield stability.

Results and Interpretation

- Grain yields were generally above average at the five Pulse Breeding Australia field pea breeding sites in 2012, due to a compination of good early winter rainfall and low disease pressure.
- Individual site yields increased with increasing growing season rainfall. All sites except Kadina showed a significant variety response for grain yield.
- Lower yielding sites Snowtown and Balaklava showed several varietal blends expressing a yield advantage over Kaspa. Reasons for these are unclear at this stage, and further validation is required.
- At Turretfield, the highest yielding site, all varieties and blends except for PBA Gunyah showed a yield penalty compared to Kaspa.

Variety	Snowtown	Minnipa	Balaklava	Kadina	Turretfield
Kaspa	1.26	1.93	2.25	2.75	3.67
PBA Gunyah	104	100	112	92	96
PBA Twilight	**112**	97	100	96	**90**
Kaspa Mix	106	103	104	96	**85**
Gunyah Mix	**111**	97	**117**	98	**90**
Twilight Mix	102	106	102	100	**89**
TwiKasYah (2012)	101	**90**	99	99	**85**
TwiKasYah (2011)	102	99	**114**	99	**89**
KasLight	97	97	**115**	102	**87**
Average	**1.33**	**1.91**	**2.39**	**2.69**	**3.23**
LSD (P<0.05) (%)	**8**	**8**	**13**	**ns**	**9**

Shaded figures denote significant difference to grain yield of Kaspa

Key Findings and Comments

- Kaspa continues to show a yield advantage over earlier maturing varieties and blends in regions with high yield potential (eg Turretfield) due to its later maturity and subsequent higher yield potential.
- Earlier maturing varieties and blends may confer a yield advantage over Kaspa in lower yielding situations/seasons.
- This work will continue for a number of years reusing the seed from each location to identify any potential benefit for growers using a mix of these varieties to manage pea yields across variable seasonal conditions.

F4. Field Pea Crop-topping/Desiccation, Yorke Peninsula (Melton), South Australia

Aim

To determine the correct maturity timing required in field pea for successful crop-topping practice.

Treatments

Varieties: Table 1
Sowing date: 6 June
Treatments: see tables for dates
Nil - no desiccant applied
Early - applied 13 days pre ryegrass milky dough stage (12 Oct)
Recommended - applied at ryegrass milky dough stage (25 Oct)
Fertiliser: Map + Zn @ 90kg/ha

Results and Interpretation

- Significant two way interactions (Timing x Variety) were observed for grain yield and grain weight (Table 1).
- Grain Yield – all varieties showed a significant yield loss from crop-topping at the Early timing (2 weeks prior to Recommended) (Table 1). The latest maturing variety, Glenroy, was the only variety to show a significant yield loss from crop-topping at the Recommended timing for ryegrass control.
  Long term summary of crop-top timing on grain yield (Table 2) shows the earliest maturing varieties to be consistently better suited to crop-topping than the later maturing lines, with fewer yield loss incidences and lower average yield losses. Yield loss results show older common cultivars Kaspa and Parafield are less suited than newer earlier maturing cultivars, with Parafield showing yield loss in three of seven trials at the Recommended timing. Yarrum shows variable response across seasons, with fewer incidence of yield loss than Kaspa at the Early timing, but more at the Recommended timing.
- Grain Weight – as for grain yield, all varieties showed reduced grain weight from crop-topping at the Early treatment timing. None of the varieties tested showed reduced grain weight from treatment at the Recommended timing, however two cultivars, Parafield and Alma, showed increased grain weight from crop-topping at this timing.

Table 1. Effect of crop-top timing on grain yield (t/ha) and grain weight (g/100 seeds) of field pea varieties, Melton 2012. Varieties are ranked according to their visual maturity rating from earliest to latest (E = Early, M = Mid, L = Late)

Treatment	Maturity Profile		Yield (t/ha)	Yield (% of Nil)		Grain Wt. (g/100)	Grain Weight (% of Nil)	
Variety	Flower Timing	Maturity Timing	Nil	Early 12-Oct	Recommended 25-Oct	Nil	Early 12-Oct	Recommended 25-Oct
PSL-RESEL	VE	VE	2.12	73	100	20.9	80	98
PBA Twilight	E	E	2.31	70	87	20.3	82	104
SW Celine	E	E	2.3	72	93	23.1	77	101
PBA Oura	M	E	2.26	73	93	22.7	74	102
PBA Gunyah	E	E	2.08	72	110	20.3	80	105
OZP0903	M	E-M	2.49	74	95	20.9	75	101
PBA Pearl	M	E-M	2.61	67	93	21.0	74	103
Sturt	M	M	2.18	68	89	19.9	79	104
Yarrum	L	M	2.28	57	100	20.4	69	98
Kaspa	L	M	2.32	54	90	21.4	70	102
Dundale	E	M-L	1.81	67	92	20.2	80	102
Parafield	M-L	M-L	1.87	72	112	20.7	82	114
Alma	L	L	1.79	62	104	19.5	79	112
Glenroy	L	VL	1.87	44	81	20.0	78	100
Mean			**2.16**	**66**	**95**	**20.8**	**77**	**103**

lsd (P<0.05)timing.var = 0.31, (Grain Yield), 1.37 (Grain Weight)

NB: Shading denotes significant difference from the Nil treatment.

Table 2. Long term summary (2008-2012) of grain yield response of selected field pea cultivars to crop-topping, Early and Recommended timings. Varieties are ranked according to their visual maturity rating from earliest to latest.

Variety	Incidence of significant yield losses (# trials)		Average Yield Loss [Range] (% of Control)	
	Early	Rec.	Early	Rec.
PBA Twilight	6 (8)	0 (8)	28 [20-57]	0 [0-9]
PBA Oura	6 (8)	0 (8)	28 [23-58]	0 [0-11]
PBA Gunyah	5 (8)	0 (8)	31 [13-61]	0 [0-10]
Yarrum	4 (7)	1 (7)	36 [13-68]	4 [0-28]
Kaspa	7 (8)	0 (8)	41 [26-69]	8 [0-19]
Parafield	7 (7)	3 (7)	41 [20-55]	8 [0-27]

Key Findings and Comments

- Yield losses from Early crop-topping generally followed cultivar maturity, with latest maturating varieties (eg Glenroy) showing the highest yield losses. Glenroy was also the only variety to show yield loss at the Recommended timing, supporting previous findings that later maturing varieties are not as well suited to crop-topping as earlier maturing recent releases PBA Twilight, PBA Gunyah and PBA Oura.
- Kaspa and Yarrum continue to show variable results across treatments and seasons. Both varieties are rated as having late flowering and mid maturity timing. Previous research has shown Yarrum to be better suited to crop-topping than Kaspa due to its more rapid maturity, and has shown relatively low yield loss from this practice in some seasons. This was not evident in 2012, as both varieties showed high yield losses at the Early treatment timing, but

no yield losses at the Recommended treatment timing. Long term results show that these varieties are not as well suited to crop-topping than some earlier maturing varieties.

- Previous results have found poor correlation between maturity timing at crop-topping and grain weight, and that crop-topping may sometimes be linked to increased grain weight in some (particularly later maturing) varieties. This is thought to be due to the removal of small seeds in the harvested sample through either abortion or elimination of seed development in the uppermost (immature) pods.

F5. Sowing Time x Impact Dressed Fertiliser, LRZ (Yenda), NSW

Aim

- To compare early and late sown commercial and advanced varieties of field pea in an eastern cropping environment of southern NSW and
- To investigate potential of Impact impregnated fertiliser to assist in disease control.

Treatments

Varieties: Kaspa, PBA Gunyah, PBA Oura, PBA Percy, PBA Pearl, OZP805,
Sowing dates: 17 May, 19 June 2012 – representing the earlier and later phases of the field pea sowing window
Stubble:
Treatments: Six varieties at two sowing dates with and without Impact-dressed fertiliser.
Fertiliser: Grain legume super (0:15:7) @ 80 kg/ha placed separately under the seed.

Results and Interpretation

The 2012 season was ideal for pulse production at "Hillview". Heavy rain in March resulted in a full profile of moisture. Rain was well below average for the remainder of the season resulting in little or no disease. Crops largely survived and grew well to maturity on this stored moisture. Under these dry finishing conditions, plants ripened a golden brown and most semi-dwarf semi-leafless types remained erect through to maturity.

Table 1. Statistically significant terms and Probabilities for yield at Yenda TOS peas 2012

Fixed term	F pr
TOS	0.004
VAR	<0.001
TOS.VAR	0.002

Impact fungicide applied on fertiliser had little or no affect on growth and grain yield under these conditions.

Differences in grain yield between varieties were small. PBA Pearl, PBA Gunyah and PBA 805 were the highest yielding varieties, but only at the early sowing date. Yields declined by about 20 % (P<0.05) as sowing was delayed from 17 May to 19 June.

Key Findings and Comments

- This was a very dry but favourable field pea season at "Hillview", resulting in erect growth, very little disease, blemish-free golden brown foliage, high DMs and grain yield.
- Varieties were only different at the earliest sowing date, where Pearl was the top yielder
- Yield dropped by around 20% as sowing was delayed from 20 May to 22 June
- Seed size increased by around 10% as sowing was delayed from 20 May to 22 June
- Seed size was greatest in Percy & Oura

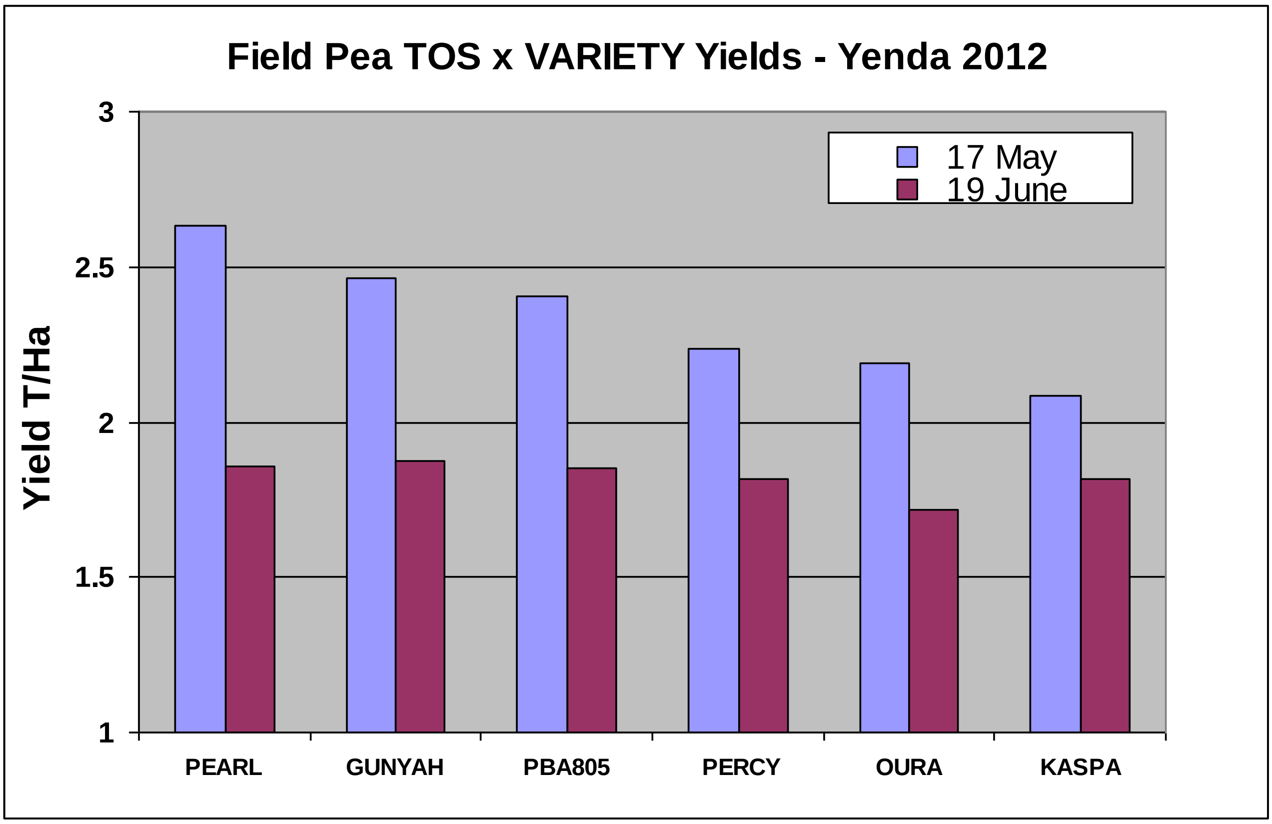


Figure 2. The effect of TOS on grain yield (t/ha) of six field pea varieties at Yenda in 2012.

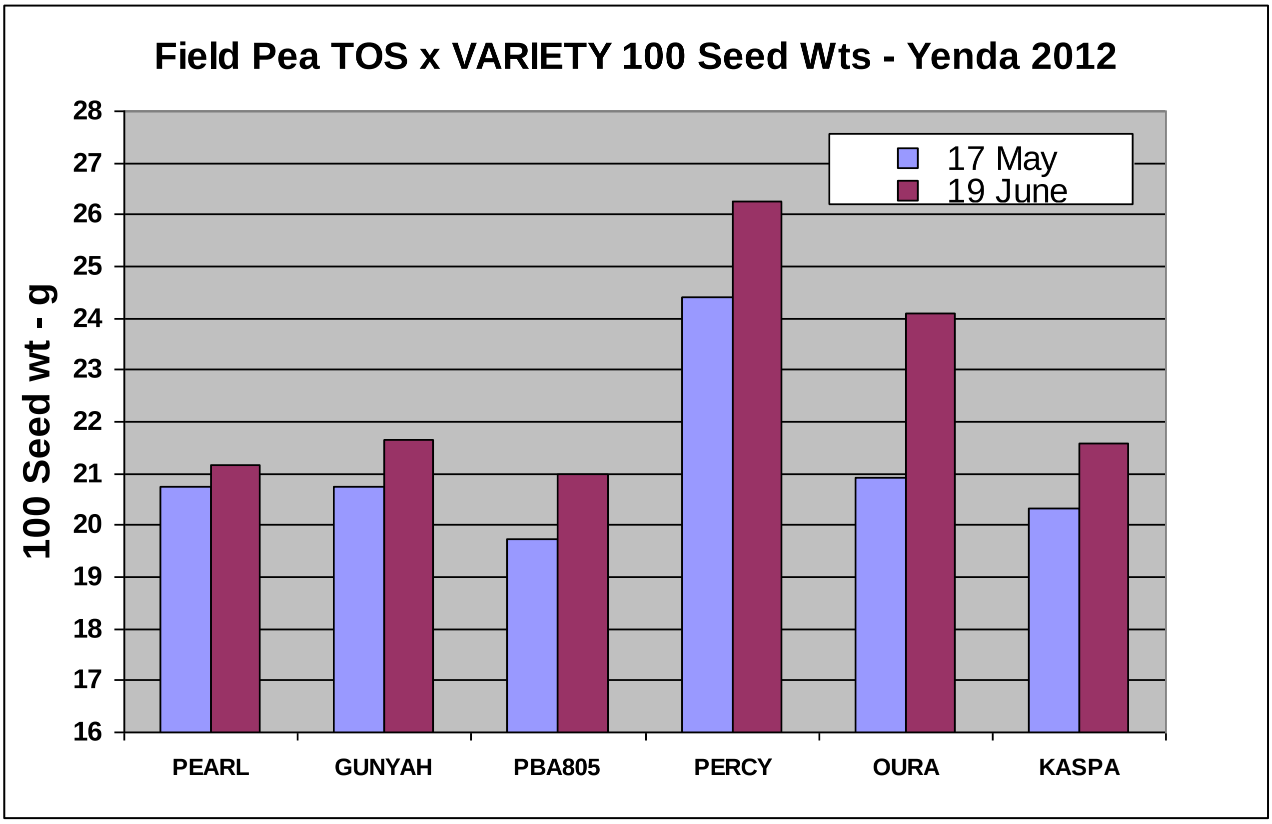


Figure 3. The effect of TOS on 100 seed weight of eight field pea varieties.

F6. Desiccation Timing, H-MRZ (Wagga Wagga), NSW

Aim

To study timing of post-flowering applications of desiccants on

1. sterilisation of developing ryegrass seeds and
2. seed-filling, development and yield of range of field pea varieties.

The objective is to time a single "crop-topping" spray to kill all developing ryegrass seeds and at the same time desiccate the field pea crop with minimal or no loss of yield or seed size.

Treatments

Varieties: Kaspa, PBA Gunyah, PBA Oura and PBA Pearl

Desiccation Timings: 1. Early: 22 October
2. On Time: 30 October
3. Late: Not applied as plots were fully mature
4. Nil

Sowing Date: 31 May

Stubble: 3-4 t/ha barley stubble (30cm high) providing good ground cover

Fertiliser: Grain legume super (0:15:7) @ 80 kg/ha placed approximately 30-40mm below the seed.

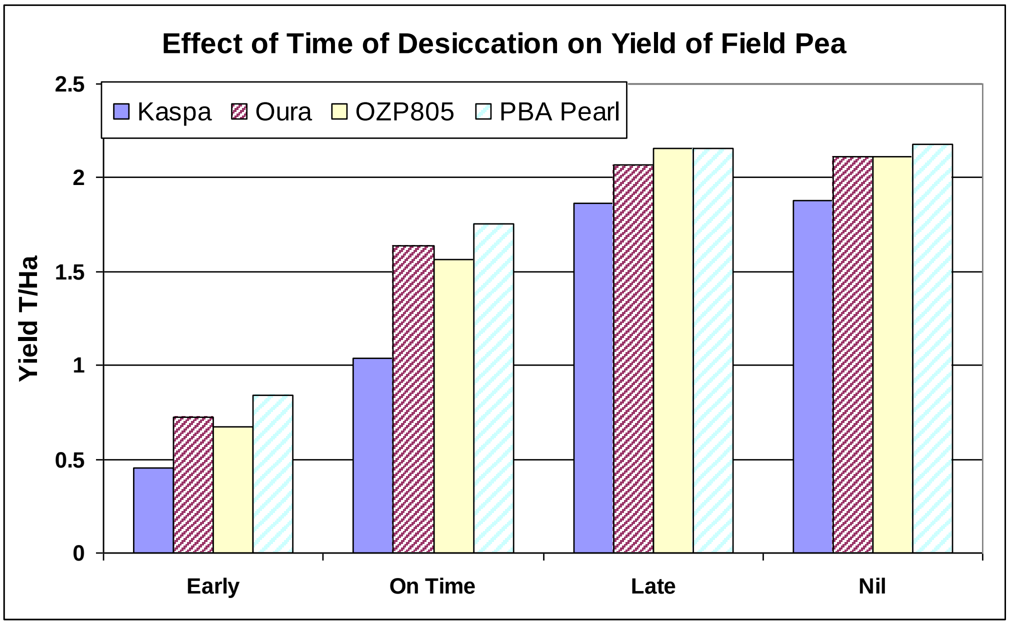
Results and Interpretation

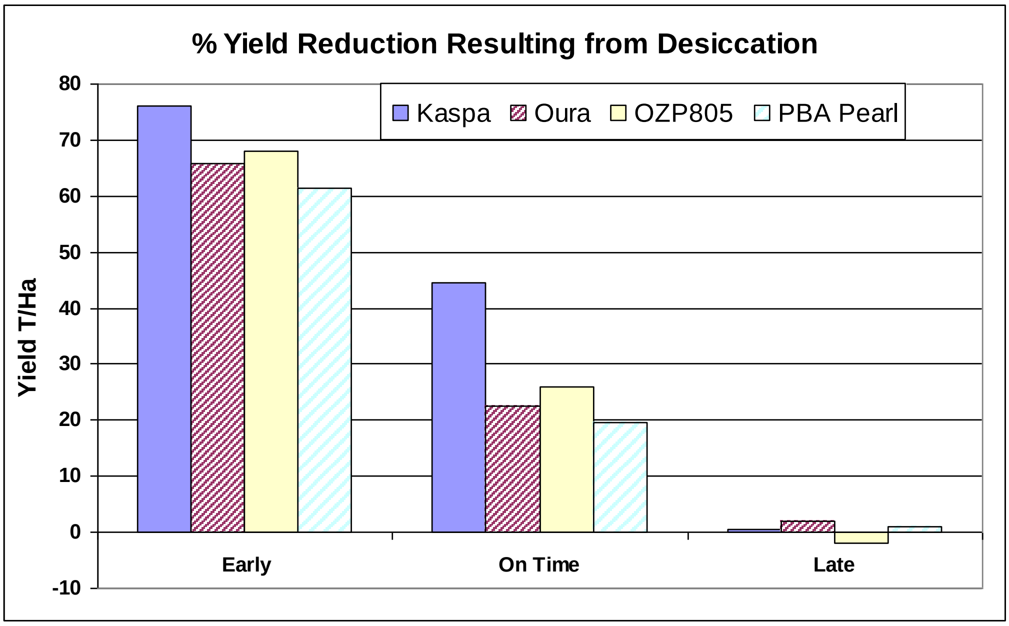
Selection of the timing for 'early' and 'on time' desiccant sprays was made particularly difficult in this experiment because the warm drying pattern forced maturity and resulted in large deviations from normal patterns of ripening. As it turned out, our estimates were considerably too early. Consequently, large yield reductions occurred at both "Early" (60-75% yield loss) and "On Time" (20-45% yield loss) desiccation sprays. As a guide, we used the end of flowering and yellowing of plant tissues as an estimate of physiological maturity. Clearly, we need to investigate these aspects more closely to fine-tune and match visible growth stages and pod development with estimates of physiological maturity, particularly under different seasonal finishing conditions.

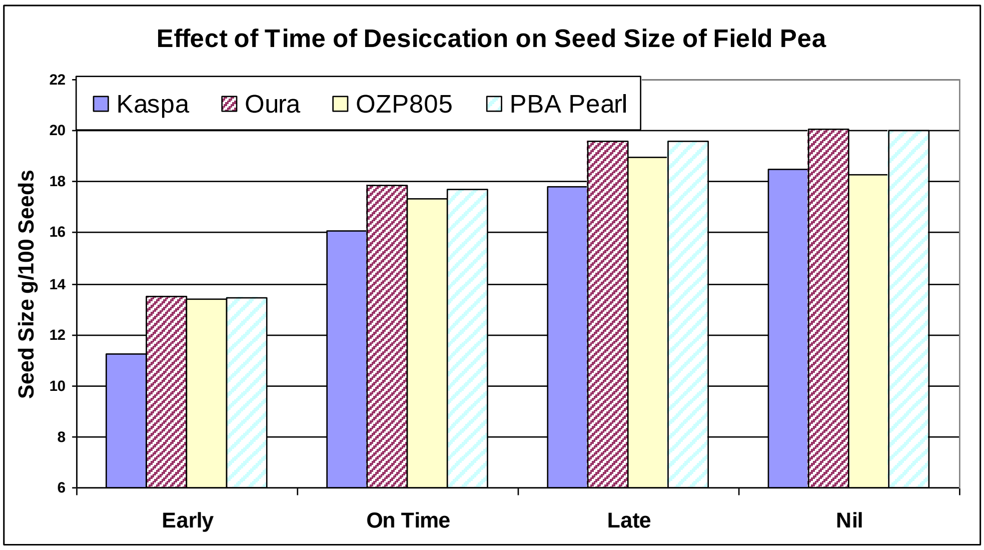
	Flowering Date	End Flowering	Flowering Days	Maturity
Kaspa	6 Oct	20 Oct	14	15 Nov
PBA Gunyah	30 Sept	18 Oct	18	10 Nov
PBA Oura	21 Sept	16 Oct	25	9 Nov
PBA Pearl	22 Sept	16 Oct	24	10 Nov

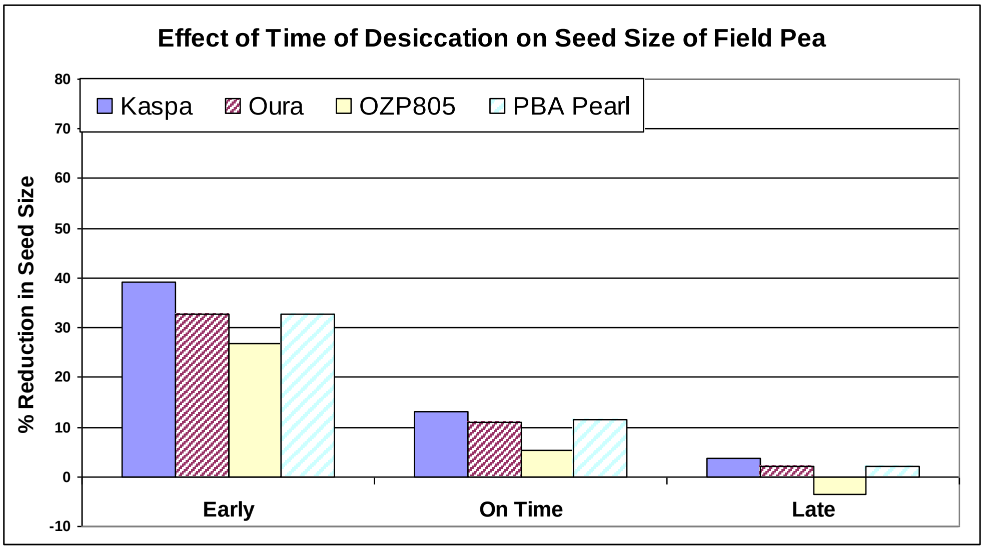
Key Findings and Comments

- Early and on time desiccation resulted in large yield losses.
- Early and on time desiccation resulted in large reductions in seed size, but not to the same degree as yield.
- What were the reasons (other than reduced seed size) that contributed to these yield losses? Was 'pinched' seed lost through the header at harvest?
- Yield losses were bigger in the later flowering variety Kaspa.
- Need to more closely fine-tune growth stages with physiological maturity to pick the "on time" desiccation spray.
- Oura and Pearl were early and the pick of varieties suited to crop-topping & desiccation.






