Southern PULSE Agronomy

2014 Results Summary

PBA Jumbo2 at Hart, SA, 2014

Jason Brand and Keshia Savage, Department of Economic Development, Jobs, Transport and Resources, Victoria – Horsham;
Michael Lines, Christine Walela, Amanda Pearce, Jenny Davidson, Sarah Day, Andrew Ware and Larn, South Australia Research and Development Institute;

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

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Further Information
Dr Jason Brand
Senior Research Agronomist - Pulses
Agriculture Research Division
Department of Economic Development, Jobs, Transport and Resources – Horsham,
Private Bag 260 Horsham Victoria 3401
T: 03 53622341 M: 0409 357076

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INTRODUCTION

The 2014 Southern Pulse Agronomy Program had more than 50 trials across south-eastern Australia at 14 sites addressing key management issues associated with the 5 pulse crops, lentil, field pea, chickpea, faba bean and lupin.

Data from trials has been used for several variety brochures produced by Pulse Breeding Australia (PBA). These include PBA Jumbo2, PBA Greenfield and PBA Giant lentils and PBA Samira beans. Results have and will be incorporated into various 2015 state publications such as the SARDI Sowing Guide and Crop Harvest Reports, Victorian Winter Crop Summary, NSW DPI Winter Crop Variety Sowing Guide and numerous Farming System Groups Result books.

Research personnel presented at various industry conferences during 2014 and early 2015, including annual GRDC Updates and grower meetings in Vic, SA and NSW. At field sites and those of grower groups results were presented and issues discussed with grower groups, undergraduate students, private agronomy groups (eg AgriVision, Dodgshun Medlin), field days (eg. MSF, SFS, Hart, BCG, CWFS, Farmlink) and industry workshops. At many field days several new PBA varieties were released and agronomic management issues highlighted. It is estimated that we were able to communicate with in excess of 1500 (650 in Vic; 550 in SA, 300 in NSW) people through these days alone. In addition, significant media coverage was generated extending information further. A particular highlight was the interest generated in the more marginal pulse production areas of the high and low rainfall zones. The strong relationships with commercial and private agronomists continue to allow maximum exposure of all pulse research work. For example, communication with one private agronomist can result in messages spreading to more than 30 growers. This project and its representatives in each state are seen as leaders in pulse research with extensive experience and credibility in delivering applied results to industry.

Unfortunately at the time of publication NSW data was unavailable for inclusion.

About Us

Southern Pulse Agronomy is a tri-state research program lead by DEDJTRVic and funded through GRDC, DEDJTRVic, 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 continue to be released 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:

1. Variety specific agronomy packages (VSAP) - 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.

2. Profitable pulses for modern farming systems - 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).

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Industry Collaborators

Matt Rodda and Peter Kennedy, Pulse Breeding Australia, DEDJTR – Horsham Victoria.

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RESEARCH HIGHLIGHTS

Herbicide Tolerance

In previous seasons research by SPA has demonstrated the tolerance of XT lentils (eg. PBA HurricaneXT) to Imazethapyr and relative tolerance to other Imi's. In 2013 and 14 research in SA and Vic has explored the potential benefits of improved Group B residual tolerance. Key findings from the agronomic herbicide trials include: a) Response of lentils to herbicide treatments varied with seasonal conditions, method of herbicide incorporation, stubble coverage, soil texture and fertility. b) XT lentil varieties showed improved tolerance compared to conventional lentil varieties to all treatments, however they still incurred yield loss to some chemistries under certain conditions, indicating low safety margins to these chemistries. c) Chlorsulfuron and triasulfuron were the most damaging treatments in the trials. Metsulfuron was found to be the safest of the sulfonylurea chemistries tested. It is important to note that all existing product label rates, plant-back periods and directions for use must still be adhered to. Further research is required to identify if sufficient crop safety exists in XT lentils to seek changes to label recommendations for other Group B herbicides.