Effect of Time of Desiccation on Seed Size of Field Pea
Kaspa
Oura
OZP805
PBA Pearl
Seed Size g/100 Seeds
22
20
18
16
14
12
10
8
6
Early
On Time
Late
Nil


Effect of Time of Desiccation on Seed Size of Field Pea
Kaspa
Oura
OZP805
PBA Pearl
% Reduction in Seed Size
80
70
60
50
40
30
20
10
0
-10
Early
On Time
Late

F7 Sowing Time, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the adaptability of a range of field pea varieties and variety mixes to varying sowing dates.

Treatments

Varieties:	Kaspa, Morgan, PBA Oura, OZP0805, PBA Pearl, PBA Hayman, PBA Percy, PBA Gunyah, PBA Twilight, Sturt, OZP1101, OZP1103, OZP1104.
Variety Mixes:	Kaspa:PBA Pearl and Kaspa:Sturt sown with a 50:50 ratio based on targeted plants/m^2, and Kaspa:PBA Twilight:PBA Gunyah sown with a 33:33:33 ratio based on targeted plants/m^2
Sowing dates:	4 May (Early), 5 June (Mid), 26 June (Late).

Other Details

Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble.
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing.
Plant Density:	35 plants/m^2.

Results and Interpretation

- Key Message: The data highlighted the yield stability of a variety like Sturt in drier seasons and the importance of early sowing to maximise yields in Kaspa. OZP0805, appears to have excellent yield and may provide an excellent replacement for Kaspa into the future.

- Plant establishment – Establishment for all field pea varieties was below target for all sowing dates at approximately 25 plants/m^2.
- Biomass production and quality (forage types) – Due to the introduction of potential biomass types of field peas, assessments where made in both biomass production and quality in selected varieties. Total biomass produced at flat pod ranged between 2 and 5t/ha, but there was no significant difference between varieties at each of the sowing dates or overall (Fig. 1). Only the main effect of sowing date was significant, showing a significant drop in biomass production as sowing was delayed. The data suggests that based purely on biomass at the flat pod stage there is no significant benefit in growing the forage types PBA Hayman and OZP1103.
  A full 'feedtest' was completed on biomass samples and crude protein and metabolisable energy are presented below (other data can be supplied up on request). Generally crude protein was slightly higher for the forage types compared with Kaspa and Morgan and increased as sowing was delayed (Table 1). Metabolisable energy of OZP1103 was similar to Kaspa for OZP1103, but lower for PBA Hayman.
- Grain Yield – Grain yields were generally good, ranging from 1.0t/ha for PBA Hayman sown June 26 to 2.6 t/ha for Kaspa sown May 4 (Fig. 2). Early sowing was highest yielding for all varieties, except PBA Oura, approximately 13% greater than the June 5 sown plot and 31% greater than the June 26 plots. Varieties like Kaspa and PBA Pearl, along with PBA Hayman and Morgan showed the greatest drop in yield with delayed sowing, while PBA Twilight, PBA Gunyah, PBA Oura and PBA Percy showed the least drop in grain yield. The data highlights the yield stability of a variety like Sturt in drier seasons and the importance of early sowing to maximise yields in Kaspa. OZP0805, appear to have excellent yield and may provide an excellent replacement for Kaspa into the future.

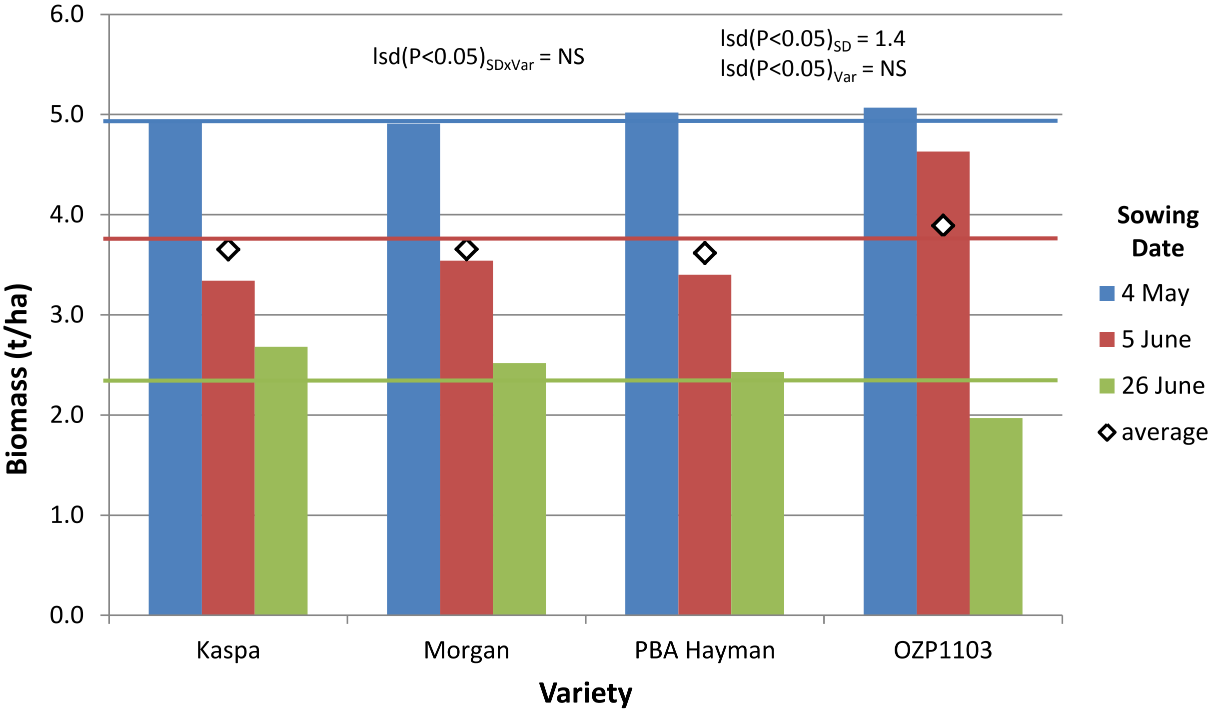


Figure 1. The effect of the interaction between sowing date and field pea variety on biomass production at flat pod at Curyo in 2012. Mean sowing date biomass indicated by horizontal lines; mean variety grain yield indicated by diamonds.

Table 1. The effect of the interaction between sowing date and field pea variety on biomass quality (Crude Protein and Metabolisable Energy) at flat pod at Curyo in 2012.

Crude Protein (%)

Sowing Date	Kaspa	Morgan	PBA Hayman	OZP1103	*Average*
4 May	13.3	15.0	16.7	15.1	*15.0*
5 June	14.8	13.2	17.2	15.5	*15.1*
26 June	17.9	17.6	18.4	19.8	*18.4*
Average	*15.3*	*15.3*	*17.4*	*16.8*	*16.2*

Metabolisable Energy (MJ/kg DM)

Sowing Date	Kaspa	Morgan	PBA Hayman	OZP1103	*Average*
4 May	11.1	11.0	9.9	11.7	*11.0*
5 June	11.4	9.1	8.8	10.8	*10.0*
26 June	10.2	9.1	8.2	10.6	*9.5*
Average	*10.9*	*9.7*	*9.0*	*11.0*	*10.2*

Crude Protein: lsd(P<0.05)SDxVar = NS; lsd(P<0.05)SD = 1.7; lsd(P<0.05)Var = NS.
Metabolisable Energy: lsd(P<0.05)SDxVar = NS; lsd(P<0.05)SD = 0.6; lsd(P<0.05)Var = 0.5.

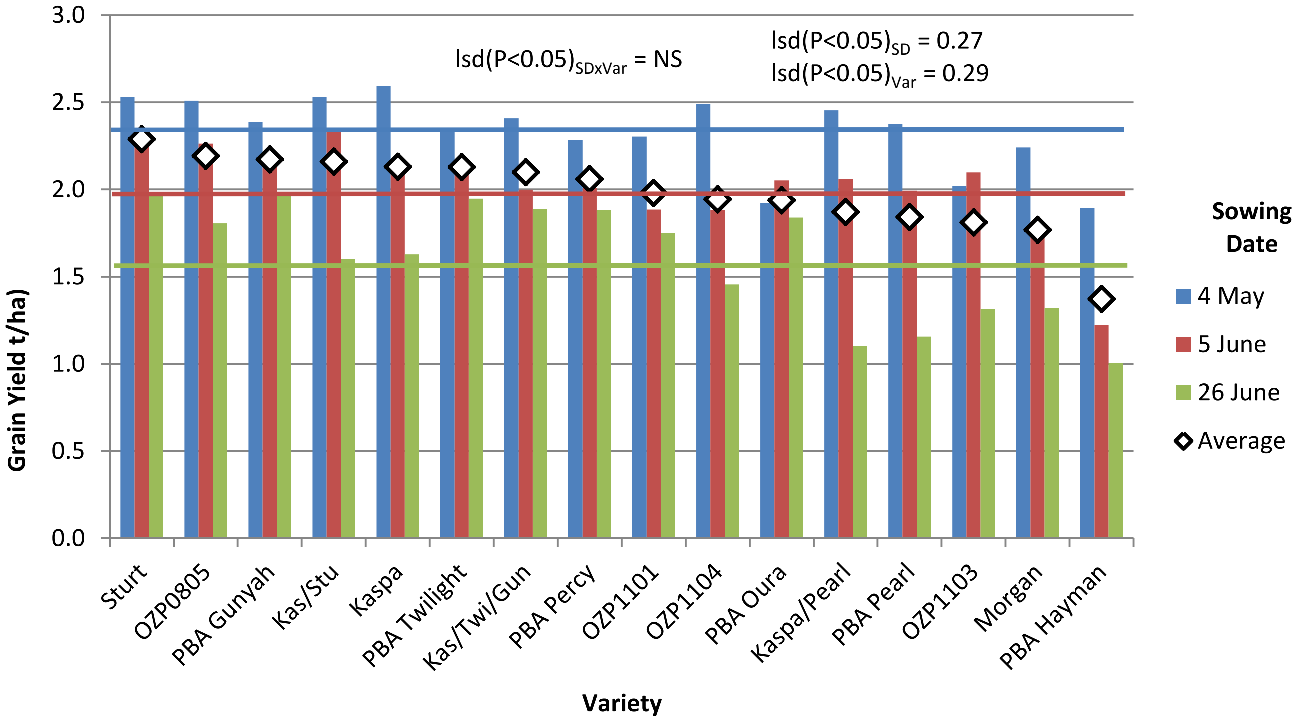


Figure 2. The effect of the interaction between sowing date and field pea variety on grain yield at Curyo in 2012. Mean sowing date grain yield indicated by horizontal lines; mean variety grain yield indicated by diamonds.

Key Findings and Comments

Similar to previous trials in the southern Mallee, earlier sowing is either highest or equal highest yielding. In most instances delaying sowing into June will result in yield declines. This trial demonstrated that the earlier maturing varieties like PBA Gunyah, PBA Twilight, PBA Oura and PBA Percy, generally have less yield decline at the later sowing dates. However there were some inconsistencies, with PBA Pearl, showing a higher relative drop in yield despite its early maturity. OZP0805, was the best of the new lines being tested and appear to have excellent yields and potentially more yield stability than Kaspa and may provide an excellent replacement as a 'Kaspa type'.

F8. Sowing Time, MRZ Wimmera (Rupanyup), Victoria

Aim

To investigate the adaptability of a range of field pea varieties and variety mixes to varying sowing dates.

Treatments

Varieties:	Kaspa, Morgan, PBA Oura, OZP0805, PBA Pearl, PBA Hayman, PBA Percy, PBA Gunyah, PBA Twilight, Sturt, OZP1101, OZP1103, OZP1104.
Variety Mixes:	Kaspa:PBA Pearl and Kaspa:Sturt sown with a 50:50 ratio based on targeted plants/m^2, and Kaspa:PBA Twilight:PBA Gunyah sown with a 33:33:33 ratio based on targeted plants/m^2
Sowing dates:	15 May (Early), 13 June (Mid), 18 June (Late).

Other Details

Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble.
Fertiliser:	MAP + Zn @ 80 kg/ha at sowing.
Plant Density:	35 plants/m^2.

Results and Interpretation

- Key Message: Bacterial blight had a significant impact on the grain yield of varieties in 2012. Sturt and OZP0805 were highest yielding varieties in this trial, similar to Curyo. Sturt and PBA Percy still seem to have the higher bacterial blight tolerance that needs to be achieved in the semi-leafless types

- Plant establishment – Establishment for all field pea varieties was on target for the May 15 sowing (30 plants/m^2) and reduced slightly in the 13 June and 18 July sowing dates (data not shown).
- Bacterial Blight Damage – Severe levels of bacterial blight were noted in this trial and scored on October 23 (Fig.1). Bacterial blight damage was worst in the early sown plots, with some plots being nearly completed wiped out. PBA Percy, Morgan Sturt and PBA Hayman had the lowest damage scores (less than 3 for all sowing dates. PBA Gunyah, Kaspa and PBA Twilight showed the worst symptoms with scores greater than 6 in the May 15 and June 13 sowing dates. These disease symptoms observed in this trial indicate that some varieties may be more susceptible than initially estimated through the breeding program.
- Grain Yield – Grain yields ranged from 0.8 t/ha for Kaspa sown May 15 to 2.15 t/ha for Sturt and OZP0805 sown June 13 (Fig. 1). As expected, grain yields were significantly negatively correlated with bacterial blight scores in the May 15 and June 13 sowing dates (r=-0.91 and r=-0.85, respectively). For the most sensitive varieties, PBA Gunyah, Kaspa and PBA Twilight grain yields were reduced by 35% to 50% in the May 15 sown plots compared with the July 18 sown plots. For the more tolerant lines, PBA Percy, Morgan Sturt and PBA Hayman, grain yields for May 15 sown plots were between 10% less and 5% greater than July 18 sown plots. The variety mix yields were generally between the component varieties.

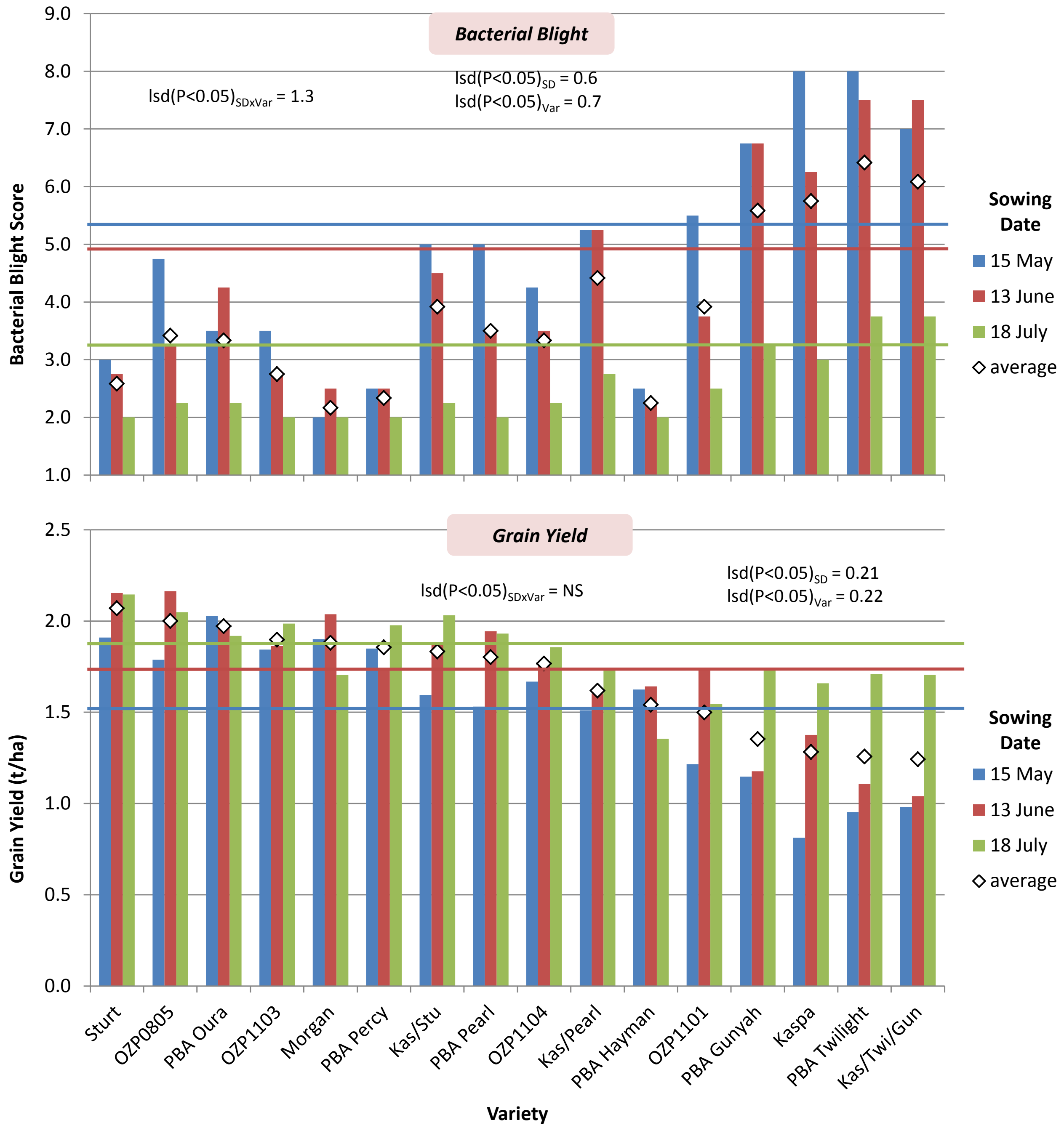


Figure 1. The effect of the interaction between sowing date and field pea variety on bacterial blight scores (1 – No damage, 9 – Dead) and grain yield at Rupanyup in 2012. Mean sowing date scores and grain yield indicated by horizontal lines; mean variety scores grain yield indicated by circles.

Key Findings and Comments

Bacterial blight had a significant impact on the grain yield of varieties in 2012. Interestingly though, the two highest yielding varieties in this trial Sturt and OZP0805, were the same as Curyo. The data highlights some of the significant improvements that have been made through the breeding program in regards to both resistance and tolerance to bacterial blight. Varieties like OZP0805, with the semi-leafless characteristic and similar grain type a had significantly lower disease scores than Kaspa and higher grain yields in this trial. However, the more conventional plant types, like Sturt and PBA Percy still seem to have the higher tolerance that needs to be achieved in the semi-leafless types. In regards to the forage types, both seem to have better resistance to bacterial blight than other varieties, but they will still show symptoms and suffer yield loss under conducive conditions.

F9. Sowing Time, Crop topping, Disease Management, HRZ Southern (Westmere), Victoria

Aim

To investigate the adaptability of a range of field pea varieties to varying sowing dates, crop topping and disease control.

Treatments

Varieties:	Kaspa, PBA Oura, PBA Hayman, Morgan, PBA Pearl, OZP0805, OZP1103, OZP1101.
Sowing dates:	9 May (Early), 6 June (Mid), 4 July (Late).
Crop Topping:	Mid: Applied at rye grass milky dough
Disease Control	Fortnightly: chlorothalonil 500 @ 2 L/ha applied fortnightly starting 6 weeks after emergence. Early: mancozeb @ 2kg applied 9 Node + early flower

Other Details

Stubble:	Cultivated
Row Spacing:	20 cm.
Fertiliser:	MAP @ 60 kg/ha at sowing.
Plant Density:	35 plants/m^2.

Results and Interpretation

- Key Message: Early sowing, concurrent with previous research, was highest yielding in 2011. There appear to be several promising new varieties available for southern Victoria, offering a range of grain types and forage options, associated with excellent yield potential. Crop topping results highlights the importance for growers and advisors to be aware of both weed and crop growth stages, otherwise significant grain yield loss could occur.

Seasonal conditions at Westmere were excellent for pulse production, with adequate rainfall and few high or low temperature events that impacted on yield. Grain yields ranged from 2.3 t/ha for PBA Hayman sown Jul 4 to 5.0t//ha for Kaspa sown 9 May. A summary for each of the agronomic treatments is outlined below.

- Disease management – There was no impact of disease management in field peas for 2012.
- Sowing Dates – As there was no impact of disease management, data for sowing dates has been averaged across all disease management treatments (but excludes the crop topping treatment (Table 1)). Generally the early (9 May) and mid (6 June) sowing dates had similar yields, while the later sowing date (4 July) was 30% lower yielding (Table 1). However, there were some varietal differences to this trend. PBA Hayman showed a slight yield increase at the mid sowing date and no yield loss at the last sowing date. OZP1103 generally showed lower yield loss with delayed sowing compared with all varieties except PBA Hayman. Conversely, PBA Oura appeared to show the greatest yield loss between the early, mid and late sowing times. Comparing the overall yield of varieties, Kaspa and OZP0805 were highest and PBA Hayman lowest (Table 1).
- Crop Topping – Yield loss from crop topping in 2012 ranged from 5% to 65% (Table 2). Generally the yield reductions were least at the latest sowing date and highest at the early sowing date. PBA Hayman showed the greatest yield loss with the crop topping treatment at all sowing dates, while there was little difference between other varieties at the early and mid sowing dates. At the latest sowing date, OZP1101 and OZP1103 appeared to show the least yield loss (Table 2).

Table 1. Effect of sowing date on grain yield (t/ha) of field pea varieties grown at Westmere in 2012. Underline indicates highest yield variety within that sowing date. Shading indicates yield significantly different from highest yielding variety.

Variety	9 May	6 June	4 July	Mean
OZP0805	4.89	4.73	3.54	*4.39*
Kaspa	4.98	4.72	3.38	*4.36*
OZP1103	4.55	4.54	3.73	*4.27*
OZP1101	4.80	4.76	3.03	*4.20*
PBA Pearl	4.54	4.25	2.84	*3.88*
Morgan	4.50	4.06	2.94	*3.84*
PBA Oura	4.69	4.06	2.74	*3.83*
PBA Hayman	2.44	2.91	2.28	*2.54*
Mean	*4.42*	*4.25*	*3.06*	*3.91*

Table 2. Grain yield reduction (%) from a crop topping treatment applied to new field pea varieties sown at 3 dates at Westmere in 2012.

Variety	9 May	6 June	4 July	Mean
OZP0805	26	42	16	28
Kaspa	25	32	21	26
OZP1103	34	45	6	28
OZP1101	32	36	5	24
PBA Pearl	31	37	25	31
Morgan	31	47	22	33
PBA Oura	30	38	12	27
PBA Hayman	65	63	46	58
Mean	34	42	19	32

Key Findings and Comments

- Varieties – Kaspa and its potential replacement OZP0805, performed extremely well at Westemere in 2012, with yields in the top 3 lines across all sowing dates. The new white pea PBA Pearl also showed promise and offers different marketing opportunities. Also of note is OZP1103 which showed both excellent yields and biomass (data note shown) as this variety has potential for dual purpose (i.e. both forage and grain). Further varietal details below.
- Sowing Dates – As has been seen in previous research, early sowing produced the highest yields. Based on yields achieved of the earlier sown treatments (4.5t/ha) peas could have achieved a gross profit of approximately $1300/ha based on management costs of $250/ha and grain price at $340/t.
- Crop Topping – In 2012 at Westmere, crop-topping targeting ryegrass at the milky dough stage caused significant yield loss in all varieties grown. This could be expected as the crop was too green and seed not sufficiently developed for application of a desiccant. It highlights the importance for growers and advisors to be aware of both weed and crop growth stages, otherwise significant grain yield loss could occur.
- Disease Management – These treatments were implemented to assess the effect disease is having on grain yields of field peas in a high rainfall zone. Unlike 2011, there was no response to disease control as disease pressure was low. A fortnightly fungicide regime is unlikely to be economically viable, unless yields are above 2t/ha and differences are in excess of 20% when using a fungicide. However, the early strategy, although not economically profitable, may be a risk management strategy to minimise the chance of yield loss from disease like black spot.

Chickpeas

C1. Chickpea Sowing Date, Yorke Peninsula (Arthurton), South Australia

Aim

To maximise yield, quality and agronomic performance of new chickpea varieties through the identification of optimum sowing dates.

Treatments

Varieties: Kabuli: Genesis079, Genesis090, Genesis114, Genesis Kalkee and CICA0857
Desi: PBA Slasher, PBA Striker and CICA0717
Sowing dates: 15 May (Early), 15 June (Mid)
Fungicides: P-Pickel T (thiram + thiabendazole) seed treatment, chlorothalonil at 8 weeks, early flower and early podding
Fertiliser: MAP + Zn @ 90kg/ha

Results and Interpretation

- Foliar disease – A "best practice" strategic fungicide regime was implemented in this trial, and there was little foliar disease observed in this trial in 2012 due to the drier than average season finish.
- Lodging – a significant sowing date x variety response was generated for lodging (Figure 1), despite only low levels of lodging in chickpea crops in 2012 compared with previous seasons. All desi chickpea varieties showed increased lodging from earlier sowing, while Genesis079 was the only kabuli variety to show increased plant lodging at the early sowing date.
  PBA Striker and CICA0717 also showed significantly greater lodging than all other varieties at the early sowing date. PBA Striker, CICA0717 and CICA0857, were the only varieties to show lodging at the late sowing date.
- Grain Yield – grain yield averaged 2.4 t/ha across the trial, less than in previous seasons due to the drier than average finish. Individual sowing date and variety responses were generated for grain yield in 2012.
  There was a 9% yield penalty from one month sowing delay from May 15th to June 15th (Table 1). All varieties responded similarly due to low disease pressure and dry seasonal conditions. The earlier maturing varieties Genesis079, PBA Striker and CICA0717 were the highest yielding varieties in the trial. CICA0857, a larger seeded and earlier maturing line, was lower yielding than other earlier maturing varieties, but yielded higher than other larger seeded, later maturing lines Genesis114 and Genesis Kalkee, which were the lowest yielding cultivars in this trial.