Low Rainfall Zone Pulses

In 2014, a number of SPA trials in the LRZ (eg. Curyo and Minnipa) with additional farming systems group trials (eg. MSF) guided by SPA researchers demonstrated the increasing yield stability of pulses. For example, in line with increasing interest in faba beans throughout the drier cropping regions, SPA has been conducting a series of agronomic trials at Curyo. Yields of beans averaged 2.8 t/ha in 2013, the highest of all pulse crops on site that year, about 10% greater than lentils and 70% higher than chickpeas. In 2014, profitable yields of above 1t/ha were still achieved, despite the dry season and the crop being affected by frost and brackling. The results also highlighted the potential of several new breeding lines and the adaptability of beans to a range of row space configurations. This work adds to the exciting expansion in faba bean production we have been seeing in HRZ zones in line with work SPA has been conducting for the last 4 years.

Sowing Time

In Vic across all rainfall zones it has been clearly demonstrated over a number of seasons that earlier sowing is beneficial for maximising the yield potential in all pulse crops. However, in SA traditionally lines like Farah faba beans, Boomer and Nugget lentils and most chickpea cultivars perform poorly sown early, often incurring yield loss, severe lodging and increased disease. Growers in SA, similar to Vic want sow early to suit farming systems and ensure maximum yield potential, particularly in poor seasons. Recent varietal releases have shown significant progress in being suited to earlier sowing with PBA Samira faba beans, PBA Jumbo2, PBA Ace and PBA Greenfield lentils all showing increased yields sown early in 2014 time of sowing trials unlike these other varieties (either losses or no increase). The improved adaptation is due to improved plant type (lodging) and disease resistance and perhaps in the case of PBA Samira later flowering, but similar maturity timing (a trait that proved so successful for Kaspa). PBA Giant (new large green lentil) while not showing an increase in yield sown early did not loose yield as did Boomer (larger green lentils) and Nugget last year, indicating a big step forward for green cultivars which were notorius for loosing yield sown early.

Chickpea Economics

Further research continued to demonstrate the benefits of increased seed size in kabuli chickpeas to on farm profitability. The net income of from the new medium sized kabuli chickpea PBA Monarch over 2012-14, was about $70/ha/annum and $200/ha/annum greater than Genesis090 and more than double the desi, PBA Striker in the Wimmera and southern Mallee, respectively, even though grain yields were similar.

Detailed results will be provided in the Annual results summary due at the end of April. The information from the GxM research is provided to PBA breeders to aid in development of future varieties suited to southern Australian management systems. In addition, specific management information is provided to industry through channels previously outlined.

Southern Pulse Agronomy Trials Sown in 2014

Experiment ID	Page	Rainfall Zone[1] Region (Location), State	Treatments (No. of treatments)	Varieties
LENTIL				
L1	19	LRZ Southern Mallee (Curyo), Vic	Sowing Date (2)	16
L2	23	MRZ Wimmera (Pimpinio), Vic	Sowing Date (2)	16
L3	25	LRZ Southern Mallee (Curyo), Vic	Herbicide Tolerance (23)	3
L4	28	MRZ Wimmera (Pimpinio), Vic	Herbicide Tolerance (23)	3
L5	31	MRZ Wimmera (Pimpinio), Vic	Green lentils Desiccation/Harvest Timing (6)	4
L6	32	MRZ Wimmera (Pimpinio), Vic	Green lentils Disease Management (4)	6
L7	33	HRZ South West (Westmere), Vic	Varieties	8
L8	34	MRZ Mid North (Pinery), South Australia	Sowing Date (2)	15
L9	38	MRZ Mid North (Pinery and Melton), South Australia	Sowing Date (2) x Plant Density (5)	6
L10	42	MRZ Mid North (Pinery), South Australia	Herbicide Tolerance (17)	5
L11	46	MRZ Yorke Peninsula (Melton), South Australia	Crop-topping (2)	17
FIELD PEA				
F1	48	LRZ Southern Mallee (Curyo), Vic	Historic Varieties	20
F2	50	LRZ Southern Mallee (Curyo), Vic	Crop Topping/Harvest Timing (4)	8
F3	52	MRZ Wimmera (Pimpinio), Vic	Sowing Date (2)	9
F4	54	MRZ Wimmera (Pimpinio), Vic	Crop Topping/Harvest Timing (4)	12
F5	56	HRZ South West (Westmere), Vic	Disease Management (3)	12
F6	58	MRZ Mid North (Hart), South Australia	Disease Trial (6)	1
F7	59	MRZ Yorke Peninsula (Melton), South Australia	Crop Topping (2)	12