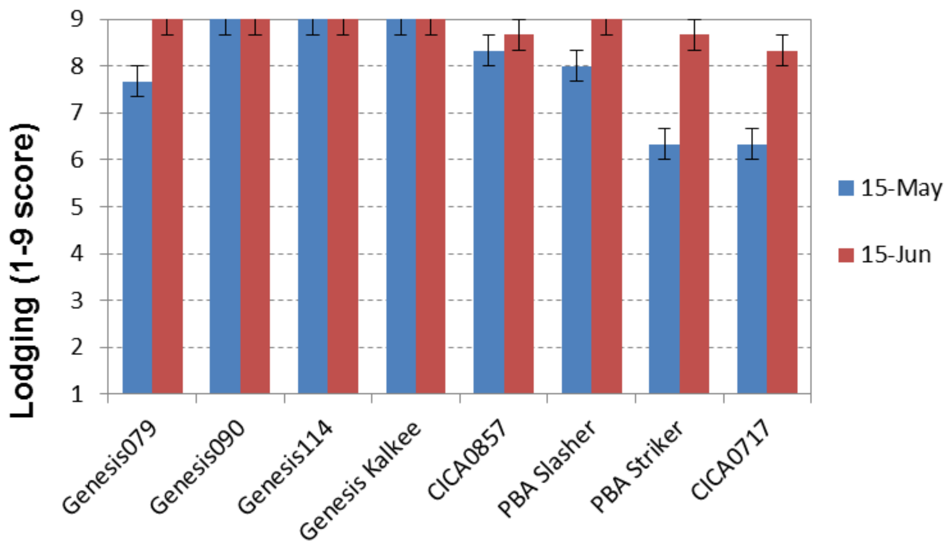


Figure 1: Effect of sowing date on lodging of five kabuli (left) and three desi (right) chickpea varieties, Arthurton 2012. Lodging score: 1= prostrate, 9 = erect

Table 1: Effect of sowing date on grain yield of chickpeas, Arthurton 2012.

Sowing Date	15-May	15-Jun	LSD (P<0.05)
Grain Yield (t/ha)	2.45	2.24	0.067

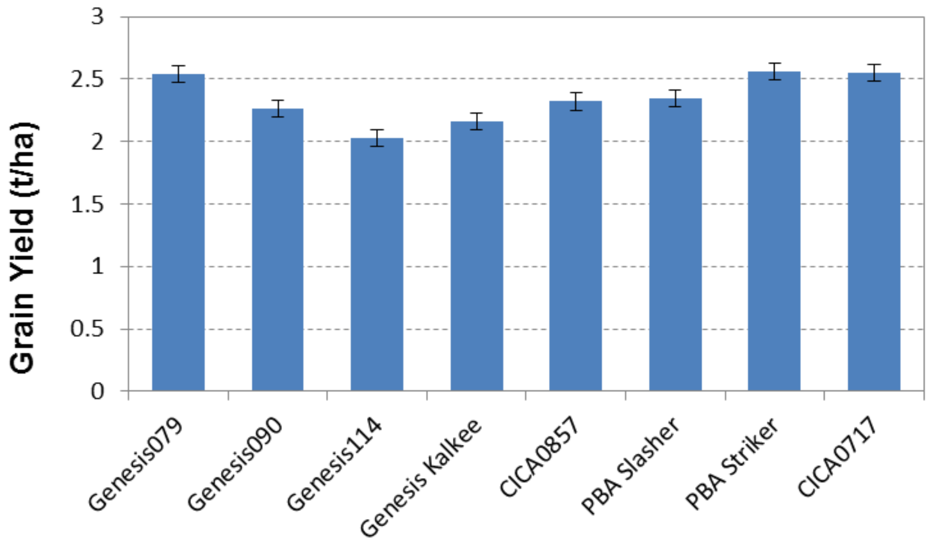


Figure 2: Grain yield of five kabuli (left) and three desi (right) chickpea varieties, Arthurton 2012.

Key Findings and Comments

- A dry (but mild) finish to the season meant that yields were less than the previous seasons but still above average, and there was less biomass production and disease pressure, resulting in low amounts of plant lodging.
- As expected, lodging was greater at the earlier sowing date, but was generally only minimal.
- Earlier maturing varieties PBA Striker and CICA0717 showed greater lodging than other varieties, but also showed equal highest grain yield with Genesis079 (also early maturing). This result supports previous findings potentially showing a link between lodging and plant maturity. The large seeded, later maturing lines Genesis114 and Genesis Kalkee were the lowest yielding varieties in the trial. However these varieties are likely to attract price premiums due to their larger and more consistent seed size than other kabuli varieties. Genesis Kalkee has the largest seed size of the two varieties, and is more likely to achieve requirements associated with this premium grade market.
- The kabuli line CICA0857 showed similar grain yield to Genesis090, and has a larger and more consistent seed size than Genesis090. Its earlier maturity compared to Genesis090 may also provide improved yield stability across variable seasons and in lower rainfall chickpea growing areas.
- PBA Striker and CICA0717 showed higher yield than the other desi variety, PBA Slasher. These earlier maturing varieties have higher ascochyta blight susceptibility than PBA Slasher, but may show higher yield stability in seasons with a drier than average finish, or in lower rainfall chickpea growing areas where the risk of ascochyta blight is low.

C2. Chickpea Ascochyta Blight Management, Mid North (Turretfield), South Australia

Co-authored by Jenny Davidson, South Australian Research & Development Institute

Aim

To identify optimum ascochyta blight management strategies for maximising grain yield of new varieties.

Treatments

Varieties: Table 1
Sowing date: 31 May
Treatments: Nil – no fungicide applied
Podding – 2L/ha Chlorothalonil at Podding (8 Oct)
Strategic – 2L/ha Chlorothalonil at 8 weeks (6 Aug), Early Flower (20 Sept) and Podding (8 Oct).
Complete - 2L/ha Chlorothalonil fortnightly from 6 Aug.
All treatments were inoculated with ascochyta blight infected chickpea straw on July 15th.
Fertiliser: MAP + Zn @ 100kg/ha

Table 1: Ascochyta blight ratings of kabuli and desi chickpea varieties, Turretfield 2012.

Variety	Grain type	Ascochyta Rating
Genesis090	Kabuli	R
Genesis114	Kabuli	MS-MR
Genesis Kalkee	Kabuli	MS-MR
CICA0857	Kabuli	MR **
PBA Slasher	Desi	R
PBA Striker	Desi	MR
CICA0717	Desi	MS-MR **

** = limited evaluation

Results and Interpretation

- Disease infection - This trial had a high initial level of ascochyta blight infection due to the inoculation with infected chickpea straw, with individual plots showing up to 15% plot infection. Dry seasonal conditions during spring reduced late season disease spread and some level of plant regrowth (recovery) was observed in the most susceptible varieties.
  Nil and Podding treatments showed the highest ascochyta blight infection, while Strategic and Complete treatments showed the lowest (Table 2).
  Genesis090 showed lower levels of ascochyta blight infection than all other varieties except CICA0857, PBA Slasher and CICA0717 (Figure 1). Genesis Kalkee showed higher levels of ascochyta blight infection than all other varieties except PBA Striker.
- Grain yield - the average grain yield for the trial was 2.6t/ha. There was no treatment x variety interaction for grain yield or ascochyta blight infection in this trial, meaning that all varieties responded similarly to each of the fungicide strategies.
  Complete disease control (fortnightly applications of chlorothalonil) yielded 13% higher than the Nil (untreated control), while the Strategic disease management treatment (chlorothalonil at 8 weeks after sowing, early flower and early podding) yielded 7% higher than the Nil (Table 2).
  The Podding treatment (chlorothalonil only at podding) yielded 4% lower than the Nil.
  PBA Slasher and PBA Striker were the highest yielding varieties in the trial, followed by CICA0717, Genesis090 and CICA0857 (Figure 1). Genesis114 and Genesis Kalkee were the lowest yielding varieties, averaging approximately 25% lower yielding than PBA Slasher.

Table 2. Effect of ascochyta blight management practice on grain yield (t/ha) and ascochyta blight infection (% plot infected) of chickpea, Turretfield 2012.

Treatment	Nil	Podding	Strategic	Complete	LSD (0.05)
Disease Infection (% plot infected)	4.57 [S]	4.85 [S]	2.95 [T]	2.24 [T]	1.34
Yield (t/ha)	2.48 [b]	2.37 [a]	2.66 [c]	2.79 [d]	0.108

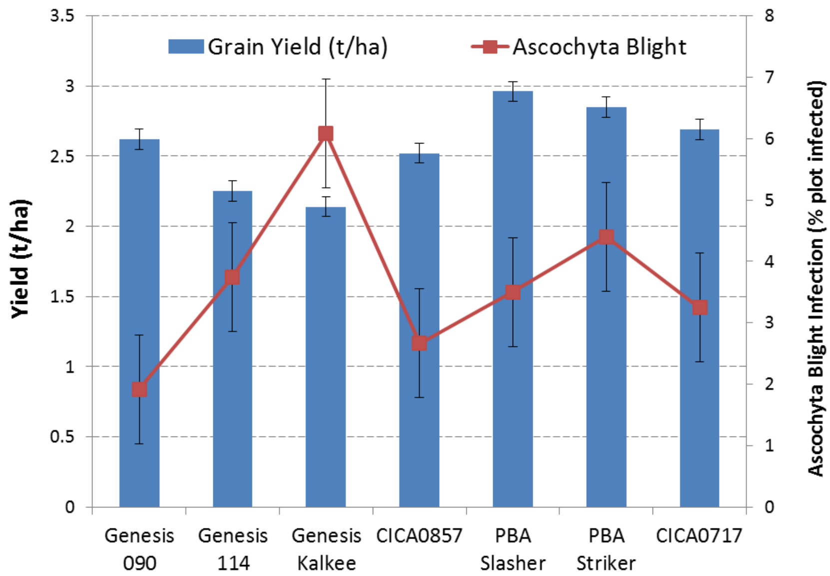


Figure 1. Grain yield (t/ha) and ascochyta blight infection (% plot infected) of chickpea varieties, Turretfield 2012.

Key Findings and Comments

- The mild (although dry) finish to the 2012 season suited chickpeas at this site enabling them to mature slowly and achieve relatively high yields (averaging 2.6t/ha).
- Across all varieties a 13% yield improvement from fortnightly disease control, and a 7% yield improvement from strategic control involving three applications of chlorothalonil compared to untreated plots occurred.
- All current chickpea varieties are susceptible to seed staining from ascochyta blight, and require foliar fungicides at the onset of podding. Varieties rated as MR and MS-MR will also benefit from strategic fungicide applications during the growing season to control disease. Previous research suggests that the optimum timing for strategic fungicide application is 6-8 weeks after sowing (when initial protection from P-Pickel T is wearing off) and at early flowering (to provide protection from flowers).
- A small yield penalty (4%) occurred in the Podding treatment compared with the Nil treatment. This response is unexpected, since application of chlorothalonil at podding merely protects the pod from ascochyta blight infection and consequential staining of seeds, and is not expected to affect grain yield. This result should be treated with caution, and further evaluation is required.
- The recently released varieties PBA Slasher and PBA Striker were the highest yielding varieties in the trial. There was no difference in ascochyta blight infection between these two varieties in this trial, however previous work has shown that PBA Slasher has improved resistance compared to PBA Striker, and is the preferred variety where this disease is common.
- Due largely to their earlier maturity the desi chickpea varieties outyielded the kabuli varieties, except for Genesis090 which yielded similarly to CICA0717. However kabuli varieties can attract premium prices if good seed quality (free from staining and uniform in colour) is achieved.

- Genesis114 and Genesis Kalkee were lower yielding than the other kabuli varieties Genesis090 and CICA0857, however will attract a premium price based on their larger and more consistent seed size.
- The kabuli line CICA0857 showed similar grain yield to Genesis090, and has a larger and more consistent seed size than Genesis090. Its earlier maturity compared to Genesis090 may also provide improved yield stability across variable seasons and in lower rainfall chickpea growing areas.

C3. Chickpea Ascochyta Blight Susceptibility, Mid North (Turretfield), South Australia

Co-authored by Jenny Davidson, South Australian Research & Development Institute

Aim

To evaluate ascochyta blight response of new varieties by comparing their susceptibility to known cultivars.

Treatments

Varieties: Table 1
Sowing date: 31 May
Treatments: Inoculated with ascochyta blight infected chickpea straw on July 15th.
No foliar or seed fungicide treatments were applied.
Fertiliser: MAP + Zn @ 100kg/ha

Table 1: Ascochyta blight ratings of kabuli and desi chickpea varieties, Turretfield 2012.

Variety	Ascochyta Rating
Ambar	R **
Genesis079	R
Genesis090	R
Genesis114	MS-MR
Genesis Kalkee	MS-MR
Howzat	S
Neelam	R **
PBA Slasher	R
PBA Striker	MR
Sonali	MS
CICA0717	MR **
CICA0857	MR **

** = limited evaluation

Results and Interpretation

- The average grain yield for the trial (including several varieties rated as S and MS) was 1.75t/ha. Yields varied between 0.4t/ha in the most susceptible variety Howzat to 2.45t/ha in the resistant PBA Slasher (Figure 1).
- This trial had a high initial level of ascochyta blight infection due to the inoculation with infected chickpea straw. Individual plots showed up to 50% plot infection during winter. Dry seasonal conditions during spring reduced late season disease spread and some level of plant regrowth (recovery) was observed in the susceptible varieties.
- There was a direct relationship between ascochyta blight infection and grain yield where resistant varieties showed less infection and higher grain yield compared to more sensitive varieties (Figure 1).
- PBA Slasher outyielded all other varieties, while there was no significant difference in yield between Genesis079, CICA0857, Ambar, PBA Striker, Genesis090, CICA0717 and Neelam.
- The kabuli varieties with MS-MR AB resistance, Genesis Kalkee and Genesis114 were lower yielding than all varieties except Howzat (S) and Sonali (MS). They also showed similar ascochyta blight infection to varieties with improved resistance in this trial, including PBA Striker (MR), CICA0717 (MR), Neelam (R) and PBA Slasher (R).
- Genesis090 showed the lowest ascochyta blight infection, but similar to Ambar and Genesis079.
- PBA Slasher, Neelam, CICA0717, PBA Striker, CICA0857, Genesis114 and Genesis Kalkee all showed higher ascochyta infection that Genesis090 but significantly less that Howzat and Sonali.

- Howzat (S) and Sonali (MS) showed the highest and second highest levels of ascochyta blight infection, respectively.

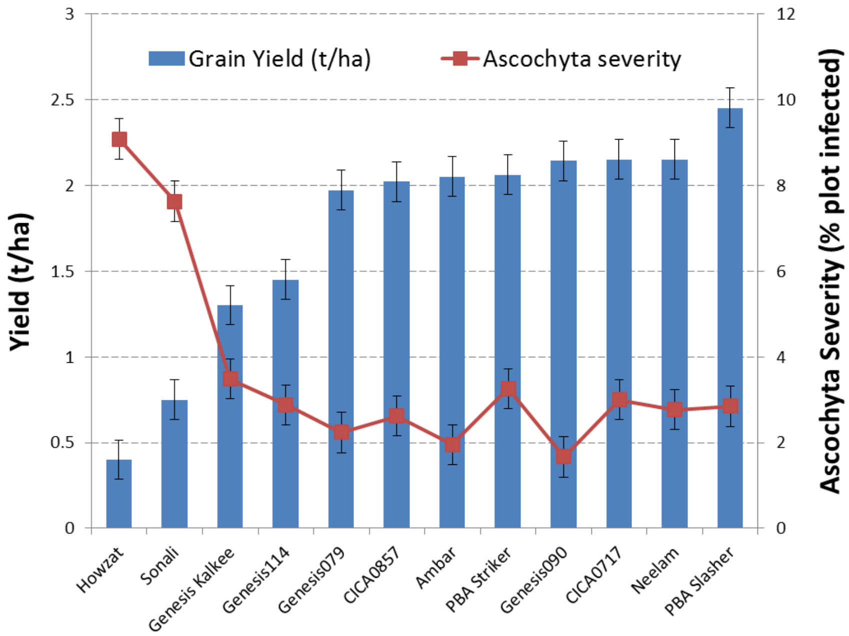


Figure 1: Grain yield (t/ha) and ascochyta severity (% plot infected) of chickpea varieties at Turretfield, 2012.

Key Findings and Comments

- A direct relationship between grain yield and ascochyta blight infection, and grain yields varying from 0.4t/ha (Howzat) to 2.45t/ha (PBA Slasher), highlight the achievements of the chickpea breeding program in developing varieties with improved ascochyta blight resistance.
- The kabuli variety Genesis090 (rated as R) has the highest level of ascochyta blight resistance of all the varieties tested in this trial, supporting previous findings.
- Despite higher levels of ascochyta blight infection, some desi varieties, including PBA Slasher, may have higher yield potential due to better general adaptation to South Australian growing environments eg earlier maturity and better tolerance to variable soil types.
- This trial showed no difference between some varieties currently rated as MS-MR, MR and R for either grain yield or ascochyta blight infection severity. Further testing is required to validate these results, and to update current ascochyta blight resistance ratings.
- All current chickpea varieties are susceptible to seed staining from ascochyta blight, and require foliar fungicides at the onset of podding. Varieties rated as MR and MS-MR will also benefit from strategic fungicide applications during the growing season to control disease.

C4. Chickpea Crop-topping/Desiccation, Yorke Peninsula (Melton), South Australia

Aim

Chickpea are generally considered to be unsuited to the agronomic practice of crop-topping due to their late maturity timing, and are the least of the four winter pulse crop types commonly grown in South Australia. This work aims to identify lines with improved adaptation (through earlier maturity) to this practice.

Treatments

Varieties:	Table 2 (details of some breeding lines have been withheld).	
Sowing date:	6 June.	
Treatments:	see tables for dates.	
	Nil	- no desiccant applied
	Early	- applied 13 days pre ryegrass milky dough stage (12 Oct)
	Recommended	- applied at ryegrass milky dough stage (25 Oct)
	Late	- applied 12 days post ryegrass milky dough stage
Fertiliser:	MAP + Zn @ 90kg/ha	

Results and Interpretation

- There was no significant interaction between variety and crop-top timing for grain yield in 2012, which means that all varieties behaved similarly at each crop-top timing. This is the first instance (out of five trials) where this result has occurred and may have been due to a combination of moderate weed (bedstraw) competition and low levels of bird damage in this trial. These results should be interpreted with caution.
- Grain Yield – site mean yield was 1.13t/ha. Crop-top timing had a significant effect on grain yield of chickpea in 2012 (Table 1). All treatment timings incurred a significant yield loss, which decreased as the treatment timing was delayed. This result was more severe in 2012 than in previous seasons where only a few incidences of yield loss from crop-topping at the Late timing have occurred.
  Crop-topping at the Recommended timing for ryegrass control (milky dough stage) caused a 21% yield loss compared to the Nil, while crop-topping 2 weeks before and after the Recommended timing caused 40% and 5% yield losses, respectively.
  CICA0717 was the highest yielding variety (Table 2), but was not significantly higher yielding than Sonali, Genesis079, PBA Striker, PBA Slasher and the breeding line Chickpea 4. The latest maturing line Genesis114 was the equal lowest yielding variety in this trial, yielding similarly to Genesis509, PBA HatTrick, Genesis090 and Chickpea 3, but higher than the remaining 9 varieties in this trial.
  Long term grain yield responses to crop-topping (Table 4) shows a clear link between cultivar maturity and response to crop-topping. The earliest maturing varieties have shown the lowest incidence of yield loss and the lowest average yield loss percentages at the Early and Recommended crop-top timing, and have therefore been better suited to crop-topping than later maturing varieties. However high average yield losses at the Recommended timing still confirm that chickpea are poorly suited to this practice.
- Grain weight – all varieties showed reduced grain weight at the Early timing (Table 2), and ten of the 14 cultivars showed reduced grain weight at the Recommended timing. The varieties which showed no reduction in grain weight at the Recommended timing were generally earlier maturing cultivars (breeder's lines Chickpea 1 and Chickpea 3, and the commercial cultivars Sonali and Genesis509). No varieties showed reduced grain weight at the Late treatment timing.
  Long term summary of crop-topping on grain weight (Table 4) shows a link between cultivar maturity and grain weight following crop-topping. The later maturing kabuli varieties

Genesis090 and Genesis114 show increased sensitivity to reduced grain weight from crop-topping, particularly at the Late timings. Lower sensitivity in these varieties compared to others at the earlier timings may be due to the abortion of later developing flower and pods, greatly limiting grain yield by reducing total number of seeds per plant but with limited effect on grain weight.

Table 1. Effect of crop-top timing on grain yield (t/ha) of chickpeas, Melton 2012.

Treatment	Early 12-Oct	Recommended 25-Oct	Late 6-Nov	Nil	LSD (P<0.05)
Yield (t/ha)	0.81 [a]	1.08 [b]	1.29 [c]	1.36 [d]	0.066

Table 2. Grain yield (t/ha) of chickpea varieties, Melton 2012. Varieties are ranked according to their visual maturity rating from earliest to latest (E = Early, M = Mid, L = Late).

Variety	Flowering time	Maturity time	Grain Yield (t/ha)
Chickpea 1	VE	VE	1.08
Sonali	E	E	1.21
PBA Striker	E	E	1.25
Chickpea 2	E	E	1.11
Genesis079	E	E	1.28
Chickpea 3	E	E-M	1.03
Genesis509	E-M	E-M	0.99
CICA0717	M	M	1.3
Chickpea 4	E-M	M	1.24
CICA1252	E-M	M	1.12
PBA HatTrick	M	M	1.06
PBA Slasher	M	M	1.21
Genesis090	M	M	1.06
Genesis114	M-L	M-L	0.94
LSD (P<0.05)			**0.124**

* Lodging (1-9 score): 1 = prostrate, 9 = erect.

Table 3. Effect of crop-top timing on grain weight of chickpea varieties, Melton 2012. Varieties are ranked according to their visual maturity rating from earliest to latest (E = Early, M = Mid, L = Late).

Variety	Grain Wt. (g/100)	Grain Weight (% of Nil)		
	Nil	Early 12-Oct	Recommended 25-Oct	Late 6-Nov
Chickpea 1	19.5	80	95	96
Sonali	18.0	88	96	100
PBA Striker	22.9	83	93	102
Chickpea 2	20.6	84	93	100
Genesis079	24.3	78	89	98
Chickpea 3	15.0	83	94	100
Genesis509	15.9	88	97	102
CICA0717	24.3	86	93	101
Chickpea 4	19.7	86	90	99
CICA1252	37.7	88	90	102
PBA HatTrick	20.2	85	86	98
PBA Slasher	19.5	83	87	95
Genesis090	29.7	90	83	97
Genesis114	36.5	83	86	100

lsd (P<0.05)timing.var = 1.214

NB: Shading denotes significant difference from the Nil treatment.

[a] = 2 weeks prior to Recommended timing

[b] = 2 weeks after Recommended timing

Table 4: Long term summary (2008-2012) of grain yield and grain weight responses of selected chickpea cultivars to crop-topping. Varieties are ranked according to their visual maturity rating from earliest to latest.

Variety	Incidence of significant yield losses (# trials)		Average Yield [Range] (% of Control)		Incidence of significant grain weight loss (# trials)			Average Grain Weight [Range] (% of Control)		
	Early	Rec.	Early	Rec.	Early	Rec.	Late	Early	Rec.	Late
PBA Striker	5 (5)	3 (5)	51 [31-68]	81 [74-93]	3 (5)	3 (5)	0 (5)	82 [60-97]	88 [80-99]	98 [93-99]
Genesis079	5 (5)	4 (5)	51 [25-81]	82 [71-96]	4 (5)	3 (5)	0 (5)	82 [72-95]	94 [86-104]	100 [99-104]
PBA Slasher	5 (5)	4 (5)	48 [30-64]	79 [65-91]	3 (5)	3 (5)	0 (5)	83 [73-92]	86 [78-96]	97 [94-101]
Genesis090	5 (5)	5 (5)	44 [25-61]	77 [64-84]	4 (5)	3 (5)	3 (5)	88 [79-96]	87 [83-93]	94 [91-97]
Genesis114	5 (5)	4 (5)	42 [17-60]	80 [65-94]	4 (5)	4 (5)	1 (5)	89 [83-96]	92 [85-102]	97 [90-104]

Key Findings and Comments

- A combination of weed competition and bird damage likely accounts for the absence of interaction between variety and crop-top application timing for grain yield in this trial. However significant treatment and variety responses were generated for grain yield, as well as a significant interaction for grain weight.
- Earlier maturing cultivars generally showed higher grain yield, favoured by the dry (but mild) finish to the season. The latest maturing cultivar Genesis114 showed the equal lowest average yield with other later maturing cultivars Genesis090, PBA HatTrick and Chickpea 3.
- Long term grain yield summary showed less yield loss from crop-topping in earlier maturing cultivars compared to later maturing cultivars. However all chickpea varieties are still poorly suited to this practice due to their unacceptably high yield losses compared to other pulse crops at the Recommended timing for ryegrass control.

- Grain weight does not generally influence profitability of pulses, however premiums are paid on seed size of kabuli chickpea. A close link exists between seed size and grain weight, and therefore grain weight was measured in this study to extrapolate the potential effect of crop-topping on seed size of chickpea.
- Earlier maturing varieties generally showed a lower reduction in grain weight at the Recommended timing, while later maturing varieties incurred a higher grain weight loss. Long term grain weight analyses also support these results. The common commercial cultivar Genesis090 showed greater sensitivity of grain weight to crop-topping applications than most other cultivars, particularly at the Late treatment timing, indicating that it may be subject to price penalties if this agronomic practice is used.

C5. Sowing Date x Plant Population, LRZ (Yenda), NSW

Aim

To test the yield response of four faba bean varieties across 2 sowing times (TOS) in southern NSW. The information from this trial will be used to improve current grower recommendations for sowing time, variety selections and plant population.

Treatments

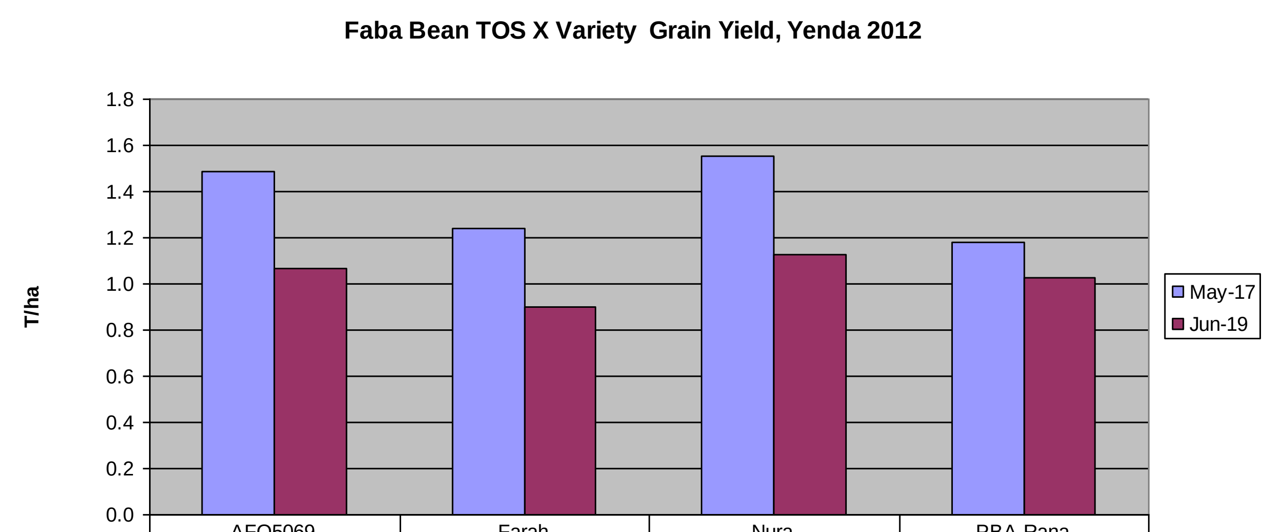
Varieties:	Farah, PBA Rana, AF5069 and PBA Nura.
Sowing dates:	17th May and 19th June 2012
Plant populations:	Targeted 15, 30 & 45 plants/m^2.
Row Spacing/Stubble:	30 cm into standing light stubble.
Fertiliser:	Legume Starter @ 115 kg/ha at sowing.
Plot size:	12 m x 1.6 m, three replicates

Results and Interpretations:

2012 season was characterised by above average summer rainfall and below average in crop rainfall. As a result crops were reliant on stored soil moisture for much of the growth period with near average August rainfall facilitating early spring growth which produced sufficient crop biomass to produce economically viable yields. The dry winter growth period reduced the incidence of foliar diseases.

The original intent of this trial was to evaluate four new faba lines, at April and May sowing times. Timing of sowing rains dictated an early May/ early June comparison. Disease pressure was low due to seasonal conditions, the levels of infection were below spray thresholds.

Sowing time significantly affected Faba Bean yields. On average, yield declined by 11kg/day with a 32 day sowing delay. Early sowing, (May) established a mean yield of 1.365 t/ha; and the later sowing (June) had a mean yield of 1.028t/ha.



	AFO5069	Farah	Nura	PBA Rana
May-17	1.486	1.239	1.556	1.177
Jun-19	1.065	0.898	1.125	1.025

Key Findings and Comments

- Sowing after the start of May resulted in a reduction in expected yields compared to previous seasons
- Delaying sowing reduced Faba bean yields by approximately 0.3t/ha
- There was significant difference between varieties and with delayed sowing
- PBA Nura was the best performed variety at both sowing dates
- There was little disease pressure.

C6. Chickpea Fertiliser rate x placement, LRZ Yenda, New South Wales

Aim

Investigate the effects of fertiliser rates and its placement on the germination & establishment of deci and kabuli type chickpeas. Secondly to measure the grain yield responses to fertiliser rates. The information from this trial plus others is used to validate and improve grower recommendations.

Treatments

Varieties (2): Desi - PBA Slasher.
Kabuli – Genesis 090.

Fertiliser rate (6): Single super at Nil, 10, 20 & 30kg/ha of Phosphorus and 20 kg/ha of P as MAP and tri phos.

Sowing dates: 17th May

Row Spacing/Stubble: 30 cm / burnt stubble.

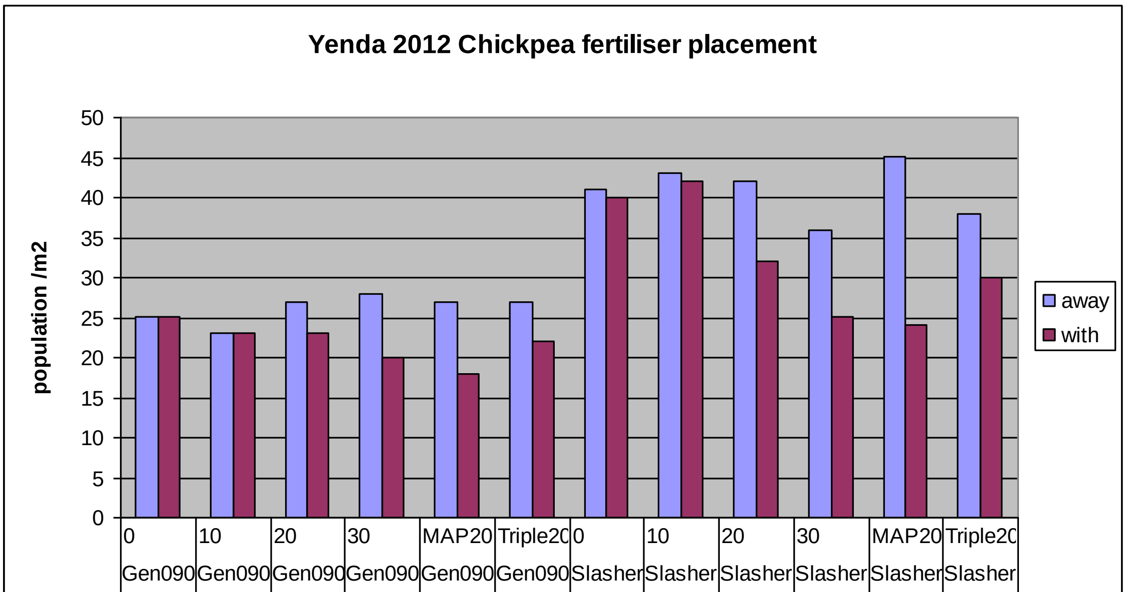
Fertiliser placements: Sown with seed in same sowing boot (WITH)
Sown separately to seed (AWAY)

Target chickpea pop.n: 35 plants/m^2

Results

Plant establishment

Plant establishment of Gen090 was below target population. However, Desi and Kabuli types responded similarly to fertiliser treatments. Zero and 10 kg P/ha rate did not effect seedling emergence.



	0 Gen090	10 Gen090	20 Gen090	30 Gen090	MAP20 Gen090	Triple20 Gen090	0 Slasher	10 Slasher	20 Slasher	30 Slasher	MAP20 Slasher	Triple20 Slasher
away	25	23	27	28	27	27	41	43	42	36	45	38
with	25	23	23	20	18	22	40	42	32	25	24	30

Figure 1. The effects of fertiliser rate and placement on chickpea emergence of Gen090 and PBA Slasher.

At 20 Kg P/ha significant reductions in population occurred when seed and fertiliser were sown together compared to being physically separated. At the 20 kg P/ha rate single and triple P formulations behaved similarly with population reduced by 15-18% and 21-24% for Gen090 and

PBA Slasher. MAP at 20 Kg P/ha had the greatest impact on plant population, with reductions of 33% and 46% for Gen090 and PBA Slasher, respectively.

It can be clearly stated that both varieties suffered severe plant establishment losses from fertiliser placement with increasing fertiliser rates.

Yield results

At the 20 & 30 kg P/ha fertiliser rates, there was significant yield decline detected with both PBA Slasher and Genesis090 when the fertiliser was placed with the seed. Even in the low rainfall 2012 cropping season the reduced plant establishment limited yield of chickpea.

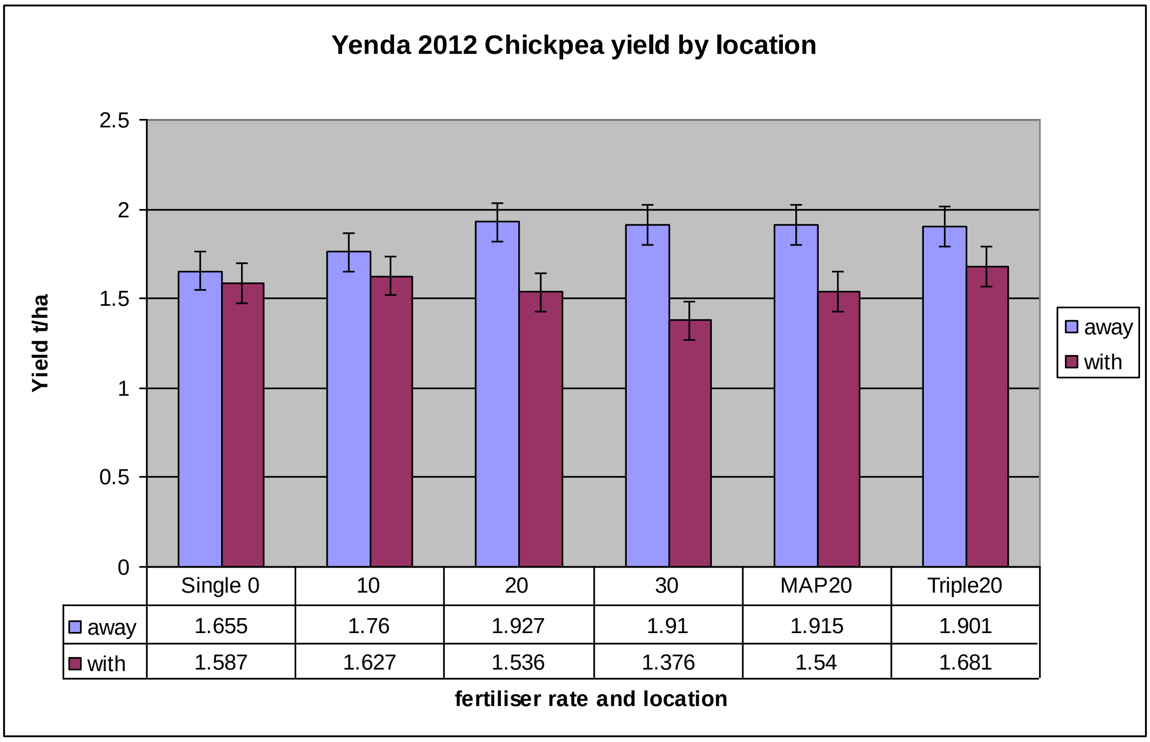


Figure 2. The effects of fertiliser rate and placement on chickpea yield averaged across varieties.

This research for a second season provides an explanation of why some southern NSW growers have had difficulty getting the crop established successfully.

The choice of fertiliser type has impacted on emergence and warrants further investigation to determine seasonal and species dynamics of this effect. As the majority of seeding units available commercially place seed and fertiliser in the same zone, producers need to be made aware of the negative consequences to plant establishment chickpea when using high fertiliser rates and especially so with MAP.

Summary

- Both desi and kabuli chickpea varieties suffered severe plant establishment reductions from fertiliser placement with the seed and with increasing fertiliser rates.
- Fertiliser rates of 20 kg P/ha and above placed with the seed had a significant negative effect on grain yields.
- Yields increased with fertiliser rate up to about 20kg/ha of P in this particular season and soil type
- Over two seasons fertiliser placement has been shown to influence plant establishment and yield of chickpea.

C7. Fertiliser Rate x Fertiliser Placement, LRZ Wagga Wagga, NSW

Aim

Investigate the effects of fertiliser rates and its placement on the germination & establishment of deci and kabuli type chickpeas. Secondly to measure the grain yield responses to fertiliser rates. The information from this trial plus others is used to validate and improve grower recommendations.

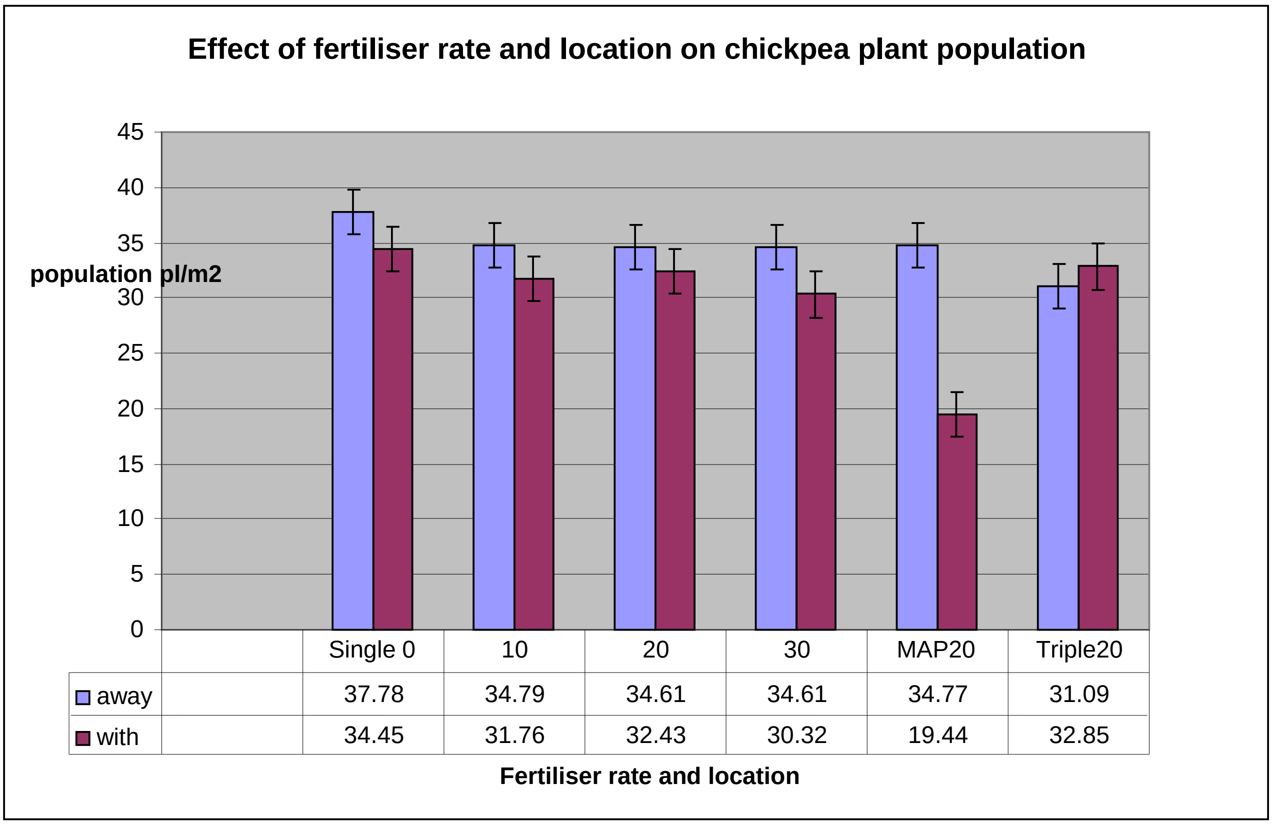
Treatments

Varieties (2):	Desi - PBA Slasher. Kabuli – Genesis 090.
Fertiliser rate (6):	Single super at Nil, 10, 20 & 30kg/ha of Phosphorus and 20 kg/ha of P as MAP and tri phos.
Sowing dates:	31st May
Row Spacing/Stubble:	30 cm / burnt stubble.
Fertiliser placements:	Sown with seed in same sowing boot (WITH) Sown separately to seed (AWAY)
Target chickpea pop.n:	35 plants/m^2

Results.

Plant establishment

Plant establishment of Gen090 was below target population at 27 plants per square meter. Desi and Kabuli types responded similarly to fertiliser treatments. In this experiment plant populations trended downward with increasing Phosphorus fertiliser rates. MAP at 20 P kg/ha reduced plant population by 42%.



	Single 0	10	20	30	MAP20	Triple20
away	37.78	34.79	34.61	34.61	34.77	31.09
with	34.45	31.76	32.43	30.32	19.44	32.85

Figure 1. The effects of fertiliser rate and placement on chickpea emergence averaged across varieties.

Yield results

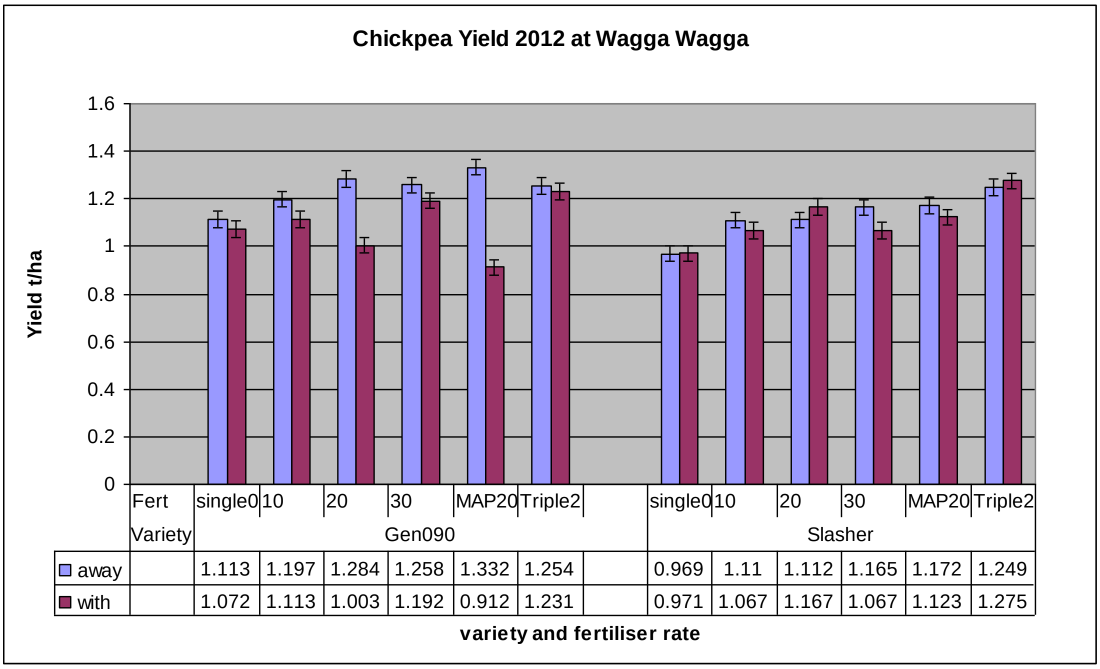


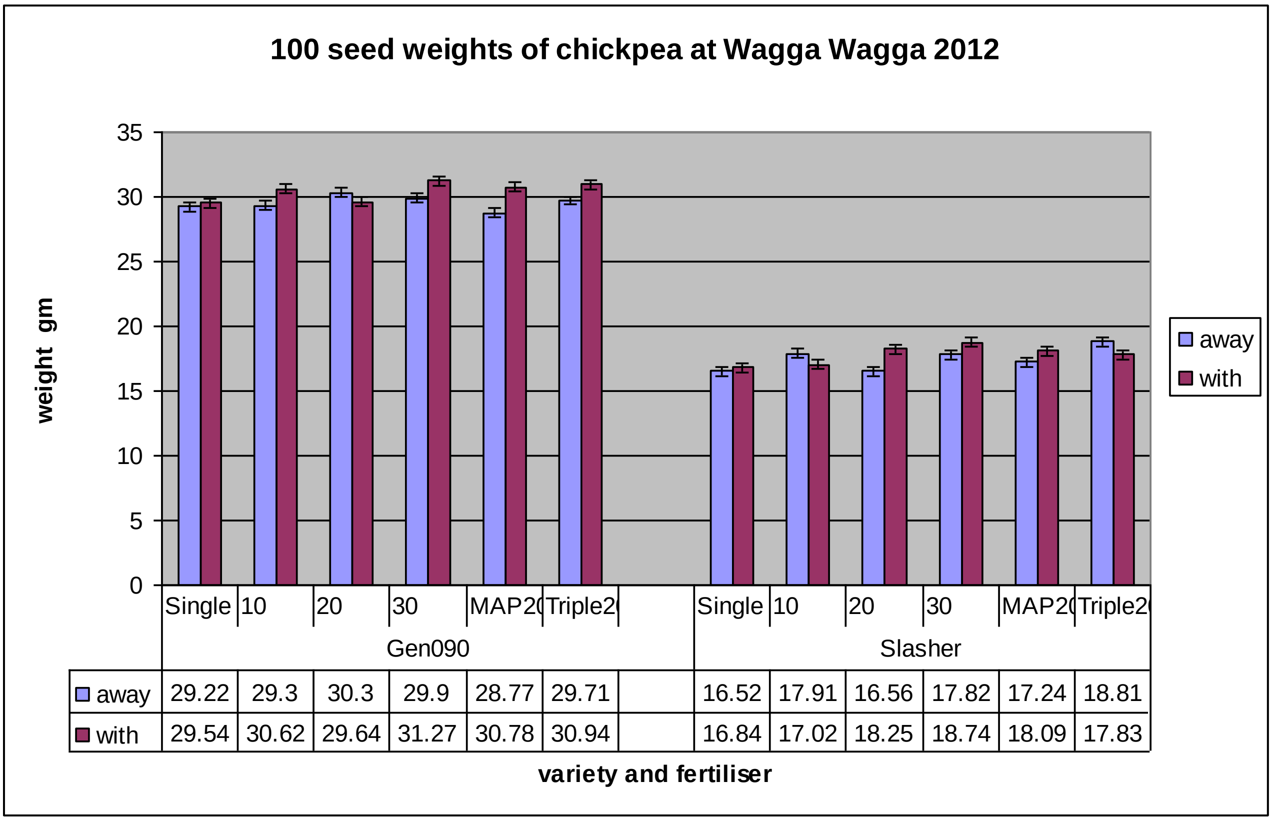
Figure 2. The effects of fertiliser rate and placement on chickpea yield.

As can be seen in the above emergence table, the high rate of fertiliser impacted on plant emergence and this possibly can be attributed as the main factor to this yield decline.

At the 20 & 30kg/ha fertiliser rates, there was significant yield decline detected with both PBA Slasher and Genesis090 when the fertiliser was placed with the seed.

This research for a second season provides an explanation of why some southern NSW growers have had difficulty getting the crop established successfully.

Further work is required to validate this research over different soil types, pulse species and seasons.
The choice of fertiliser type has impacted on emergence and warrants further investigation to determine seasonal and species dynamics of this effect. Irrespective of this, there is merit from this trial that shows the effects of fertiliser damage on plant emergence and associated grain yields.



Summary

- Both desi and kabuli chickpea varieties suffered severe plant establishment reductions from fertiliser placement with the seed and with increasing fertiliser rates.
- Fertiliser rates of 20 kg P/ha and above placed with the seed had a significant negative effect on grain yields.
- The dry spring conditions have compressed achieved yields to that possible from the limited water supply. Differences in plant population still negatively influenced achieved yields. Yields increased with fertiliser rate up to about 20kg/ha of P in this particular season.

Over two seasons fertiliser placement has been shown to influence plant establishment and yield of chickpea.

C8. Sowing Time, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the adaptability of a range of chickpea varieties and variety mixes to varying sowing dates.

Treatments

Varieties:	Genesis090, Genesis079, GenesisKalkee, PBASlasher, PBA Striker, Almaz, CICA0717, CICA0857, CICA1016, CICA1122.
Variety Mixes:	Genesis090:PBA Striker, Genesis090:PBA Slasher. All sown with a 50:50 ratio based on targeted plants/m^2.
Sowing dates:	4 May (Early), 5 June (Mid), 26 June (Late).

Other Details

Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble.
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing.
Plant Density:	30 plants/m^2.

Results and Interpretation

- Key Message: Grain yield and profitability was maximised in the Mallee by earlier sowing. In particular, in 2012, the larger seeded Kabuli types had very high profits as yields were similar to other varieties and grain size excellent.

- Plant establishment – Establishment for all chickpea varieties was acceptable in 2012, ranging between 20 and 30 plants/m^2 (data not shown).

- Grain Yield – Grain yields were average, ranging between 0.8 and 1.9 t/ha (Fig .1). There was no interaction between sowing date and variety, however the main effects were significant. The June 26 sowing date had yields 20-45% less than the May 4 sowing date, while the June 5 date was 0-15% less. All varieties generally had similar yields, except Almaz which was about 20% lower overall. The lack of yield difference between varieties is reflective of the mild conditions experienced during the reproductive phase of crop development.