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	61	LRZ Southern Mallee (Curyo), Vic	Sowing Date (2)	12
C2	64	MRZ Wimmera (Pimpinio), Vic	Sowing Date (2)	12
C3	65	MRZ Wimmera (Pimpinio), Vic	Disease Management (4)	12
C4	66	HRZ South West (Westmere), Vic	Varieties	8
C5	67	MRZ Yorke Peninsula (Melton), South Australia	Sowing Date (2)	12
C6	69	MRZ Yorke Peninsula (Melton), South Australia	Crop-topping (4)	12
C7	71	HRZ Mid North (Turretfield), South Australia	Disease Susceptibility	14
FABA BEAN				
B1	74	LRZ Southern Mallee (Curyo), Vic	Row Spacing (3)	8
B2	77	MRZ Wimmera (Pimpinio) and HRZ South West (Westmere), Vic	Canopy Management (21)	2
B3	80	MRZ Wimmera (Pimpinio), Vic	Disease Management (6)	8
B4	82	HRZ South West (Westmere), Vic	Row Spacing (3) Sowing Rate (3)	7
B5	83	HRZ South East (Bool Lagoon), South Australia	Canopy Management (28)	1
B6	86	HRZ Mid North (Tarlee), South Australia HRZ Lower Eyre Peninsula (Wangary), South Australia HRZ South East (Bool Lagoon), South Australia	Crop Topping (4)	15 (T), 5 (BL, W)
B7	89	HRZ Mid North (Tarlee), South Australia	Sowing Date (3)	9
MULTI-CROP				
M1	92	MRZ Mid North (Pinery), South Australia	Stubble Management (Chickpea, Lentil and Field Pea)	
M2	95	LRZ Upper Eyre Peninsula (Minnipa), South Australia	Varieties (Chickpea, Lentil, Faba Bean and Field Pea)	5 each

Trial Site Locations for the 2014 Southern Pulse Agronomy Trials

NEW VARIETIES 2014 and VARIETY AGRONOMIC TABLES

The following varieties were released during the 2014 cropping season

Lentils: red - PBA Jumbo 2 (previously CIPAL1203), PBA Greenfield (CIPAL1104), PBA Giant (CIPAL1207)

Field Peas: nil

Chickpeas: nil

Faba Beans: PBA Samira (AF05069-2)

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

FABA BEANS

Variety	Seed Size	Seed Colour	Flowering	Maturity	Height	Lodging Resistance	Ascochyta (Foliage)	Ascochyta (Seed)	Chocolate spot	Cercospora	Rust
Nura	Small-Medium	Light buff	Mid	Early-Mid	Short	MR	RMR	RMR	MS	S	MS
Farah	Medium	Light brown/brown	Early-Mid	Early-Mid	Medium	MS	RMR	RMR	S	S	S
Fiord	Small	Light brown	Early-Mid	Early	Short	MS	S	S	S	S	S
PBA Kareema	Large	Light brown	Late	Late	Tall	MS	RMR	RMR	MS	S	MRMS
PBA Rana	Medium-Large	Light brown	Mid	Mid	Medium-tall	MR	R	R	MS	S	MS
PBA Samira	Medium	Light brown	Mid	Mid	Medium	MR	R	R	MS	S	MS
AF05095-1	Medium-Large	Light brown	Mid	Mid-late	Medium-tall	MR	R	R	MS	S	MR
AF06125	Medium	Light brown	Mid	Mid	Medium	MR	R	R	MS-MR	S	MS
AF07125	Medium	Light brown	Early-Mid	Early	Medium	MR	R	R	S	R	S
Aquadulce	Large	Light buff	Late	Mid-late	Tall	MS	MS	MS	MS	S	MS
AF09167	Medium	Light brown	Early	Early	Short	MR	RMR	RMR	MS	S	MS
AF09169	Medium	Light brown	Early-Mid	Early-Mid	Medium	MR	RMR	RMR	MS	S	MS
AF10089	Medium-Large	Light brown	Mid	Early-Mid	Medium	MR	R	R	MS	S	S
Fiesta VF	Medium	Light brown/brown	Early-Mid	Early-Mid	Medium	MS	MRMS	MS	S	S	S