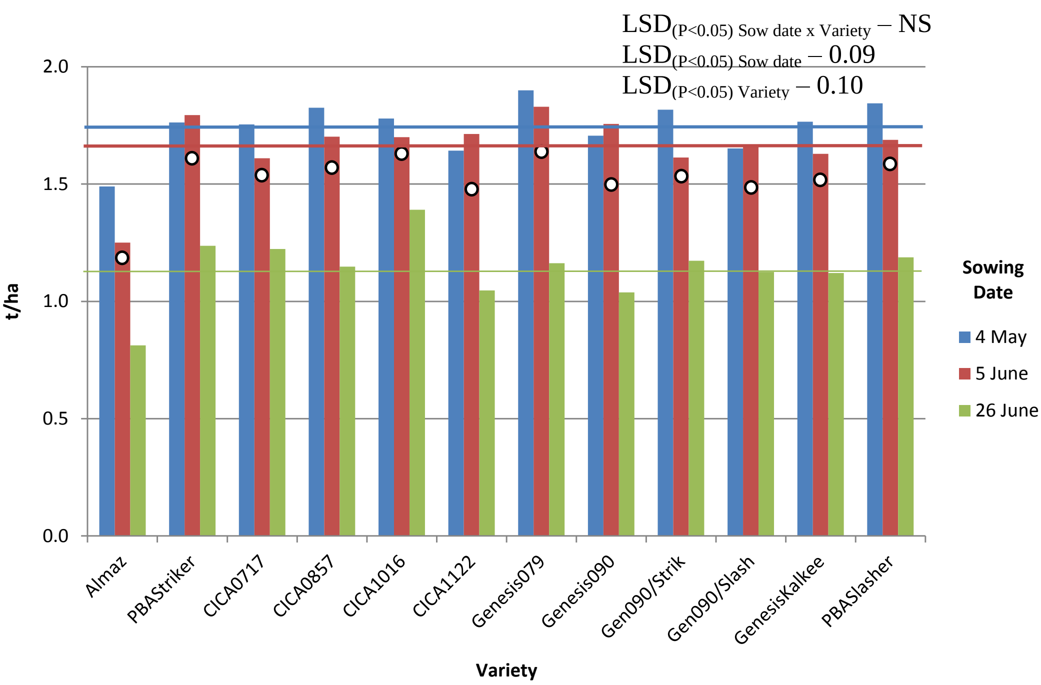


Figure 1. The effect of the interaction between sowing date and chickpea variety on grain yield at Curyo in 2012. Mean sowing date grain yield indicated by horizontal lines; mean variety grain yield indicated by circles.

- Profitability – Net profit estimates range from about $240/ha for CICA1122 sown June 26, up to $1100/ha for CICA0857 sown May 4 (Fig. 2). All Kabuli varieties were more profitable than the desi's because of the estimated price differentials. In this season the larger seeded Kabulis were particularly profitable as yields were similar to other varieties and grain size was excellent (discussed below).

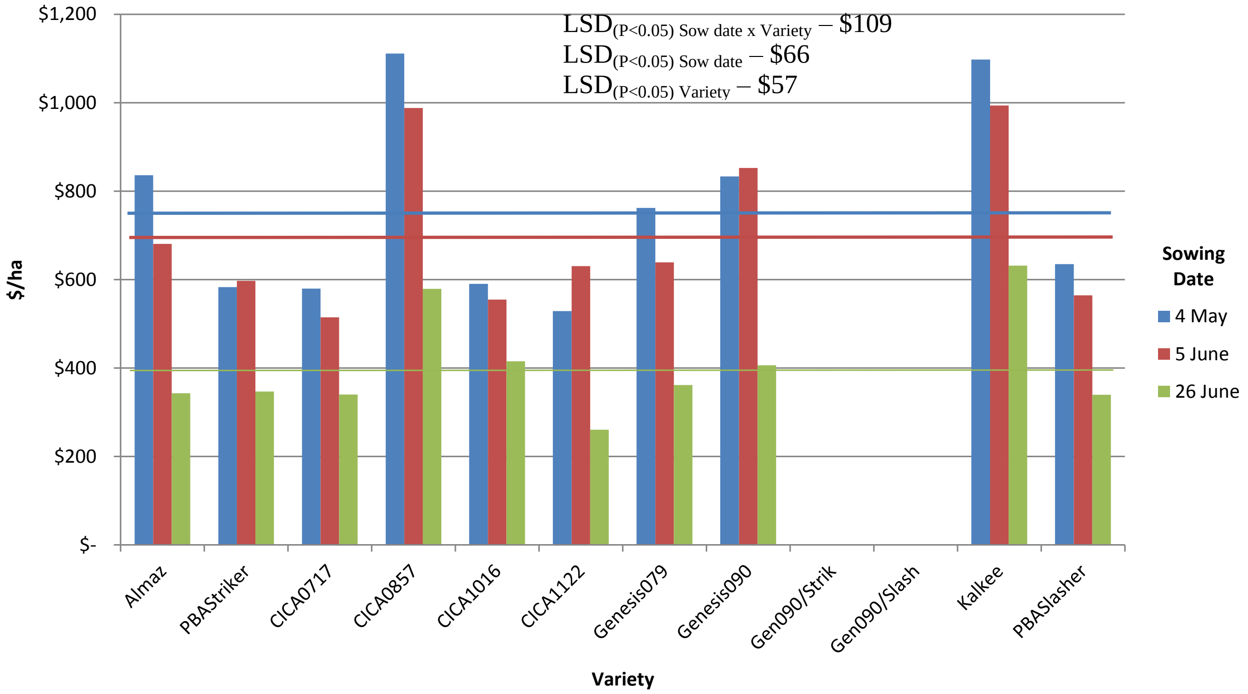


Figure 2. The effect of the interaction between sowing date and chickpea variety on net return ($/ha) at Curyo in 2012. Mean sowing date return indicated by horizontal lines. Based on the following grain prices: Desi = $450/t; Kabuli = <7mm-$330, 7-8mm-$550, 8-9mm-750, 9-10mm-$850, 10-11mm-$1000 with fixed management costs of $180/ha and fungicides at $15/ha per application (No. of sprays based on varietal resistance: resistant = 1, moderately resistant = 2, moderately susceptible = 3).

- Kabuli Seed Size Distribution – There were significant sowing date and variety interactions within each of the grain size groupings. For the smaller Kabuli's, Genesis079 and Genesis090 delaying sowing generally resulted in a greater proportion of seed in the smaller categories (Fig. 3). However in the larger Kabuli's trends across sowing dates were not obvious. Kalkee had the largest seed, with about 85% of seed greater than 8mm and for the later sowing date 48% of seed greater than 9mm. Interestingly CICA0857 had a very high proportion of seed in the 8-9mm category, indicating, relative stability in seed size.

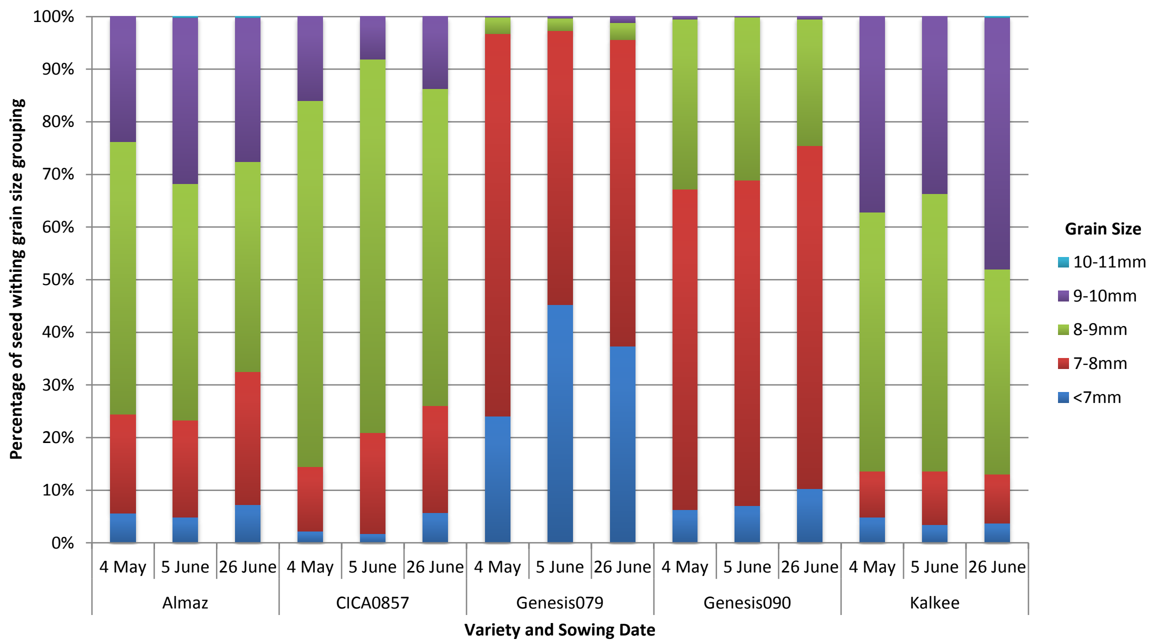


Figure 3. The effect of the interaction between sowing date and kabuli chickpea variety on the proportion of grain within each grain size category at Curyo in 2012.

Key Findings and Comments

Despite the season being significantly drier than average, a mild spring was experienced, meaning that relative grain yield differences among varieties were small. The data again highlighted that earlier sowing in the southern mallee is beneficial for chickpeas, particular in terms of profitability. If consistent seed size and grain yields can be replicated across seasons, the larger Kabulis could prove to be very profitable in the southern mallee, particularly given the lower disease risk due to the dryer conditions generally experienced, compared with traditional production zones like the Wimmera.

C9 Disease Management, MRZ Wimmera (Rupanyup), Victoria

Aim

To investigate if optimum disease management strategies change in different row spacings in standing and burnt residue across a range of chickpea varieties, differing in ascochyta blight susceptibility.

Experimental Treatments

Varieties: Genesis 090, Genesis 114, Kalkee, PBA Slasher, PBA Stiker, Almaz, CICA0717, CICA0857, CICA1016, CICA1122.

Variety/mixes:

Fungicide Regimes:

Regime	Chemical & Application Rate[1]	Timing
Fortnightly	chlorothalonil 500 @ 2 L/ha	Fortnightly starting 6 weeks after emergence. Total = 8 applications.
Strategically	chlorothalonil 500 @ 2 L/ha	Strategically from vegetatively through to podding. Total = 3 applications.
Podding	chlorothalonil 500 @ 2 L/ha	Podding. Total = 1 application.
Nil	Nil	Nil

1. Refers to application rate of the product

Ascochyta Blight inoculant applied 26th July

Other Details

Sowing date: 11 May.

Row Spacings/Stubble: 30 cm row spacing, standing stubble

Fertiliser: MAP + Zn @ 80 kg/ha at sowing.

Plant Density: 35 plants/m^2.

Results and Interpretation

- Key Message: The kabuli chickpeas, both smaller and larger seed types were much more profitable than desi's at Rupanyup in 2012. Disease had no significant effect on yield, although symptom scores highlighted potential risks with a new line CIC0717

- Ascochyta Blight Damage – Ascochyta blight was present at relatively low levels in the trial in 2012, however there were significant differences in the varieties compared (Table 1). Across all management treatments CICA0717 and PBA Striker generally showed the most symptoms, while Genesis090, Kalkee and PBA Slasher showed the least symptoms. Overall there was little difference between the Nil, Podding and Strategic fungicide management regimes, however there was a trend that the more susceptible varieties like CICA0717 and PBA Striker, had a significant reduction in damage scores as the number of fungicide sprays was increased.

Table 1. The interaction effect of fungicide regime and variety on ascochyta blight damage score (1 – no symptoms present, 9 – complete plot death) and the average of grain yield (t/ha) across fungicide regimes for each variety of chickpeas at Rupanyup in 2012 (as there was no significant interaction with fungicide regime).

Variety	Ascochyta Blight Damage Score						Grain Yield
	Fortnightly	Strategically	Podding	Nil	*Ave*		
Genesis090	1.0	1.8	2.0	2.0	*1.7*		1.79
Kalkee	1.0	2.0	2.3	2.0	*1.8*		1.63
PBA Slasher	1.0	2.0	2.3	2.0	*1.8*		1.63
Genesis090 + PBA Slasher 50:50	1.0	2.0	2.0	2.3	*1.8*		1.62
CICA1122	1.0	2.0	2.8	2.5	*2.1*		1.55
Genesis090 + PBA Striker 50:50	1.0	2.0	2.3	2.5	*1.9*		1.67
Genesis114	1.0	2.0	3.0	2.5	*2.1*		1.69
Almaz	1.0	3.0	2.8	2.8	*2.4*		1.54
CICA1016	1.0	2.0	2.8	2.8	*2.1*		1.68
CICA0857	1.0	2.3	2.8	3.0	*2.3*		1.53
PBA Striker	1.0	2.5	3.5	3.3	*2.6*		1.58
CICA0717	1.0	2.3	3.8	4.0	*2.8*		1.45
Average	*1.0*	*2.1*	*2.7*	*2.6*	*2.1*		*1.61*

LSD(P<0.05) Disease Score – regimexvariety=0.7, regime = 0.4, variety = 0.3; Grain yield - regimexvariety=ns regime = ns, variety = 0.14

- Grain Yield – The fungicide management regime had no significant impact on grain yields in 2012. Across varieties yields ranged between 1.4 to 1.8 t/ha, with Genesis090 have the highest yield and CICA0717 lowest (Table 1).

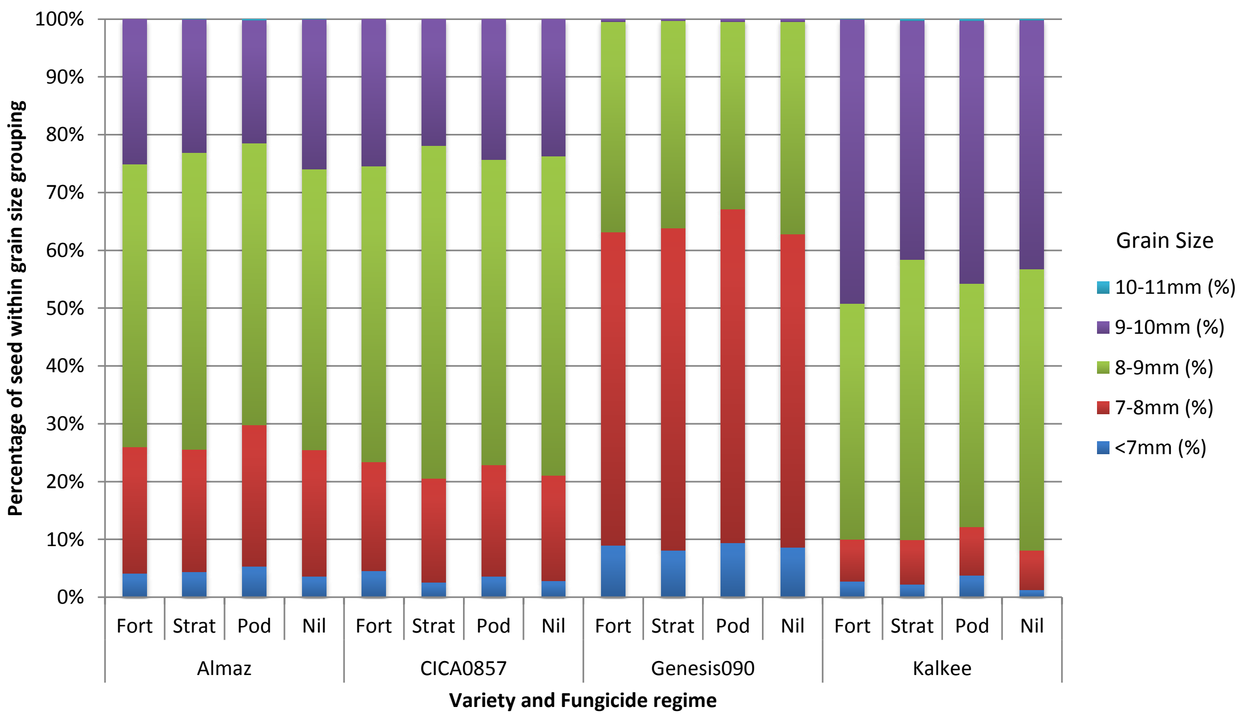


Figure 1. The effect of the interaction between sowing date and kabuli chickpea variety on the proportion of grain within each grain size category at Curyo in 2012.

- Kabuli Seed Size Distribution – There were no significant interactions between variety and fungicide regime within each of the grain size groupings (Fig. 1). However there was the main effect of variety, with Kalkee producing the largest seed (90% greater than 9mm) and Genesis090 the smallest. Almaz and CICA0857 had a similar seed size distribution profile.

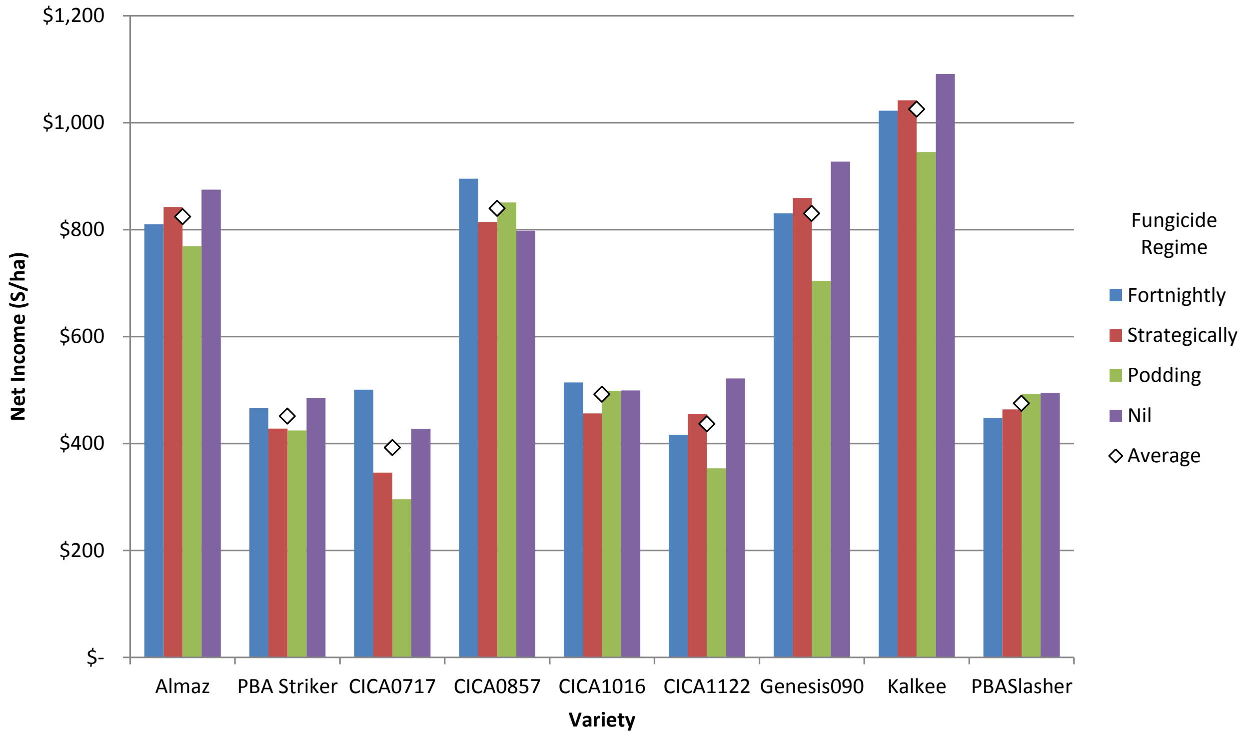


Figure 2. The effect of the interaction between fungicide regime and chickpea variety on net return ($/ha) at Rupanyup in 2012. Mean variety return indicated by diamonds. Based on the following grain prices: Desi = $450/t; Kabuli = <7mm-$330, 7-8mm-$550, 8-9mm-750, 9-10mm-$850, 10-11mm-$1000 with fixed management costs of $220/ha and fungicides at $15/ha per application (Fortnightly = 8, Strategically = 3, Podding = 1, Nil = 0).

- Profitability – The profitability of varieties generally did not vary greatly across fungicide regimes, although in 5 out of 9 of the varieties the podding regime had the lowest returns. Comparing varieties, generally the larger seeded Kabulis were most profitable, with Kalkee have a net income of $1000/ha and Almaz, Genesis090 and CICA0857 at $800/ha. The Desi's ranged from $390 to $490/ha (Fig Cxxx.2).

Key Findings and Comments

Due to the dryer than average conditions in 2012, yields and disease pressure were lower than in 2011. This also meant that disease had no major impact on the yields of the varieties grown in this trial, despite a low level of symptoms being observed during the season. The symptoms also indicated that growers will need to be cautious with growing varieties like PBA striker and the potential release CICA0717 and implement fungicide strategies that minimise risk for their environment.

Mild spring conditions meant that relative grain yield differences among varieties were small. This also meant that due to higher prices expected to be received for Kabuli chickpeas, these varieties were far more profitable than desi's in 2012. The larger variety Kalke displayed return more than double that of any desi variety. If consistent seed size and grain yields can be replicated across seasons, the larger Kabulis will prove to be profitable in the Wimmera, particularly when appropriate disease management packages are implemented.

Faba Beans

B1 Faba Bean Sowing Date x Plant Density, Mid North (Tarlee), South Australia

Aim

To determine optimum sowing dates and sowing densities for maximising yield of new faba bean varieties in high rainfall areas.

Treatments

Varieties: Faba bean - Nura, Farah, Fiord, PBA Rana
Broad bean - PBA Kareema

Sowing dates: 30 April (Early), 31 May (Late)

Plant densities:

Treatment Name	% of Recommended sowing rate	Plant Density (plants/m^2)	
		Faba bean	Broad bean
Low	66%	16	8
Recommended	100%	24	12
High	133%	32	16

Fertiliser: Map + Zn @ 100kg/ha at sowing

Results and Interpretation

- Disease – disease infection was generally low in 2012, and controlled using standard management practices representative of grower practice.
- Plant Height – a plant density x variety response was generated for plant height (Figure 1). Farah and PBA Rana showed increased plant height at the High plant density compared to the Low and Recommended. Fiord showed decreasing plant height with increasing plant density, while Nura and PBA Kareema showed no plant height differences between plant densities.
- Lodging – only low levels of lodging were observed in 2012. However differences in lodging were still apparent between sowing dates and varieties. Extent of lodging was greater for Early sown beans (Table 1). Farah, Fiord and the broad bean PBA Kareema showed more lodging than Nura and PBA Rana, which showed only minor lodging (Table 2).
- Necking – (where the top part of the stem collapses and bends over sharply, but does not break completely) was observed to a small extent in the 2012 trials, and a sowing date x variety response was produced (Figure 2). Necking was the highest in PBA Kareema and to a lesser extent Farah. All varieties except Farah showed similar levels of necking at Early and Late sowing dates. Necking increased in Farah as sowing date was delayed.
- Pre-harvest grain loss – grain losses due to shattering and pod drop were higher than usual in 2012, likely due to several post-maturation wind events. A significant variety response was observed. PBA Kareema had the highest pre-harvest losses, averaging 38 grains/m2 across the trial, and a greater proportion of this was due to pod loss rather than shattering compared to other varieties (data not shown). All other varieties had similar pre-harvest losses (Table 2). Sowing date had no significant effect on shattering or pod drop.
- Grain Yield – grain yield was high considering the rapid season finish, buoyed by the lack of disease and mild winter and early spring conditions. Significant variety and plant density responses were generated, but there was no significant sowing date response.
- Farah and Fiord were the highest yielding varieties, averaging 18% higher than Nura and PBA Rana, which performed similarly (Table 2). The broad bean PBA Kareema yielded the lowest, 25% (1t/ha) lower than Farah and Fiord, and 11% lower than Nura and PBA Rana.
  A plant density response showed that grain yield was greater at the Recommended (7% higher) and High (9% higher) plant densities compared to the Low plant density treatment (Table 3).

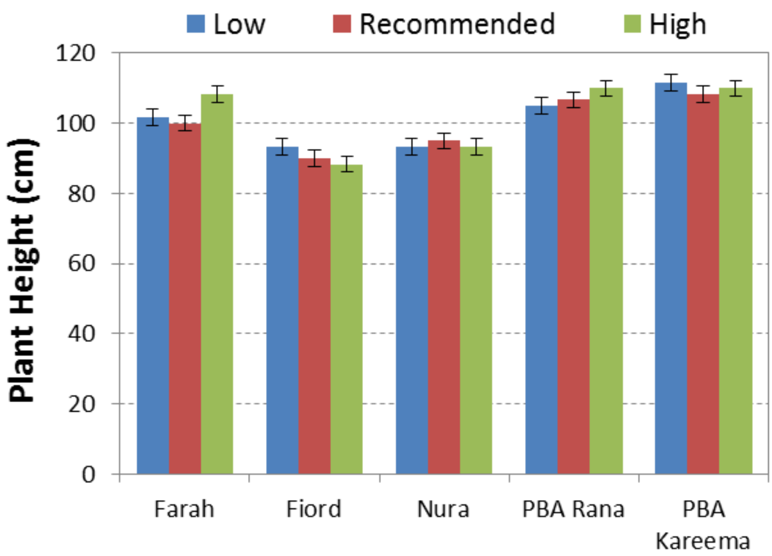


Figure 1: Plant height of faba and broad bean varieties sown at Low (66%), Recommended (100%) and High (133% of Recommended) plant densities, Tarlee 2012

Table 1: Effect of sowing date on lodging (1-9 score*), Tarlee 2012.