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

LENTILS

Variety	Seed coat colour	Cotyledon colour	Seed size (%) relative to Nugget	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	Moderate	Medium	Mid	Mid/Late	MS	MR	R	MRMS	MRMS	MRMS	I	I
PBA Ace	Grey	Red	100	Good	Medium	Mid	Mid	MRMS	R	MRMS	MRMS	R	R	I	I
PBA Blitz	Grey	Red	115-120	Mod/Good	Med/Tall	Early	Early	MR	MR	MR	MR	MR	MRMS	I	I
PBA Bolt	Grey	Red	100	Mod/Good	Medium	Early/Mid	Early/Mid	R	R	R	S	MR	R	MI	MI
PBA Flash	Green	Red	100-110	Moderate	Medium	Early/Mid	Early/Mid	MR	MR	MR	MRMS	MS	MS	MI	MI
CIPAL0901	Grey	Red		Mod/Good	Medium	Early	Early/Mid	MR	MR	MR	MRMS	MR	MS	MI	MI
Small red															
PBA HurricaneXT	Grey	Red	85	Moderate	Medium	Mid	Mid	MR	MR	R	MRMS	MR	R	I	I
PBA HeraldXT	Grey	Red	75	Poor/Mod	Short	Mid/Late	Mid/Late	MRMS	MR	MR	R	R	R	I	I
Nipper	Grey	Red	75-80	Poor/Mod	Short	Mid/Late	Mid	MR	MR	MR	R	MRMS	MR	I	MT
PBA Bounty	Grey	Red	90	Moderate	Med/short	Mid/Late	Mid	S	R	R	MS	MRMS	MS	I	MI
Large red															
Aldinga	Green	Red	120	Moderate	Medium	Mid	Mid	S	R	MRMS	MS	MRMS	MS	I	MI
PBA Jumbo2	Grey	Red	120	Mod/Good	Medium	Mid	Mid	MRMS	MR	R	R	R	R	MI	I
PBA Jumbo	Grey	Red	120	Moderate	Medium	Mid	Mid	MS	MR	MR	MS	MRMS	S	MI	I
Large green															
Boomer	Green	Yellow	150	Good	Tall	Mid	Mid/Late	S	MR	S	MRMS	MR	MRMS	MI	I
PBA Greenfield	Green	Yellow	130	Good	Tall	Mid	Mid/Late	MS	R	MR	MR	MRMS	MRMS	I	MI
PBA Giant	Green	Yellow	170	Good	Tall	Mid	Mid/Late	MS	R	MRMS	MS	MR	MS	MI	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	16		Poor/Mod	Early	Early	Sht-Mid	MS	S	R	S	semi spread
Neelam	Medium	17		Mod	Mid	Mid	Sht-Mid	MS	S	R	S	semi spread
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
CICA1156	Medium	36	8	Mod	Mid	Mid	Mid	MR	S	MR	S	semi erect
CICA1352	Large	44	8-10	Poor/Mod	Mid	Mid/Late	Mid-Tall	MS	S	MR	S	semi spread
CICA1451	Large	44	8-10	Good	Mid/Late	Mid	Mid	MR	S	R	S	
CICA1452	Medium	37	8-9	Good	Mid	Mid	Mid	MR	S	R	S	
CICA1453	Medium	39	8-9	Poor/Mod	Mid/Late	Mid/Late	Mid	MR	S	R	S	
CICA1454	Small	32	7-8	Poor/Mod	Mid/Late	Mid/Late	Mid	MR	S	R	S	
CICA1455	Small											

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

FIELD PEAS

Variety	Plant habit	Plant vigour, Early Season	Flowering	Maturity	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	R	R	R	R	MT	MT
PBA Gunyah	SD-SL	High	Early-Mid	Early	Fair-Good	R: SP	MS	S	S	R	S	S	S	S	SMS
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	*Sp*	S	S
PBA Coogee	C	High	Mid-Late	Mid	Poor	MR:NSP	MS	MRMS*p*		*Sp*	R		*Sp*	T	MT
Parafield	C	High	Mid	Mid	Poor	MR: NSP	MS	MS	S	S	S	S	S	S	MS
PBA Oura	SD-SL	High	Early-Mid	Early	Fair-Good	MR: NSP	MRMS*p*	MRMS	MRMS	MR	S	S	MR	MS	S
PBA Percy	C	High	Early	Early	Poor	MR: NSP	MS	MR	S	S	S	S	S	S	MT
Yellow Type															
PBA Hayman	Mult-branched	Moderate	Very Late	Very late	Poor	MR: NSP	*Sp*	MR*p*		RMR	R			MS	MS
PBA Pearl	SD-SL	Moderate	Early-Mid	Early-mid	Good	MR: NSP	MS	MS	S	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															
OZP1101	SD-SL	High	Mid-Late	Mid	Good	R:SP	MS	MRMS*p*	MS	R	S	S	S	S	S
OZP1208	SD-SL	High	Mid-Late	Mid	Fair-Good	R:SP	MS	MRMS*p*	S	R	S	S	MR	S	S
OZB1303	SD-SL	High	Mid*	Mid*	Fair-Good										
OZB1308	SD-SL	High	Mid*	Mid*	Fair-Good	R:SP									
OZB1309	SD-SL	High	Mid*	Early*	Fair-Good										
OZB1310	SD-SL	High	Mid*	Mid*	Fair-Good										
OZB1311	SD-SL	High	Early-Mid*	Mid*	Fair-Good										
OZB1315	SD-SL	High	Early-Mid*	Mid*	Fair-Good										
OZB1324	SD-SL														
OZP0908	SD-SL		Early			R:SP									
OZP0911	SD-C	Low - Moderate	Early												
OZP0916	C	High	Mid						S		R		S	MT	
Historic and International varieties															
DUNDALE	C	High	Early	Early	S	S: NSP	S			S	S				
ALMA	C	Moderate	Late	Late	S	S: NSP	MS	S	MS	S	S	S	MS	S	S
BLUEY	SD-SL														
KING	C	Low	Mid	Early-Mid	Very Poor	S: NSP	S			MS	S				
EXCELL	SD-SL	High	Early	Early-Mid	Good	S: NSP	S	S		R	S			S	S
SNOWPEAK	SD-SL	High	Early	Early	Good	S: NSP	S			R	S				
BOHATYR	C	Moderate	Early	Early	Poor	S: NSP	S			R	S				
PARAFIELD	C	High	Mid	Mid	Poor	S: NSP	S	MS	S	S	S	S		MT	MT
MUKTA	SD-SL	Fair	Late	Late	MS	S: NSP	MS			R	R				

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.

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.

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

CLIMATE - SEASONAL SNAPSHOT

Victoria

- Pulse grain yields were highly variable in 2014, ranging from failed crops on the heavier soils of the southern Mallee, through to average to above average in the central and northern Mallee on some of the sandier loam soils and regions that experienced extensive summer rainfall. Yields were significantly impacted by the extremely dry spring conditions, combined with frost in many regions. Grain quality was surprisingly good given the extensive frosts experienced.
- Following an excellent early break with above average rainfall recorded in April most growers were able to sow and establish pulse crops in a timely manner. Unfortunately rainfall was well below average for the rest of the season. Both annual and growing season rainfall was approximately 40% less than long term averages at both Southern Pulse Agronomy (SPA) research sites. In the critical reproductive period for pulse of August to October rainfall was about 75% less than long term average.
- Autumn and early winter temperatures were generally warmer than average, however late winter and spring produced some extreme cold events. At the Wimmera pulse agronomy site, 40 days between Aug 1 and Oct 17 experienced overnight frost conditions, severely impacting yields.
- Given the excellent early start to the season there were early signs that disease may become a significant issue in pulses throughout spring. However, given the extremely dry weather, epidemics never eventuated and any disease was generally well managed.