TOS	Early	Late	LSD (P<0.05)
Lodging (1-9) *	8.3	8.7	0.3

* Lodging score: 1 = prostrate, 9 = erect

Table 2: Lodging (1-9 score*), pre-harvest grain losses (# beans per m2) and grain yield (t/ha) of faba bean and broad bean varieties, Tarlee 2012.

Variety	Farah	Fiord	Nura	PBA Rana	PBA Kareema	LSD (P<0.05)
Lodging (1-9) *	8.3	8.3	8.9	8.8	8.2	0.41
Pre-harvest Grain Loss (# beans/m2)	25.7	23.3	21.9	28.6	38.2	7
Grain Yield (t/ha)	4.0	4.0	3.4	3.4	3.0	0.3

* Lodging score: 1 = prostrate, 9 = erect

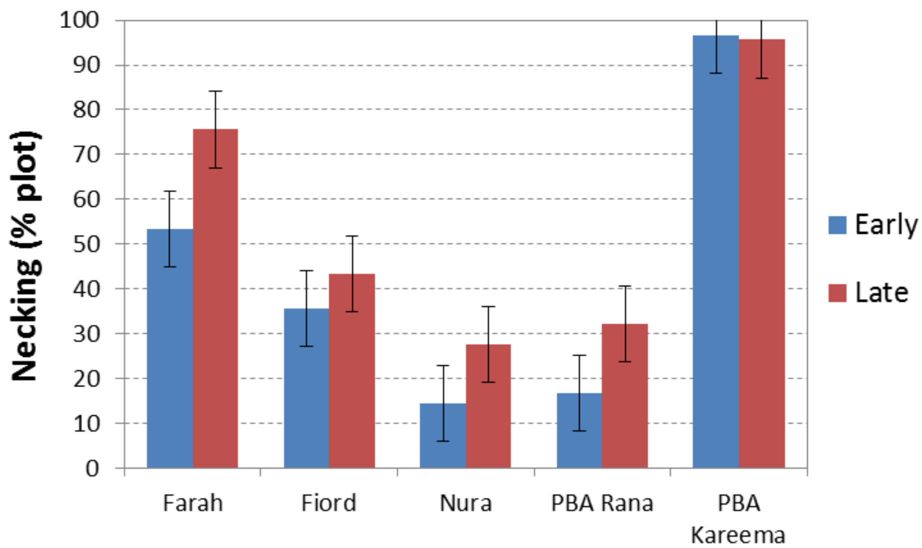


Figure 2: Effect of sowing date on necking (% of plot necked) of faba and broad bean varieties, Tarlee 2012.

Table 3: Grain yield of faba and broad beans sown at Low (66%), Recommended (100%) and High (133% of Recommended) plant densities, Tarlee 2012.

Plant Density	Low	Recommended	High	LSD (P<0.05)
Grain Yield (t/ha)	3.4	3.6	3.7	0.2

Key Findings and Comments

- Plant height was shorter than normal for the Tarlee area, likely due to the drier than average spring in 2012. A plant density x variety response showed that Fiord was the only variety to show decreased plant height with increasing plant density. Previous studies have shown that high plant density can cause increased disease pressure in Fiord (the most disease sensitive variety in the trial). Despite only low levels of disease in the 2012 trial, this may have resulted in reduced growth and plant height at the High plant density of Fiord in this trial.
  Farah and PBA Rana showed increased plant height from increasing plant density. These are medium height beans (shorter than the broad bean PBA Kareema but taller than other faba beans), and this response is likely a phototropic response due to increased competition for sunlight at the higher plant density.
  Nura (a short faba bean) and PBA Kareema (a tall broad bean) showed no response in plant height to varying plant densities. Although PBA Kareema was the tallest variety in the trial, it is sown at half the plant density of the faba beans, which may have resulted in less plant to plant competition for sunlight.
- Pre-harvest grain losses were high in 2012, most likely due to either isolated wind events (causing the pods to break off) or the rapid maturation and high per-harvest temperatures in 2012 (causing the pods to become brittle and shatter more easily).
  The broad bean PBA Kareema showed the highest pre-harvest losses. This is the latest maturing variety in this trial, and also produces the largest grain (110-120g/100 seeds versus 55-75g/100 seeds in faba bean varieties). The high pod losses in this variety are probably due to the heavier pods, and brittle stems due to the rapid maturation in this late maturing variety.
- Despite the rapid season finish there was no sowing date response for grain yield in this trial. This is probably due to the lack of disease and relatively low amounts of lodging. Farah and Fiord were the highest yielding varieties. This supports existing knowledge that in the absence of disease the older (disease susceptible) variety Fiord has very high yield potential, particularly under dry finishing conditions, however its yield has been limited in recent seasons with high disease pressure.
- Yield of PBA Rana was lower than Farah and Fiord, likely due to its later maturity and the dry season finish in 2012. PBA Rana is best suited to the more favourable bean growing areas such as the lower South East and the high rainfall areas of the lower and mid-North of South Australia, where long term yields have generally equal to or greater than Fiesta VF and Farah. It is unclear why Nura showed lower grain yield than Farah and Fiord in this trial.
- PBA Kareema showed the lowest grain yield of all varieties in this trial. As a broad bean it is taller and later maturing than the faba bean varieties, and may have “hayed off” due to the high biomass and dry finish to the season. However, lower grain yields are boosted by higher grain prices for broad bean grain.
- Thinly sown beans (ie 66% of the recommended sowing rates of 24 plants/m2 for faba beans and 12 plants/m2 for broad bean) were lower yielding than recommended and above recommended sowing rates. Previous research has shown that yield gains are possible by increasing plant density, but may also contribute to higher disease and increased lodging in some seasons.

B2. Faba Bean Sowing Date x Plant Density, South East (Moyhall), South Australia

Co-authored by Jeff Paull, University of Adelaide, and Charlton Jeisman, SARDI
This report was published in the Mackillop Farming Systems Trial Results book.

Aim

To determine optimum sowing dates and sowing densities for maximising yield and agronomic performance of new faba bean varieties in high rainfall areas.

Treatments

Varieties: Faba bean - Nura, Farah, Fiord, PBA Rana
Broad bean - PBA Kareema

Sowing dates: 30 April (Early), 31 May (Mid)

Plant densities:

Treatment Name	% of Recommended sowing rate	Plant Density (plants/m^2)	
		Faba bean	Broad bean
Low	66%	16	8
Recommended	100%	24	12
High	133%	32	16

Fertiliser: Map + Zn @ 100kg/ha at sowing

Results and Interpretation

Grain Yield – Bean yields averaged 3.6t/ha across all varieties, sowing dates and plant densities in 2012. This was lower than previous seasons where bean yields averaged 4.9t/ha and 4.3t/ha in 2010 and 2011, respectively, but still high considering the low growing season rainfall.
A significant sowing date by variety interaction occurred for grain yield (Figure 1). All varieties showed a yield penalty from delayed sowing. Nura showed the greatest yield penalty from delayed sowing (53%) and Farah showed the least (29%). Nura, Fiord and PBA Rana were the highest yielding varieties sown early and Farah the lowest. At the late sowing date Nura was the lowest yielding variety but similar to PBA Kareema and Farah.
A two-way interaction between sowing date and plant density showed that yield of Farah, Fiord and Nura increased from the Low density (16 plants/m2) to the High density (32 plants/m2) (Figure 2). There was no advantage of increasing plant density over the Recommended density for each bean type however Fiord did incur a yield loss at the Low plant density which was not seen in any other variety. PBA Rana and the broad bean variety PBA Kareema showed no effect of plant density on yield. Within each plant density all varieties performed similarly except that PBA Rana yielded higher than Farah at the Low and Recommended plant densities. Fiord was the most responsive variety to plant density, showing a 29% increase in yield when plant density was increased from 16 to 32 plants/m2.

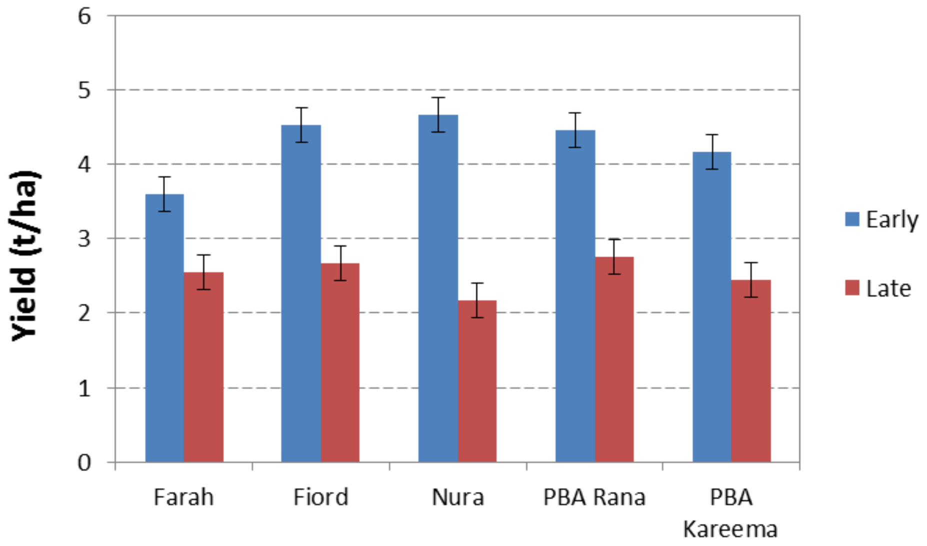


Figure 1: Yield of five bean varieties at two sowing dates, Bool Lagoon sowing date trial, 2012.

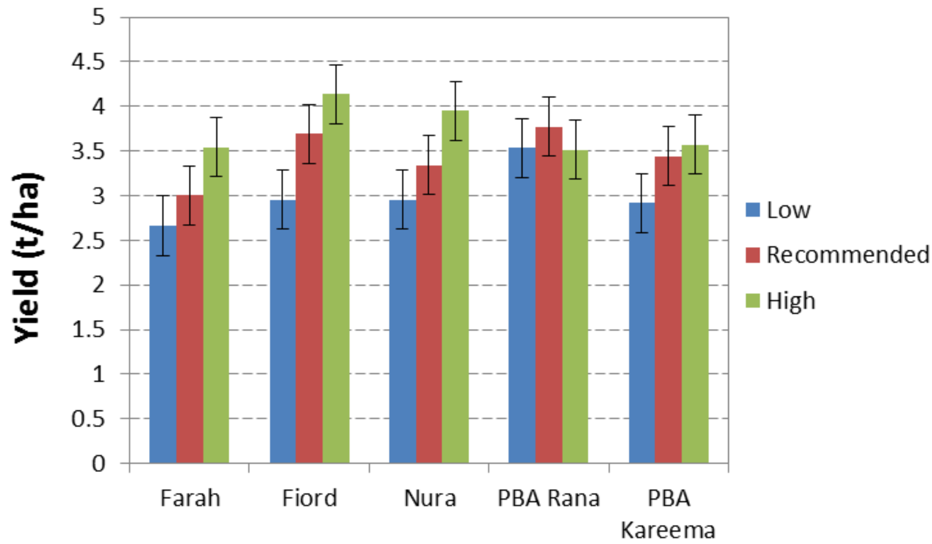


Figure 2: Yield of five bean varieties at three plant densities, Bool Lagoon sowing date trial, 2012.

Key Findings and Comments

- Despite relatively low growing season rainfall in 2012, bean yields were still reasonably high at Bool Lagoon in 2012. It is likely that yields were buoyed by high December 2011 rainfall, lack of disease, and the relatively mild (although dry) finish to the 2012 season.
- In the recent run of seasons with favourable finishes (2009 to 2011) time of sowing has not been important for maximising grain yield of beans in this region. However due to the low growing season rainfall and lack of disease in 2012 beans benefited significantly from early sowing in this trial. This complements previous findings that early sowing offers higher yield potential providing disease, weed issues and other agronomic practices (eg spraying, harvesting) can be managed. Sowing date by plant density trials at Bool Lagoon and Tarlee in the states mid north, have shown that the later maturing and larger biomass types generally show the highest yield losses from delayed sowing. These later maturing plant types are also more reliant on long favourable seasons for yield stability, and are best suited to higher rainfall, longer growing season areas.
- Nura showed the greatest benefit from early sowing at Bool Lagoon in 2012. Sowing date trials at Bool Lagoon and Tarlee have shown Nura to be well suited to early sowing due to its combination of shorter plant type, mid flowering and improved chocolate spot and rust

resistance compared to other varieties. These characteristics favour this variety in areas where late season humidity-driven diseases (eg chocolate spot and rust) are common.

- Bean sowing density trials over the last three seasons have shown that yield gains are possible by increasing plant density from 16 to 32 plants/m2. Recommended sowing rate of faba beans is 24 plants/m2, while broad beans are recommended to be sown at 12 plants/m2. However this target may vary significantly in practice where growers base seeding rate on a kg/ha output and may not allow for variations in grain weight and germination percentages across seasons and varieties. The yield increase was more prominent where sowing was delayed, such that increasing plant density was able to recapture some of the yield loss caused by delayed sowing. However, previous research has shown a link to increased disease pressure at higher plant densities, which may negate any potential yield advantage from this high seeding rate if disease is not managed. Fiord was the most responsive variety to plant density in 2012, while in 2011 it was the most responsive variety to increasing plant density when sown early but was the only variety not to respond to plant density when sown late. Preliminary results from bean experiments where plant and pod traits were measured have shown that Fiord produces more branches per plant than other varieties tested. Further to this, sowing at higher plant densities reduced total branch production per plant more in Fiord than in other varieties. This could indicate that Fiord may be more responsive to exploiting soil moisture by producing extra branches than other varieties, however increasing plant density may provide a more effective method of converting biomass into grain yield. This is likely to be of greater importance in seasons with a rapid finish where late branches do not get the opportunity to produce and set many pods.
- PBA Rana (faba bean) and PBA Kareema (broad bean) showed no grain yield response to plant density in 2012. This may be related to their later maturity timing than the other varieties evaluated. These varieties had grain yields similar to earlier maturing varieties at this site in 2012 despite their later maturity and the relatively low growing season rainfall. This is somewhat surprising given the season and results from the Mid North of SA in 2012, and highlights the suitability of these varieties to the South East region, where the longer growing season can favour their later maturity.

B3. Faba Bean Chocolate Spot Disease Management, Mid North (Tarlee), South Australia

Co-authored by Jenny Davidson, SARDI

Aim

To determine optimum disease management practices for new faba bean varieties, and confirm disease ratings on recently released varieties.

Treatments

Varieties:	Nura (S), Farah (S) and PBA Rana (MS)
Sowing date:	30 April
Treatments:	Nil – no fungicide applied
	Double Carb – 500ml/ha Carbendazim pre flowering/canopy closure (6 Aug) and mid-September (10 Sept).
	Triple Carb – 500ml/ha Carbendazim pre flowering/canopy closure (6 Aug) and mid-September (10 Sept), 500ml/ha Procymidone early October (8 Oct).
	Complete – 500ml/ha Carbendazim fortnightly from 6 Aug as necessary.
Fertiliser:	Map + Zn @ 100kg/ha at sowing

Background

Chocolate Spot is a major disease affecting yield of beans in all growing areas. It can infect all above-ground parts of the plant, and is generally worse after flowering when temperatures and canopy humidity's are high. Previous research found that a triple spray strategy provided a 25% increase in yield compared to untreated plots in a high disease pressure season, but still 7% lower than plots where disease was completely controlled using a fortnightly spray strategy. This trial aims to validate this result, and determine optimum chocolate spot control strategies in a recently released faba bean cultivar with improved chocolate spot resistance (MS) compared to the current commercial cultivars Nura and Farah (S).

The trial was set up at Tarlee, in the High Rainfall Zone of the state's Mid North where faba bean are commonly grown. Soils at his site vary significantly from deep black red-brown-earths to heavy red clays. The trial was positioned on a heavy red clay soil, where disease levels tend to be higher due to the higher canopy humidity associated with poorer drainage and higher water holding capacity of clay soils.

Results and Interpretation

- Disease severity –below average winter and spring rainfall meant that disease pressure was low in 2012, and there was only a very minor chocolate spot infection in this trial. Due to the low infection there was no significant treatment or variety response for disease severity.
- Grain Yield – there was no significant treatment or variety response for grain yield in this trial. Grain yields averaged 2.9t/ha across all varieties and treatments in this trial.

Key Findings and Comments

Chocolate spot is a major disease in bean crops, causing significant losses to yield and profitability. Low disease levels in 2012 and favourable seasonal conditions meant that there was no treatment or variety response for either disease severity or grain yield. Work is ongoing in this area.

B4. Faba Bean Cercospora Leaf Spot Management, Yorke Peninsula (Maitland), South Australia

Aim

To determine whether fungicide-amended-fertiliser (eg Impact-in-furrow) can be used for effective control of Cercospora Leaf Spot (CLS) in faba bean.

Treatments

Varieties: Nura (S), Farah (S), AFO7125 (R)
Sowing dates: 29 May
Treatments: Nil – no fungicide applied
Foliar fungicide – 145 ml/ha tebuconazole applied at 6 WAS (9 July)
Fertiliser fungicide – Impact-in-furrow (a.i. flutriofole) applied at 100kg/ha at seeding.
Fertiliser: DAP + Zn @ 100kg/ha at sowing (Nil and Foliar only)
Disease management: Ascochyta Blight and Chocolate Spot infections were controlled using standard district practice.

Results and Interpretation

- Disease infection – Despite having found CLS infection in previous trials in surrounding paddocks, no CLS was evident in this trial in 2012. This may be due to positioning the trial in a paddock sown to lentil and the drier than average seasonal conditions.
- Grain Yield – yields averaged 4.3t/ha across the trial. The CLS resistant advanced breeding line AFO7125 was the highest yielding line in the trial, outyielding Farah and Nura by 5%. Farah and Nura performed similarly for grain yield in this trial.

Table 1: Grain yield (t/ha) of faba bean varieties at Maitland, 2012.

Variety	Farah	Nura	AF07125	LSD (P<0.05)
Grain Yield (t/ha)	4.2	4.2	4.4	0.18

Key Findings and Comments

- An advanced breeding line (AF07125) has been developed with improved resistance to CLS.
- There was no CLS in the trial, and the fungicide amended fertiliser (Impact-in-furrow) provided no additional benefits in terms of grain yield.
- Disease levels were low, and grain yield was high, averaging 4.3t/ha across the trial.
- The potential release AF07125 was the highest yielding variety, outyielding Farah and Nura by 5%.
- Further testing will be required to determine whether fungicide-amended-fertilisers (eg Impact-in-furrow) can be used for effective control of CLS in faba bean.

B5. Faba Bean Disease Management, Eyre Peninsula (Wanilla), South Australia

Co-authored by Andrew Ware, SARDI, and Jeff Paull, University of Adelaide
This report was published in the LEADA Farming Systems results booklet.

Aim

To determine optimum disease management practices for faba bean varieties in a district characterised by acidic red soil types and traditionally not considered suited to faba bean production.

Treatments

Varieties: Nura, Farah and PBA Rana
Sowing date: 8 May
Treatments: Nil – no fungicide applied
Double Carb – 500ml/ha Carbendazim pre flowering/canopy closure (6 Aug) and mid-September.
Triple Carb – 500ml/ha Carbendazim pre flowering/canopy closure and mid-September, 500ml/ha Procymidone early October.
Complete – fortnightly Carbendazim.
Fertiliser: Map + Zn @ 90kg /ha at sowing

Results and Interpretation

- Due to the low disease pressure in 2012 there was no yield response from fungicide management in this trial.
- A variety response (Table 1) showed that the broad bean PBA Kareema (0.6t/ha) was significantly lower yielding than two faba beans, Nura (1.7t/ha) and PBA Rana (1.4t/ha).
- Yields decreased with increased plant height and later plant maturity.

Table 1: Yield of faba beans varieties, Wanilla 2012.

Variety	Plant Height	Maturity Rating*	Yield (t/ha)
Nura	Short	E-M	1.7 [a]
PBA Rana	Medium	M	1.4 [b]
PBA Kareema	Tall	L	0.6 [c]
LSD (P<0.05)			0.13

* E = early, M = mid, L = late

Key Findings and Comments

- Yield of faba beans (ignoring the broad bean PBA Kareema) averaged 1.5t/ha at Wanilla in 2012. Early establishment and growth was excellent, disease pressure was low, and beans showed high yield potential.
- Beans appeared to "hay off" late in the season due to high early season biomass production and the dry and rapid finish to the season, together with the occurrence of several high temperature events during late flowering.
- There was no yield response from disease management in this trial due to the low incidence of disease in general in the 2012 season. The dry finish to the season minimised onset of humidity-driven diseases such as chocolate spot and rust, and there was little ascochyta blight during the winter months.
- The three varieties included in the fungicide trial showed a differential response for grain yield whereby a yield penalty was associated with taller and later maturing varieties. Nura was the best suited variety to the seasonal conditions experienced in 2012 due to its earlier maturity

and shorter plant type, making it less prone to haying off. It is also well suited to sowing early due to its shorter plant type (allowing easier management and harvest than other varieties) and its favourable disease resistance profile.

- The broad bean PBA Kareema had the lowest yield, and is also the latest and tallest variety of the three. Current broad bean varieties are not as broadly adapted as faba beans and have a lower yield potential due to their later maturity and larger seed size in most environments, but generally attract higher grain prices. PBA Kareema is best suited to the higher rainfall, longer season areas where its late maturity is better suited

B6. Faba Bean Inoculation and Liming, Eyre Peninsula (Wanilla), South Australia

Co-authored by Andrew Ware and Liz Drew, SARDI, and Jeff Paull, University of Adelaide
This report was published in the LEADA Farming Systems results booklet.

Aim

To assess the effect of various inoculum and liming techniques on the yield of faba bean in a district characterised by acidic red soil types and traditionally not considered suited to faba bean production.

Treatments

Varieties: Nura
Sowing date: 8 May
Inoculum treatments: Nil
Granular (Gp F)
Peat (Gp F)
Liming treatments: Nil
Lime @ 2t/ha
Fertiliser: Map + Zn @ 90kg /ha at sowing

Results and Interpretation

- There was no grain yield response to the addition of lime at 2t/ha. Soil pH was 6.8 in an unlimed area at this site, which is in the ideal range for beans, and is likely to explain the lack of yield response. Soil pH was not tested after liming.
- Beans showed a yield response to use of inoculum (Table 1), which is not surprising since this soil has no history of growing beans and is prone to waterlogging.
- Applying granular inoculum with the seed generated a 13% yield response compared to the nil.
- Applying peat inoculum as a slurry generated a 22% yield response compared to the nil, and an 8% increase compared to the granular treatment.

Table 1: Effect of inoculum type of grain yield of faba bean, Wanilla 2012.

Inoculum	Yield (t/ha)
Nil	1.45 [a]
Granular	1.64 [b]
Peat	1.77 [c]
LSD ($P<0.05$)	0.06

Key Findings and Comments

- Soil pH (6.8) at this site was ideal for bean growth, and attempted amelioration through application of lime had no effect on grain yield. In soils with higher acidity beans may still benefit from the application of lime.
- Inoculation of beans is considered to be “cheap insurance” in areas with low previous history or acidic soils prone to water logging. However the addition of inoculum may not always provide a significant yield response, but will generally improve nodulation and consequently N fixation.
- Since there has been no history of growing faba beans within the trial area a significant yield response was generated by the use of inoculum (peat and granular), and applying inoculum in peat form increased yield further than granular.
- There are a number of benefits of using granular inoculum compared to peat, such as ease of application and potential for dry sowing (which may be important when growing beans). Seed dressed with peat inoculum, applied in the form of a slurry, should be used within 24 hours, and should not be sown into dry soil. However, peat contains a higher concentration of rhizobia per gram than granular inoculants, and this may explain the higher yield generated

using peat inoculum in this trial. If this is the case, it is possible that using a higher rate of granular inoculum may have generated a larger yield response.

B7. Faba Bean Growth Regulant trial, Mid North (Tarlee), South Australia

Aim

To determine whether certain plant growth regulants (PGR's) or non-selective herbicides can be used to modify canopy height and increase grain yield of faba beans in high rainfall regions of SA.

Treatments

Variety: Farah

Sowing Date: 30 April

Chemical treatments:

Chemical name	Active	Rate	Timings
Herbicide			
2,4-D Amine	625g/L 2,4-D	250ml/ha	Single (T1)
Roundup Attack	570g/L Glyphosate	1L/ha	Single (T1)
Hormone			
Cycocel	582g/L Chlormequat	2L/ha	Single (T1) and Double (T1 + 2)
Ethephon	720g/L Ethephon	1L/ha	Single (T1) and Double (T1 + 2)
Moddus	250g/L Trinexapac-ethyl	400ml/ha	Single (T1) and Double (T1 + 2)
Moddus + Cycocel		200ml/ha + 1L/ha	Single (T1) and Double (T1 + 2)

Timings: Single – 5 WAS
Double – 5 WAS and 8 WAS

Fertiliser: Map + Zn @ 100kg/ha at sowing

Background

Penetration of fungicides into large bean canopies is a common problem, particularly in higher rainfall areas where canopies are larger and incidence of disease can be higher due to high humidity and poor fungicide penetration.

Manipulation of bean canopies by reducing height would allow improved fungicide application and efficacy, and may reduce disease intensity and plant lodging, potentially resulting in increased grain yield.