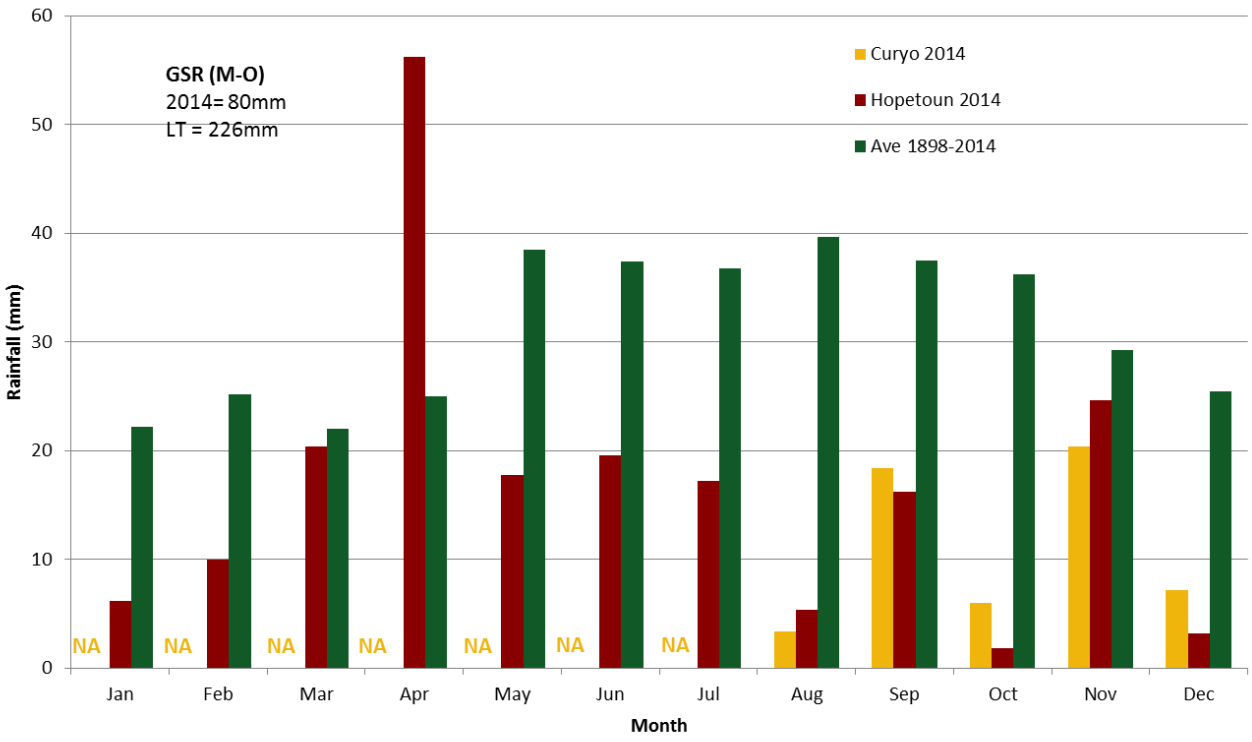

Figure 1. Average monthly rainfall at the Curyo trial site (LRZ, Vic) in 2014 compared with the actual and long term average for Beulah.