Results and Interpretation

- Plant canopies were large in 2012 due to warm temperature conditions during winter and early spring.
- Disease incidence was low and below detection in 2012, likely due to below average growing season rainfall.
- Vegetative plant height – Glyphosate and the double application of Ethephon were the only treatments to significantly reduce plant height of faba bean at the early measurement timing (mid flowering). These chemicals reduced plant height by 37% and 13%, respectively (Table 1).
- Mature plant height – Five of the ten treatments resulted in a significant reduction in plant height at maturity. These include the herbicide treatments 2,4-D Amine (15% shorter) and Roundup (37%), and the PGR chemistry treatments Moddus T1+2 (9%), Ethephon T1 (12%) and Ethephon T1+2 (21%) (Table 1).
- Lodging – minimal plant lodging was evident at this site in 2012, and the Nil treatment showed no lodging. The herbicide treatments 2,4-D Amine and Glyphosate showed a very low level of increased lodging compared to the Nil (Table 1).
- Grain Yield – All products tested performed similarly to the Nil for grain yield except 2,4-D Amine and Glyphosate, which showed yield penalties of 26% and 32%, respectively (Table 1).

Table 1: Effect of various chemicals applied as growth regulants on the plant height (at flowering and maturity), lodging and grain yield of faba bean, Tarlee 2012.

Treatment	**Plant Height (cm)**		**Lodging ***	**Grain Yield**
	Flowering	**Maturity**	**(1-9 score)**	**(t/ha)**
Nil	95 cm	112 cm	8.7	3.94 t/ha
2,4-D Amine T1	90	85	7	74
Glyphosate T1	63	63	8	68
Cycocel T1	98	96	8.3	95
Cycocel T1+2	100	96	9	101
Moddus T1	101	98	8.7	96
Moddus T1+2	94	91	9	101
Moddus + Cycocel T1	100	94	9	100
Moddus + Cycocel T1+2	94	88	8.7	98
Ethephon T1	91	88	9	99
Ethephon T1+2	87	79	9	96
LSD (P<0.05)	**12**	**10**	**0.6**	**13**

Shaded figures denote significant difference to grain yield of Kaspa

* Lodging score: 1= prostrate, 9 = erect

Key Findings and Comments

- This study showed that the two herbicide treatments, 2,4-D Amine applied at 250ml/ha and Glyphosate applied at 1L/ha, produced the largest reduction in mature height, but also caused a large yield penalty.
- In a previous pilot study, Glyphosate applied at 100ml/ha had no effect on plant height or grain yield. It is possible that a rate somewhere between 100-1000ml/ha may suppress plant height with little or no effect on grain yield, although yield recovery from early season herbicide damage is likely to depend on end of season weather conditions.
- Ethephon (single and double applications) and the double application of Moddus were able to significantly reduce faba bean height with no effect on grain yield.
- The effect of PGR's on lodging of faba bean could not be fully assessed due to minimal levels of plant lodging in this trial in 2012, and there was generally no difference in lodging between PGR chemicals and the Nil. Increased plant lodging caused by the use of the herbicides 2,4-D Amine and Glyphosate is likely due to stem weakness caused by herbicide application. Further work across seasons and environments is required to validate these results.
- Further study could examine different rates or alternative products to test whether growth regulants can be employed for canopy management to improve disease management and harvestability of faba bean in high rainfall regions.

B8. Faba Bean Crop-topping/Desiccation, Yorke Peninsula (Melton), Eyre Peninsula (Yeelanna) and South East (Bool Lagoon), South Australia

Co-authored by Jeff Paull, University of Adelaide, and Charlton Jeisman, SARDI
This report was published in the Mackillop Farming Systems Trial Results book.

Aim

To determine the correct maturity timing required in faba bean for successful crop topping practice.

Treatments

Sites: Bool Lagoon - AR = 550mm, Soil type: clay
Melton – AR = 425mm, Soil type: sandy clay loam over light clay
Yeelanna – AR = 400mm, Soil type: loamy clay over sandy clay
Varieties: Table 1
Treatments: see tables for dates
Nil - no desiccant applied
Early Crop-top - applied 7-14 days pre ryegrass milky dough stage
Mid Crop-top - applied at ryegrass milky dough stage ("Recommended")
Late Crop-top - applied 7-14 days post ryegrass milky dough stage

Table 1: Flowering and maturity patterns of faba bean crop-top varieties.

Variety	Flowering	Maturity
Fiesta	E-M	E-M
Nura	M-L	E-M
PBA Rana	M-L	M-L
Farah *	E-M	E-M
AFO5095-1 *	M-L	L
AFO8014 *	E	E

E = Early, M = Mid, L = Late
* = variety included in trial at Melton site only

Results and Interpretation

- All three trials showed only a crop-top timing response (ie no interaction with variety).This means that all varieties showed the same grain yield response at each timing of application, and that no variety was better suited to crop-topping in these trials.
- Early crop-topping caused significant yield losses at all three sites (Table 2). Bool Lagoon was the only site to show a yield loss from crop-topping at the Mid treatment timing, while there was no yield loss from crop-topping at the Late application timing at any site.
- The Bool Lagoon trial showed the highest yield loss from Early crop-topping of the three sites (72% yield loss compared to the Nil treatment), and also showed a 9% yield loss from crop-topping at the Mid Treatment timing. The Melton and Yeelanna trials showed yield losses of 24% and 38%, respectively, from crop-topping at the Early treatment timing compared to the Nil.

Table 2: Effect of crop-top timing on grain yield (% of Nil) of faba bean varieties, Bool Lagoon, Melton and Yeelanna 2012.

Site	Timing	Yield (% of Nil)	LSD (P<0.05) (% of Nil)
Bool Lagoon	**Early** 8/10	28	7
	Mid 26/10	91	
	Late 6/11	104	
	Nil	4.7 t/ha	
Melton	**Early** 12/10	76	17
	Mid 25/10	88	
	Late 6/11	103	
	Nil	1.7 t/ha	
Yeelanna	**Early** 24/10	62	15
	Mid 14/11	94	
	Late 30/11	105	
	Nil	1.3 t/ha	

Shaded figures denote significant difference to the corresponding Nil treatment

Key Findings and Comments

- Crop-topping 7-14 days prior to milky dough stage of ryegrass caused significant yield loss at all three sites, and ranged from 24% at Melton to 72% at Bool Lagoon.
- Crop-topping at the milky dough stage (MDS) of ryegrass caused significant yield loss at only one of the three sites (Bool Lagoon).
- Variation in response to crop-topping between the three sites is likely due to a combination of differences in sowing dates, site yields, seasonal conditions (particularly end season) and the maturity profiles of the local ryegrass biotype.
- Previous research has shown that sensitivity to crop-topping in pulse crop species is generally related to variety maturity, where later maturing varieties generally show higher yield losses when applied too early. These trials showed no relationship between varietal maturity and yield loss from crop-topping in 2012. Work will be ongoing to identify varieties or plant types better suited crop-topping for weed control.
- Previous research has shown that untimely crop-topping of beans can result in reduced grain weight. Across all varieties this has averaged 9% grain weight reduction from crop-topping at ryegrass MDS, and 17% redection from crop-topping 7-14 days prior to ryegrass MDS. Grain size and grain weight is particularly important in broad bean production, where emphasis is paid to seed size and consistency.

B9. Sowing Date x Sowing Rate, LRZ (Yenda), New South Wales

Aim

To test the yield response of four faba bean varieties across 2 sowing times (TOS) in southern NSW. The information from this trial will be used to improve current grower recommendations for sowing time, variety selections and plant population.

Treatments

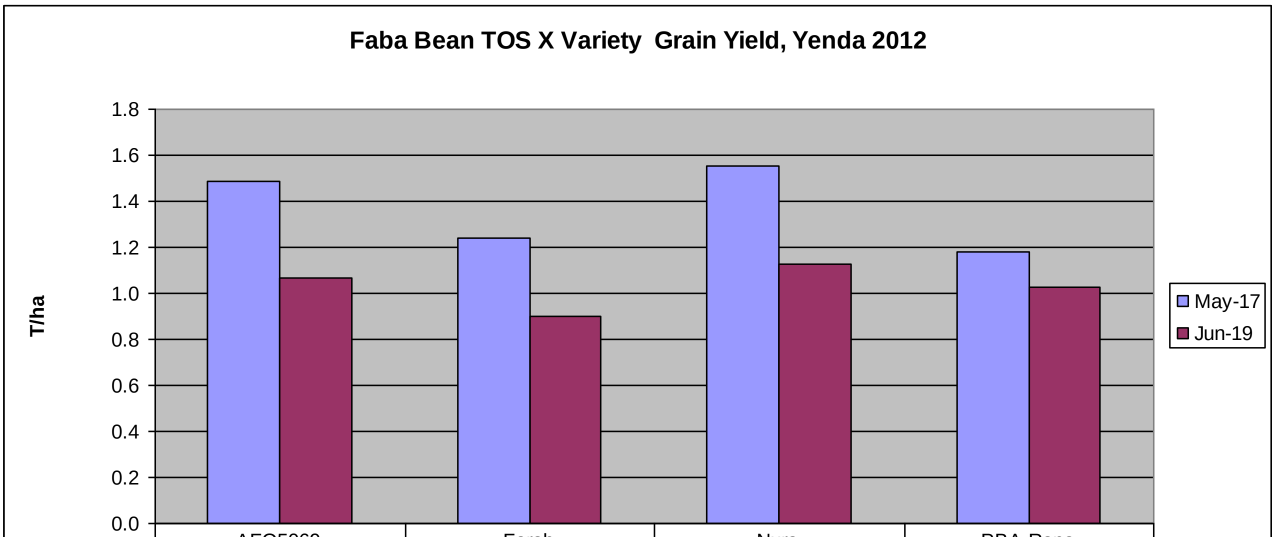
Varieties:	Farah, PBA Rana, AF5069 and PBA Nura.
Sowing dates:	17th May and 19th June 2012
Plant populations:	Targeted 15, 30 & 45 plants/m^2.
Row Spacing/Stubble:	30 cm into standing light stubble.
Fertiliser:	Legume Starter @ 115 kg/ha at sowing.
Plot size:	12 m x 1.6 m, three replicates

Results and Interpretations:

2012 season was characterised by above average summer rainfall and below average in crop rainfall. As a result crops were reliant on stored soil moisture for much of the growth period with near average August rainfall facilitating early spring growth which produced sufficient crop biomass to produce economically viable yields. The dry winter growth period reduced the incidence of foliar diseases.

The original intent of this trial was to evaluate four new faba lines, at April and May sowing times. Timing of sowing rains dictated an early May/ early June comparison. Disease pressure was low due to seasonal conditions, the levels of infection were below spray thresholds.

Sowing time significantly affected Faba Bean yields. On average, yield declined by 11kg/day with a 32 day sowing delay. Early sowing, (May) established a mean yield of 1.365 t/ha; and the later sowing (June) had a mean yield of 1.028t/ha.



	AFO5069	Farah	Nura	PBA Rana
May-17	1.486	1.239	1.556	1.177
Jun-19	1.065	0.898	1.125	1.025

Key Findings and Comments

- Sowing after the start of May resulted in a reduction in expected yields compared to previous seasons
- Delaying sowing reduced Faba bean yields by approximately 0.3t/ha
- There was significant difference between varieties and with delayed sowing
- PBA Nura was the best performed variety at both sowing dates
- There was little disease pressure.

B10. Sowing Time x Fungicide regime, HMRZ (Wagga Wagga), NSW

Aim

To test the yield response of four faba bean varieties across 2 sowing times (TOS) in southern NSW. The information from this trial will be used to improve current grower recommendations for sowing time, variety selections and plant population.

Treatments

Varieties:	Farah, PBA Rana, AF5069 and PBA Nura.
Sowing dates:	17th May and 19th June 2012
Plant populations:	Targeted 15, 30 & 45 plants/m^2.
Row Spacing/Stubble:	30 cm into standing light stubble.
Fertiliser:	Legume Starter @ 115 kg/ha at sowing.
Fungicides:	For chocolate spot. Bavistan 27th June, and Bravo® + Howzat foliar fungicides on 25th July, 25th September, Prosaro 25th September.
Plot size:	12 m x 1.6 m, three replicates

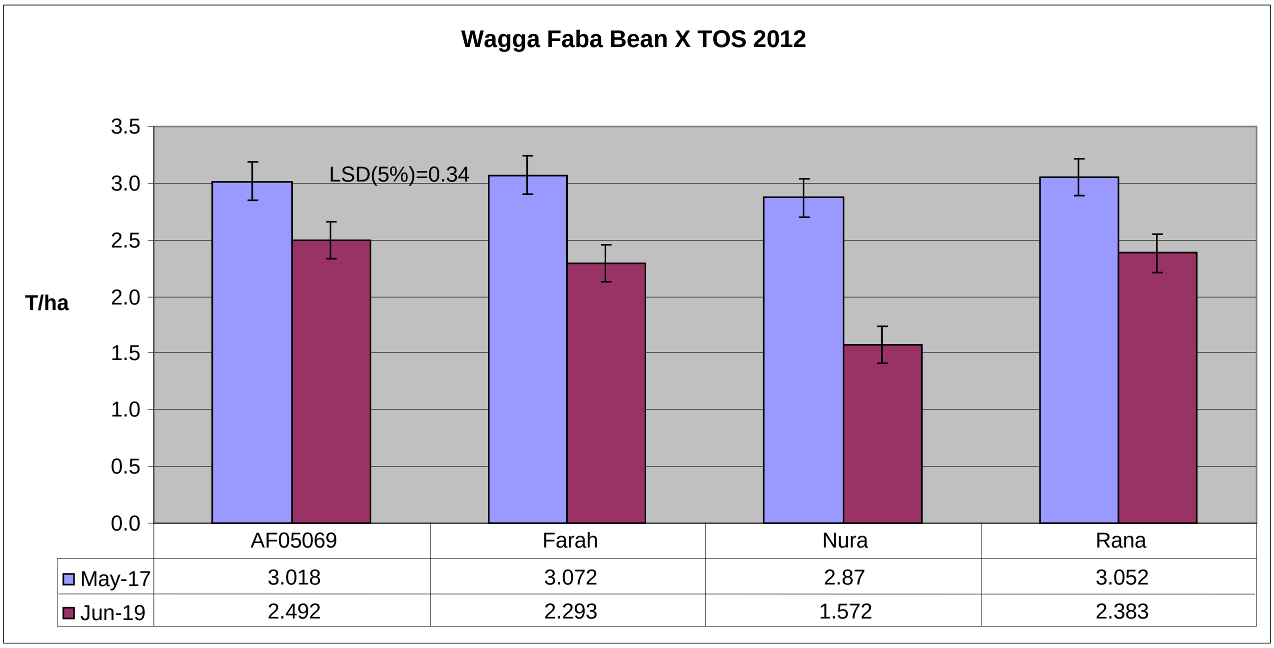
Results and Interpretations:

2012 season was characterised by above average summer rainfall and below average in crop rainfall. As a result crops were reliant on stored soil moisture for much of the growth period with near average August rainfall facilitating early spring growth which produced sufficient crop biomass to produce economically viable yields. The dry winter growth period reduced the incidence of foliar diseases.

The original intent of this trial was to evaluate four new faba lines, at April and May sowing times. Timing of sowing rains dictated an early May/ early June comparison. Three fungicide treatments were imposed on the trial, spray as needed with Bravo + Howzat, Impact only on fertiliser and Impact plus a late Prosaro foliar spary.

Disease pressure was low throughout 2012 and there was no significant interaction with fungicide applications. Fungicides are more effectively used as a protectant than as a cure to infection.

Sowing time significantly affected Faba Bean yields. On average, yield declined by 24kg/day with a 34 day sowing delay. Early sowing, (May) established a mean yield of 3.0 t/ha; and the later sowing (June) had a mean yield of 2.18t/ha.



Impact®In-Furrow is a product that is related to one of the foliar treatments and is registered as a seed-dressing for many other crop species. There is clearly merit in evaluating the potential for this product to protect faba seedlings.

Impact®In-Furrow was used as a stand-alone treatment and as part of the third regime in conjunction with a foliar application. In a "normal" season there is an expectation that the data from the three regimes may produce a yield variance that validates the merit of the Impact®In-Furrow seed-dressing.

Key Findings and Comments

- Delaying sowing reduced Faba bean yields by approximately 0.8t/ha.
- There was significant difference between varieties and with delayed sowing.
- There was little disease pressure.
- There was no significant yield difference between fungicide treatments.
- The merit of protecting faba seedlings with in furrow fungicide application requires further evaluation in a season with a wet winter.

B11. Disease Management x Stubble, MRZ Wimmera (Rupanyup), Victoria

Aim

To investigate if optimum chocolate spot management strategies change in different row spacing's and standing and burnt residue across a range of faba bean varieties.

Experimental Treatments

Varieties: Farah, Nura, PBA Rana, AF05069, AF05073, AF05095, AF06125, AF07125.

Treatment	Chemical and Application Rate[1]	Timing
Nil	Nil	Nil
Double Choc (Cx2)	carbendazim 500 @ 500ml/ha	Early and late flower
Triple Choc (Cx3)	carbendazim 500 @ 500ml/ha	Early, mid and late flower
Complete (Com)	mancozeb 800 @ 2kg/ha chlorothalonil 720 @ 2L/ha carbendazim 500ml/ha	mancozeb + chlorothalonil applied fortnightly from 6-8 weeks after emergence All 3 chemical applied fortnightly during flowering.
Rust (Rx2)	Tebuconazole 430 at @ 350ml/ha	6-8 weeks after emergence and early flower
Rust (Rx3)	Tebuconazole 430 at @ 350ml/ha	Early, mid and late flower

1. Refers to application rate of the product

Stubble: Standing stubble; Burnt stubble.

Note: Stubble treatments were sown as independent trials.

Other Details

Sowing date: 10 May.
Row Spacing: 30 cm.
Fertiliser: MAP + Zn @ 80 kg/ha at sowing.
Plant Density: 20 plants/m^2.

Results and Interpretation

- Key Message: No significant disease was noted in trials this year so grain yields were unaffected by disease management treatments. However the trials did clearly highlight the yield advantage of AF05069, AF05073 and AF05095 compared with Farah.

- Grain Yield - Grain yields in 2012 were excellent given seasonal conditions, ranging from 2.4 to 3.2t/ha (Fig. 1). No significant disease was seen thin the beans which meant that no significant differences were noted in the grain yields between disease management treatments, so data presented is based varieties only. Generally there was little difference between the standing stubble trial and burnt stubble trial. On average across both trials, AF05069, AF05073 and AF05095 were all about 5% higher yielding than Farah, AF07125 was equivalent, AF06125 5% less, PBA Rana 10% less and Nura 15% less.

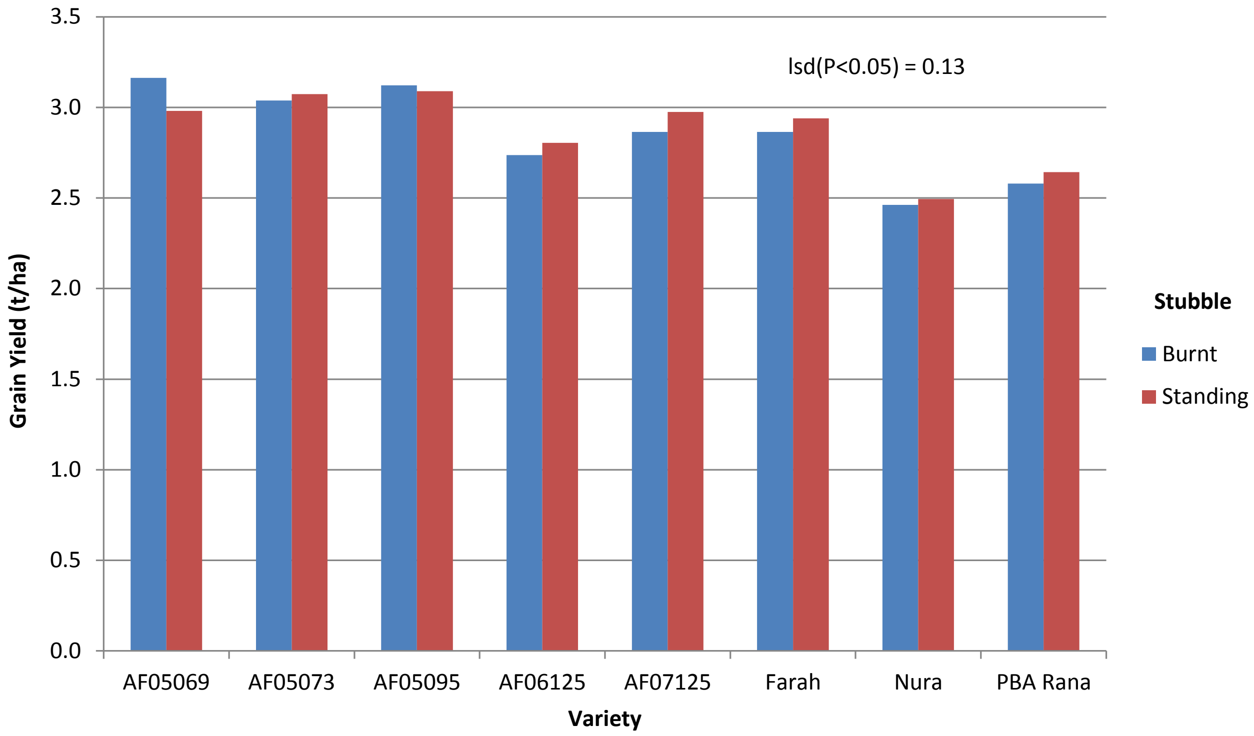


Figure 1. The main effect of stubble management on grain yield of faba bean varieties at Rupanyup in 2012.

Key Findings and Comments

No significant disease was noted in trials this year so grain yields were unaffected by disease management treatments. Unlike the previous year there was no difference between burnt and standing stubbles. However, the trials did clearly highlight the yield advantage of AF05069, AF05073 and AF05095 compared with Farah, similar to Westmere and previous trials.

B12. Disease Management x Stubble, HRZ Southern (Westmere), Victoria

Aim

To investigate the effect of chocolate spot and rust management strategies across a range of faba bean varieties.

Experimental Treatments

Varieties: AF050069, AF05095, AF06125, AF07125, Farah, Nura, PBA Rana.

Fungicide Regimes:

Treatment	Chemical and Application Rate[1]	Timing
Nil	Nil	Nil
Double Choc (Cx2)	carbendazim 500 @ 500ml/ha	Early and late flower
Triple Choc (Cx3)	carbendazim 500 @ 500ml/ha	Early, mid and late flower
Complete (Com)	mancozeb 800 @ 2kg/ha chlorothalonil 720 @ 2L/ha carbendazim 500ml/ha	mancozeb + chlorothalonil applied fortnightly from 6-8 weeks after emergence All 3 chemical applied fortnightly during flowering.
Rust (Rx2)	Tebuconazole 430 at @ 350ml/ha	6-8 weeks after emergence and early flower
Rust (Rx3)	Tebuconazole 430 at @ 350ml/ha	Early, mid and late flower

1. Refers to application rate of the product

Other Details

Sowing date: 2 May.
Stubble: Cultivated
Row Spacing: 20 cm.
Fertiliser: MAP @ 60 kg/ha at sowing.
Plant Density: 20 plants/m^2.

Results and Interpretation

- Key Message: New varieties are likely to offer significant yield improvement in southern Victoria, along with improvements in disease resistance.

- Disease Damage – Due to a relatively dry winter and spring, disease pressure was only low to moderate in the faba beans. Chocolate spot and cercospera were first noted in August, but disease development was slow. Chocolate spot was the predominant disease, while no rust was seen in the trials. There was a significant interaction between the fungicide regime and variety (Figure 1). For all varieties there was minimal disease in the 'complete' treatment, while the Nil treatment resulted in significant infection with scores ranging between 4.5 and 5.5. AF05073, AF07125, Farah and PBA Rana showed significantly worse symptoms than all other varieties. The chocolate spot and rust control strategies reduced disease scores similarly in all varieties and the relative trend among varieties within a regime remained similar to the Nil treatment.
- Grain Yield - Dissimilar to 2011 trials in Lake Bolac, none of the disease management regimes translated into any significant effect on grain yield, so only the mean grain yield across all treatments has been presented (Table 1). Grain yields were excellent ranging from 4.0t/ha to 5.5 t/ha. AF05095 was the highest yielding variety (5.53t/ha), 37% higher than Farah and 33% higher than Nura which were lowest yielding varieties this year.

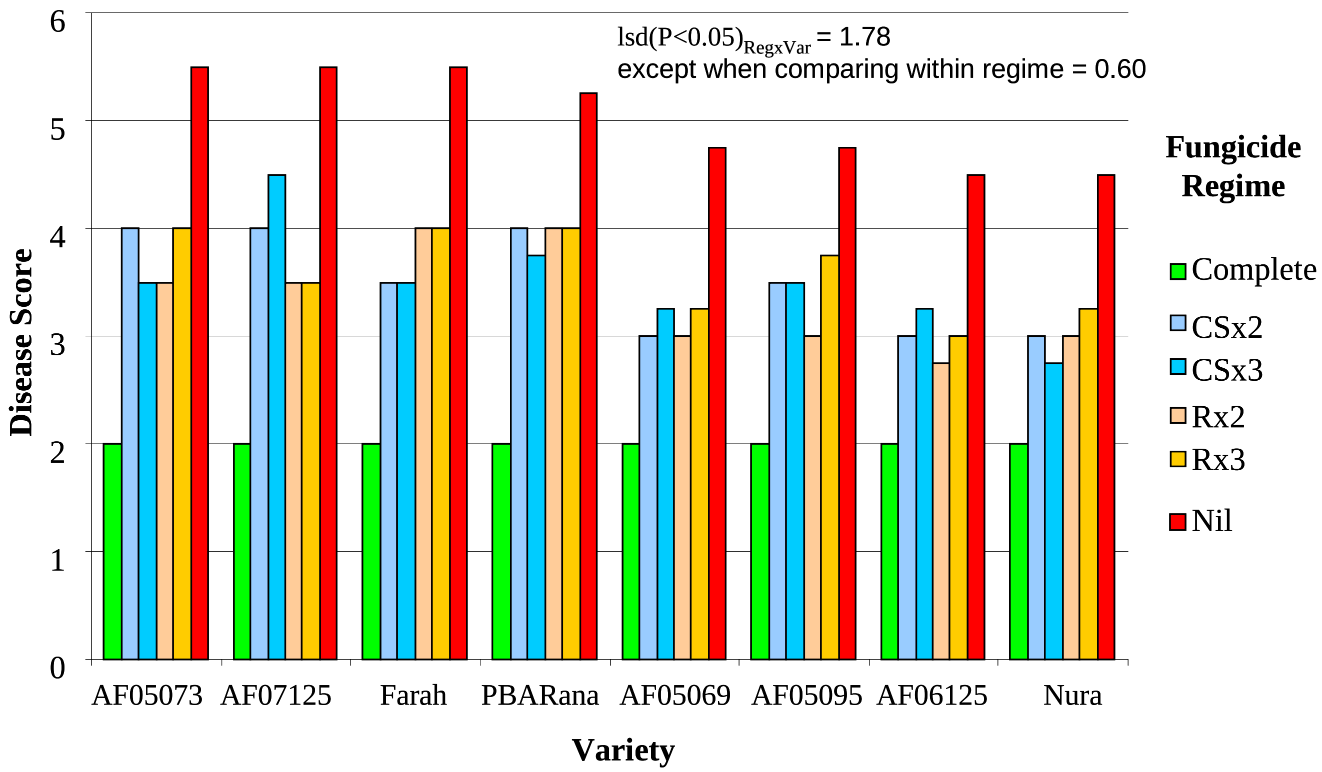


Figure 1. The interaction effect of fungicide regime and variety on disease damage score (1 – no symptoms present, 9 – complete plot death) of faba beans at Westmere recorded November 8, 2012. [1]*Disease damage was a combination of Chocolate Spot and Cercospera; Rust was the predominant disease present.*

Table 1. Grain yield of faba bean varieties grown at Westmere in 2012.

Variety	Grain Yield (t/ha)
AF05095	5.53
AF05069	5.14
AF05073	5.00
AF07125	4.49
PBA Rana	4.49
AF06125	4.49
Nura	4.14
Farah	4.04

$lsd_{P<0.05}$ = 0.37

Key Findings and Comments

Growing conditions in 2012 were excellent for faba beans, due to adequate growing season rainfall and mild temperatures during flowering and podding periods with few frost or high temperatures. In addition, the disease intensity was relatively low, so yield potential was high. While there were clear varietal differences in susceptibility to disease and level of disease within fungicide treatments, it had no impact on grain yield. This probably occurred because spring conditions were relatively dry and not conducive to an increase in disease intensity, which often occurs in wetter spring conditions.

Grain yield of the beans was excellent and the potential new varieties all had yields significantly higher than Farah, with AF05095, 37% greater than Farah. Longterm data across a range of environments from the breeding program indicates that AF05095, AF05069 and AF05073 all have yields approximately 10% greater than Farah. Similar to observations in this trial, AF05095 and AF05069 also have improvements in disease resistance. AF05095 along with other new varieties assessed in this trial are likely to offer significant yield improvements in southern Victoria, along with improvements in disease resistance

Based on yields achieved (5t/ha) beans could have achieved a gross profit of approximately $1900/ha based on management costs of $300/ha and grain price at $440/t.

MultiCrop Trials

M1. Field Pea, Lentil and Chickpea Variety x Stubble Management, Mid North (Pinery) and Yorke Peninsula (Minlaton), South Australia

Aim

To determine whether sowing inter-row in standing stubbles varying in stubble height will benefit yield of field pea, lentil and chickpea varieties.

Treatments

Crop and variety details:

Crop	Variety	Maturity	Plant type
Field Pea	PBA Gunyah	Early	erect, semi-dwarf
	PBA Pearl	Early-mid	erect, semi-dwarf
	Parafield	Late	prostrate, conventional
Lentil	PBA Flash	Early	Erect
	Nipper	Mid	Erect
	CIPAL0803	Mid-late	Prostrate
Chickpea	PBA Striker	Early	Desi
	CICA0857	Early	Desi
	PBA Slasher	Mid	Kabuli

Sowing date: 28th May (Pinery) and 8th June (Minlaton)

Treatments: Short – 5cm high
Medium – 20cm high
Tall – 40cm high
All slashed stubbles were retained in inter-row so that stubble loads were identical between treatments

Stubble: Pinery = 1.8t/ha wheat stubble, Minlaton = 1.4t/ha wheat stubble
East-West direction at both sites

Fertiliser: MAP + Zn @ 75kg/ha

Background

Previous work conducted in South Australia by the Southern Pulse Agronomy project has shown that yield improvements of up to 30% are possible in lentils when inter-row sown into standing cereal stubble (depending on variety and sowing date) compared to where stubbles were removed.

Besides the benefit of stubble on soil moisture retention, it was hypothesised that lentils may have benefitted from protection from wind provided by the stubble. Firstly, by altering the "microclimate" at the plant level in standing stubble systems to increase soil moisture and subsequent yield. Secondly, by diverting additional carbohydrates into the photosynthetic development and flower production, rather than into stem development for wind resistance. And finally, by preventing the erosion and displacement of soil from around the plant stem caused by the moving plants, which may also minimise the breakage of upper lateral roots.

This trial aims to determine whether varying stubble height (but with the same amount of stubble) will benefit yield of field pea, lentil and chickpea varieties of varying plant type and maturity profiles.

Results and Interpretation

- Vegetative biomass – biomass cuts taken in late August showed that stubble height had a significant effect on biomass at Pinery (Table 1). Plots sown into Medium and Tall stubble treatments showed 16-29% (respectively) greater biomass than those sown into Short stubble. No biomass data was collected from the Minlaton trial.
- Final biomass – stubble height had no significant effect on final biomass at Pinery (Table 1).

- Maturity – end of season maturity scores showed that stubble height had a significant effect on maturity at Pinery (Table 1). Pulse crops sown into Short stubble showed earlier maturity than those sown into Medium and Tall stubbles. Maturity data was not collected from the Minlaton trial.
- Grain yield – Stubble height had a significant effect on grain yield (across all crop types and varieties) at Pinery (Table 1). Grain yield was 12% higher in Medium (20cm) and Tall (40cm) stubble treatments than Short (5cm) stubble. Stubble height had no effect on grain yield at Minlaton.
  There was a significant difference in yield between the three crop types at both sites (Table 2). Field pea was the highest yielding crop at both sites, by 25-42% at Pinery and 42-48% at Minlaton. Chickpea yielded 14% higher than lentil at Pinery, while there was no significant difference in yield between lentil and chickpea at Minlaton.
  A significant variety response was generated for each crop type at both sites (Table 3). Field pea and lentil varieties behaved similarly at both sites. PBA Pearl was the highest yielding field pea variety, while PBA Gunyah and Parafield performed similarly. PBA Ace was the highest yielding lentil variety, while PBA Flash and Nipper performed similarly. PBA Striker was the highest yielding chickpea variety at Minlaton, and equal highest with PBA Slasher at Pinery. The kabuli chickpea CICA0857 was the lowest or equal lowest yielding chickpea at both sites.

Table 1: Effect of stubble height on biomass (t/ha), maturity score (1-9) and grain yield (t/ha) of pulse crops, Pinery 2012.

Stubble treatment	Short	Medium	Tall	LSD (P<0.05)
Vegetative biomass (t/ha)*	0.25 a	0.29 b	0.32 b	0.032
Mature biomass (t/ha)*	1.86	2.04	2.00	Ns
Maturity (1-9 score)**	3.37 L	3.63 M	3.78 M	0.27
Yield (t/ha)	1.44 S	1.62 T	1.60 T	0.10

* Measurements taken 21st August and 31st October

** Maturity score: 1 = dead, 9 = healthy

Table 2: Grain yield (t/ha) of field pea, lentil and chickpea at Pinery and Minlaton, 2012.

Crop	Field Pea	Lentil	Chickpea	LSD (P<0.05)
Pinery	1.86 a	1.31 c	1.49 b	0.14
Minlaton	3.30 S	2.33 T	2.23 T	0.18

Table 3: Grain yield (t/ha) of field pea, lentil and chickpea varieties at Pinery and Minlaton, 2012. Varieties are listed in order of maturity for each crop type

Crop	Variety	Pinery		Minlaton	
		Yield (t/ha)	LSD (P<0.05)	Yield (t/ha)	LSD (P<0.05)
	PBA Gunyah	1.77 b		3.14 b	
Field Pea	PBA Pearl	2.04 a	0.09	3.50 a	0.17
	Parafield	1.78 b		3.22 b	
	PBA Flash	1.23 M		2.25 M	
Lentil	Nipper	1.16 M	0.15	2.21 M	0.15
	PBA Ace	1.54 L		2.52 L	
	PBA Striker	1.63 S		2.33 S	
Chickpea	CICA0857	1.31 T	0.12	2.16 T	0.11
	PBA Slasher	1.53 S		2.20 T	

Key Findings and Comments

- Yields were relatively high at these sites in 2012, particularly given the drier than average growing season. Chickpeas performed particularly well, yielding equal to lentils at Minlaton and higher than lentils at Pinery. Yields may have been buoyed by the presence of stubble in all treatments, helping to conserved soil moisture, and the mild (although dry) finish to the season.

- Variety responses were similar across both sites, with PBA Pearl, PBA Ace and PBA Striker being the highest yielding varieties for each crop type. These lines have also consistently performed well across National Variety Testing trials in South Australia.
- Stubble height had a significant effect on early season biomass, end season maturity and grain yield of pulse crops at Pinery in 2012. For each measurement, the Short stubble treatment was significantly different to Medium and Tall stubbles, which performed similarly.
- The absence of a grain yield response from stubble height at Minlaton may be due to the lower and inconsistent stubble load at this site due to wheel traffic and stock damage over summer. It may also indicate that stubble retention, and the conservation of soil moisture, is more important at lower rainfall and lower yielding sites (eg Pinery).
- There was no interaction between stubble treatment and variety, meaning that all varieties (regardless of their varying plant type and maturity profiles) behaved similarly across the three stubble treatments in 2012.
- Despite there being no difference in total stubble load, differences in vegetative growth and grain yield were generated between the three stubble heights at Pinery. This supports previous work conducted by this project showing that the physical arrangement of stubble (ie standing versus slashed) can have a significant effect on the growth and performance of pulse crop types, as well as the amount of stubble present (ie retained versus removed).
- Precise reasons for the differences in vegetative growth and grain yield between the three stubble heights (but same total stubble load) are still unclear, however they are likely generated from the protection from wind (particularly early in the season) provided by the stubble, which may result in moisture conservation. Further work is required to discover the mechanisms for this response.

M2. Field Pea and Lentil Sowing Date x Soil Type, Mid North (Hart), South Australia

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Aim

To compare new lentil varieties with current commercial varieties as well as current commercial field pea varieties and Kaspa type pea blends on two different soil types.

Treatments

Varieties:	Lentils: PBA Blitz, PBA Flash, PBA Jumbo, Nipper, Nugget and CIPAL0902 Peas: PBA Gunyah, PBA Twilight, PBA Oura and Kaspa Blends: 'Kaspa Mix' (50% Kaspa, 25% PBA Gunyah and 25% PBA Twilight) and 'TwiKasYah' (33% Kaspa, 33% PBA Gunyah and 33% PBA Twilight)
Sowing dates:	22 May (Early-Mid), 19 June (Mid-Late)
Soil types:	Western site: shallow, hard setting, higher salinity Eastern site: deeper, well-structured and more friable
Fertiliser:	MAP + Zn @ 90kg/ha

Background

Interest in growing lentils has increased in recent years due to high grain prices and grain yields, and this has pushed lentil production into more marginal pulse growing areas. Recently released lentil varieties with improved disease characteristics and a variety of maturity timings may be better suited to these environments. Field peas are still considered to be a reliable break crop in these areas despite lower prices so they are included in the trials.

Two "Kaspa type" seed mixtures (Blends) with a wider maturity range have also been included to compare against standard varieties. Two trial sites were established one on a less suitable soil type (West Site) with higher EC soil and the other was placed on a deeper soil more suited to pulse production (East Site), this has been done to compare varieties in less favourable conditions.

Results and Interpretation

- Across both sites lentils produced an average grain yield of 0.94t/ha and peas 1.43t/ha . The average grain yield for the western site was 1.10t/ha and at the better suited eastern site the grain yield was 1.27t/ha.
- All varieties and both sites responded the same way to time of sowing, whereby, as sowing was delayed grain yields declined (Table 1). At the Eastern site a yield decrease was 0.54t/ha for both crops while at the Western site the yield decrease was smaller and 0.32t/ha for lentil and 0.22 t/ha for field pea.
- Across both times of sowing all lentils performed similarly at the eastern site, producing an average yield of 0.99t/ha with a range from 0.89t/ha (Nipper) to 1.07t/ha (CIPAL902) (Table 2). At the western site with less suitable soil type there were significant differences where Nipper produced the lowest grain yield (0.63t/ha) and the earlier maturing variety, PBA Blitz produced 1.07t/ha. Nugget was also significantly lower yielding than some other varieties.
- All field pea varieties produced similar grain yields ranging from 1.48t/ha ('TwiKasYah') to 1.61t/ha (PBA Oura) at the eastern site and 1.24t/ha (Kaspa) to 1.43 (PBA Twilight) at the less suited western site (Table 3). The Kaspa mixtures all produced similar yields showing that there are no detrimental effects of mixing these similar seed types and conversely no improvements under the seasonal conditions of last year.

Table 1. Average lentil and field pea grain yield (t/ha) for time of sowing and site at Hart in 2012.

	Grain yield t/ha			
	Lentils		Field peas	
TOS	East site	West site	East site	West site
May-22	1.26	1.04	1.82	1.43
Jun-19	0.73	0.72	1.28	1.21
Yield decrease	0.54	0.32	0.54	0.22
LSD 0.05	0.08	0.13	0.12	0.17

Table 2. Lentil variety grain yields averages for time of sowing at the east and west site, letters indicated statistically similar varieties.

Variety	Grain yield (t/ha)	
	East	West
Nipper	0.89 a	0.63a
Nugget	0.99a	0.72ab
PBA Jumbo	1.00a	0.91bc
CIPAL902	1.07a	0.97c
PBA Flash	1.02a	0.98c
PBA Blitz	0.99a	1.07c
LSD 0.05	ns	0.22

Table 3.Field pea variety grain yields averages for time of sowing at the east and west site.

Variety	Grain yield (t/ha)	
	East	West
Kaspa	1.50	1.24
Kaspa Mix	1.52	1.37
PBA Gunyah	1.59	1.31
PBA Oura	1.61	1.26
PBA Twilight	1.60	1.43
'TwiKasYah'	1.48	1.30
LSD 0.05	ns	ns

Key Findings and Comments

- Overall lentil and pea grain yields averaged 1.18 t/ha across all sites and treatments. There was no significant foliar disease and the major yield limiting factor was the lack of late season rainfall, only 25mm in September and October. Although only small the slightly higher grain yield at the eastern site compared to the western site highlights the importance of paddock and crop selection to maximise pulse yields in these more marginal areas. A similar result was found in 2011 where there was a 0.46t/ha yield increase from the western site to the eastern site, 1.76 t/ha to 2.23 t/ha respectively.
- There was a clear advantage observed from sowing early in 2012, all varieties from both crops were significantly penalised as sowing was delayed until the 19th of June. This result was also observed at Hart in 2011 in similar trials.
- In previous seasons variety maturity timings have had a strong influence on grain yield. In 2012 this was only observed in lentils at the eastern site. It is likely that the shorter seasoned varieties PBA Blitz and PBA Flash were able to take advantage of the better soil type and available moisture to mature before the season finished off. The peas at both sites and the lentils at the western site all produced similar yields despite maturity timings. A similar result

was observed in field peas at other Pulse Breeding Australia trials around the mid north, such as Snowtown and Balaklava in 2012. The steady decline in soil moisture without a specific timing to the end of the season may explain why there was little difference between varieties. All varieties may have used all available moisture and therefore produced similar grain yields.

M3. Brown Manuring- Evaluation of new pulse varieties in a brown manure system and their role in a crop sequence- Wagga Wagga NSW

Aim

To compare three time of sowing dates across five newly released and commercial varieties of Field peas, Lupins and Vetch and evaluate their contribution to soil nitrogen and the benefits to the following wheat crop.

Treatments

Varieties:	Field peas - Morgan, PBA Percy and PBA Hayman (OZP902); Vetch – Morava; White Lupin - Rosetta, Narrow leafed lupin - Mandelup.
Sowing Dates:	20 April, 9 May and 2 June 2012

Other Details

Sowing date:	20 April, 9 May and 2 June
Row Spacings:	30 cm row spacing
Fertiliser:	Grain Legume @ 30 kg/ha at sowing.
Plant Density:	50 plants/m^2 for field peas and lupins and 40 plants/m^2 for vetch
Soil Type	Red Chromosol (pH_{H20} (0-10cm): 5.2)

Results and interpretation

Climate and crop growth

The 2012 season at Wagga started with high levels of soil moisture after heavy rains in March. This was followed by below average growing season rainfall, average winter temperatures and dry but mild finish during grain fill. Ascochyta and bacterial blight observed particularly in the April 20 sowing of field pea. The plant were able to grow away from the bacterial blight throughout the season.

Biomass

Biomass cuts were taken at two timings; flat pod stage and physiological maturity. The first timing, at flat pod stage, reflects typical grower practice for brown manuring to control Black oats, while the second measures the total dry matter biomass for each treatment. Biomass cuts were carried out according to each treatment's phenology.

At flat pod, there was a significant interaction between varieties and sowing date. Morava vetch sown early produced 20-70% more biomass than other sowing date and crop treatments (Fig 2.1). However, also showed the greatest reduction in biomass across the three sowing dates. Generally field peas and lupins did not show any trends across the three sowing dates. However, Morgan field pea and Mandelup lupin at the second sowing (9 May) produced greater biomass then the first and third sowing dates. The lower lupin biomass from the first sowing was attributed to grazing by hares.

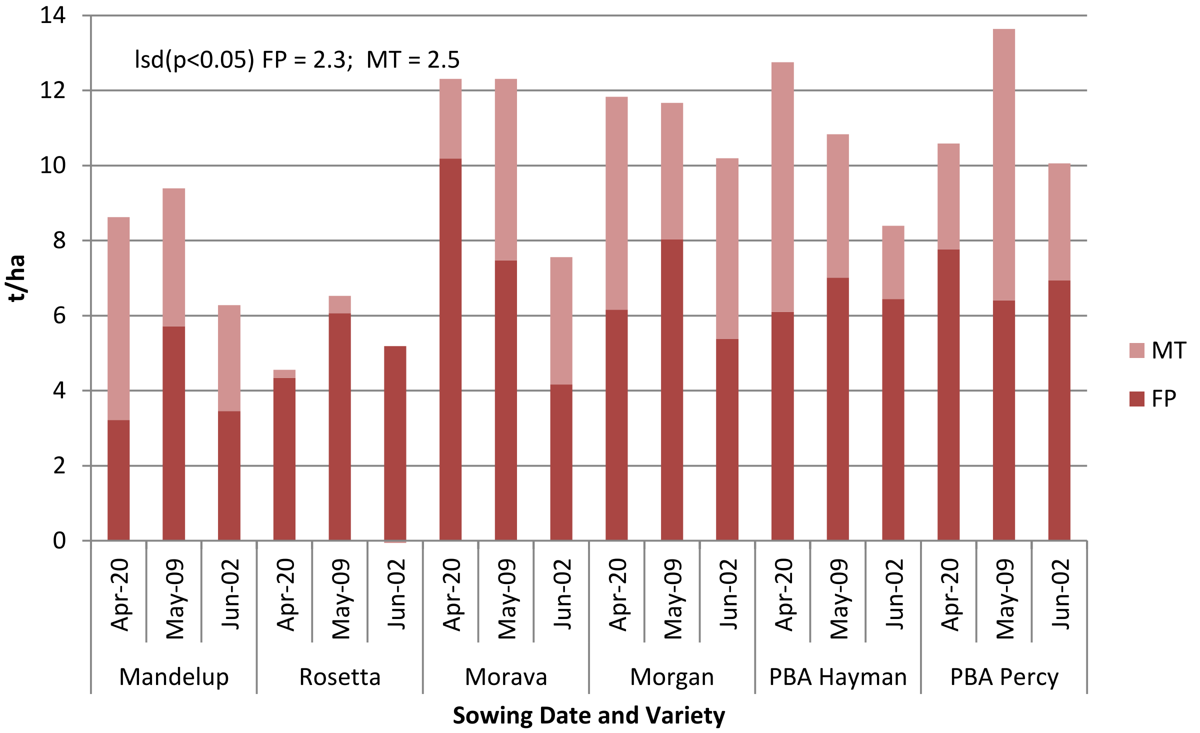

Figure 2.1. Biomass production at flat pod (fp) and maturity (Mat) of vetch, field pea and lupin varieties sown April 20, May 9 and June 2 at Wagga Wagga, 2012. (*Still working on this – will include lsds and change colours to make it look better)**

At physiological maturity, the main effects of variety, sowing time and the interaction of variety x sowing time were all found to be significant. Typically, later sowing of all species resulted in reduced biomass (Fig 2.1). The highest biomass was achieved by Morava vetch and all field peas sown April 20 and May 9 (except PBA Percy sown April 20). Rosetta white lupins generally had the lowest maturity biomass.

Biomass production between flat pod and physiological maturity varied significantly between the treatments. Rosetta white lupin produced almost no increase in biomass, while all other crops and varieties produced between 2 and 7 t/ha increase in biomass. Generally the earlier April and May sowing dates displayed a greater increase than the June sowing date.

Grain Yield

PBA Percy, PBA Hayman and Morgan field peas displayed reduced grain yield when sown April 20. This was probably due to the increased disease infection that was observed. Grain yields were very similar for May and June sowing. With both lupins, May sowing had significantly higher yield. At the first sowing, lupin plots were severely grazed by hares, from which they never fully recovered as indicated by the biomass figures. Morava vetch yielded similarly across all sowing dates.

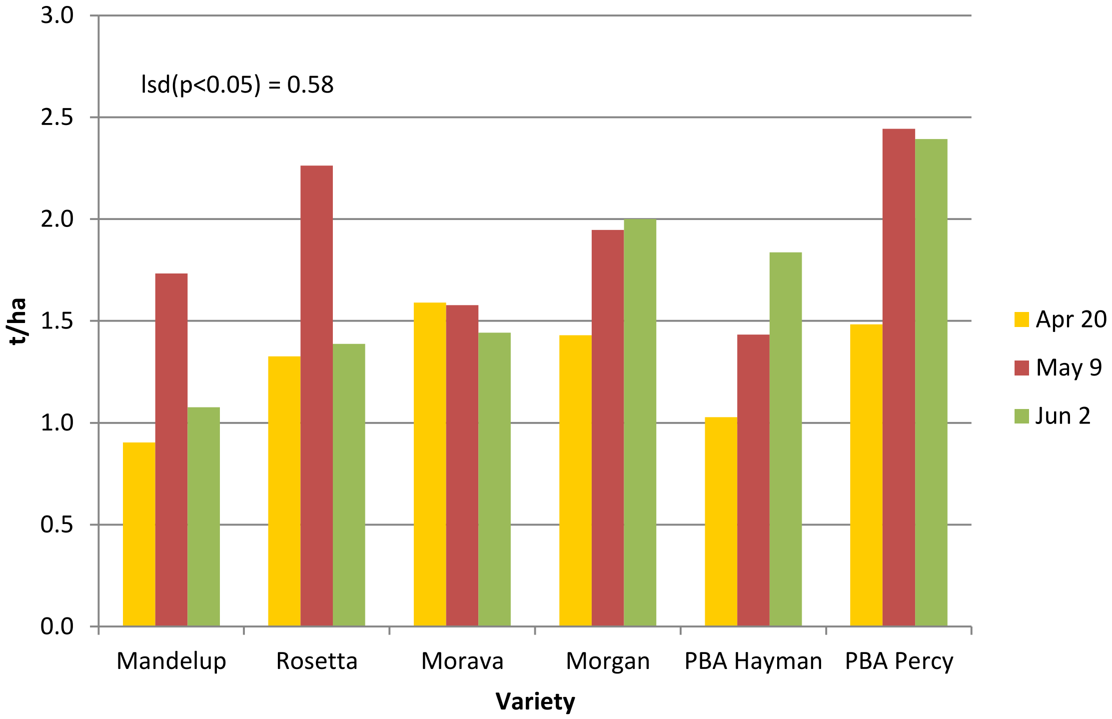

Figure 2.3. Grain yield of vetch, field pea and lupin varieties sown April 20, May 9 and June 2 at Wagga Wagga, 2012. lsd = 0.29 **(will draw something on graph)

Key Findings and Comments

- If early sowing, Morava vetch is the best choice for brown manuring, particularly if brown manuring for early weed control is the objective since early desiccation will preclude any persistence of hard-seeded vetch into subsequent crops. Field peas are the preferred option for later (mid May) sowing for either brown manuring or crop topping
- TOS 1 field peas had disease problems in early winter reducing biomass.
- Lupins produced the least biomass of all crops in this experiment, even when hare damage was not a factor. The poor competitive ability of lupins during early growth would further restrict their biomass production in the presence of weeds.
- At maturity, the best treatments in this trial potentially fixed over 300 kg/ha of N (based on 25kg nitrogen fixed per tonne dry matter). The highest grain yields of 2.5 t/ha of grain represents the export of approximately 80kg of N, leaving a residual of over 200kg of N.