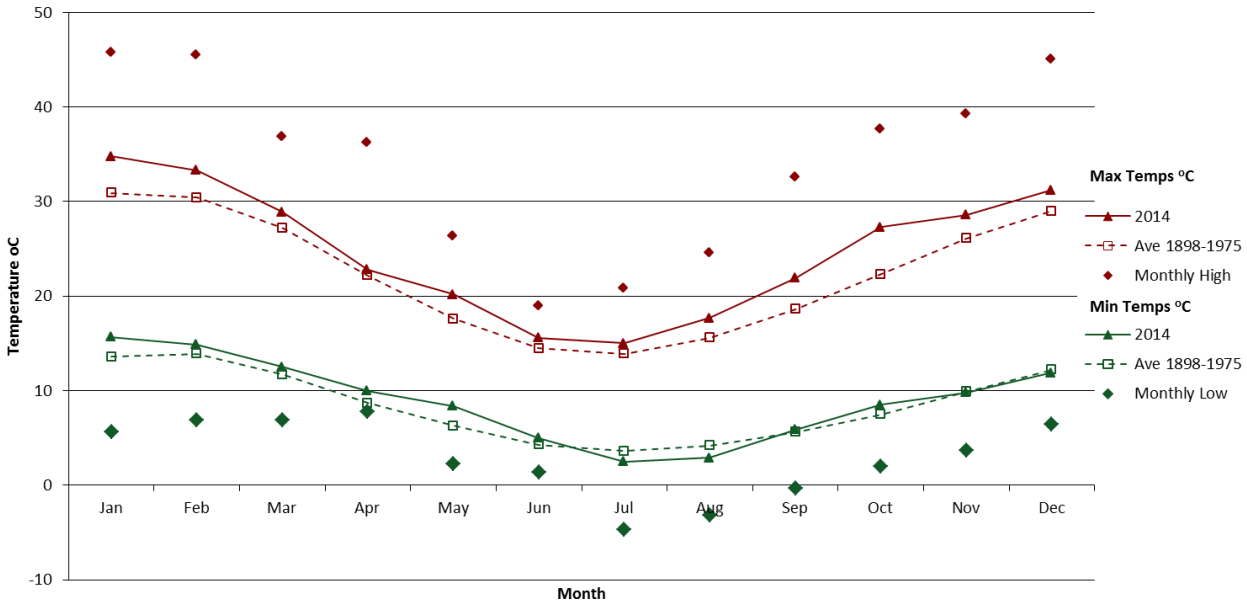

Figure 2. Average monthly maximum and minimum temperatures and absolute maximum or minimum at the Curyo trial site (LRZ, Vic) in 2013 compared with the long term average of Beulah.

South Australia

Rainfall data was accessed from one of the agronomy sites, Hart in the Mid North region of SA (medium rainfall zone) and compared to long term data from Brinkworth 8 km north of site to analyse the weather pattern in 2014. Annual rainfall in 2014 exceeded the long term average (**Error! Reference source not found.**), however the 2014 growing season rainfall (April-October) was 6% below the long term average. Warm temperatures were recorded at the start of the growing season and throughout autumn but gradually declined during the months of winter which were mainly characterized by cold and frosty conditions (Figure 2). The warm autumn temperatures favoured rapid early growth for crops but also provided an environment for disease infection in some situations. Rainfall amounts were low in the last month of winter and early spring followed by a dry and hot October which halted disease progression. Conditions were however relatively cool in November which allowed the crops to finish slowly despite the heat and moisture stress during the previous month. Despite being dry the relatively cool finish to the season was critical for allowing pulses to generally yield average to above average in many parts of SA.

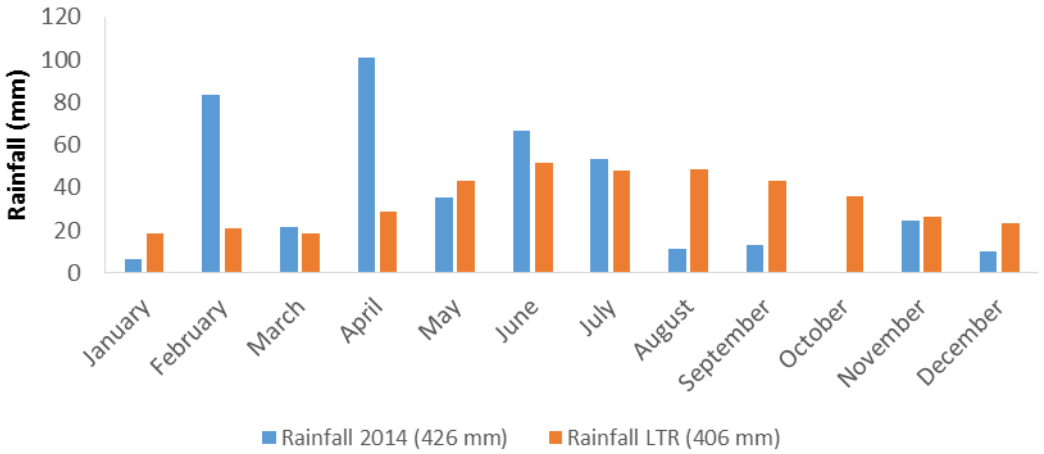

Figure 1: Mean monthly rainfall in 2014 at Hart and for the period 1998-2014 at Brinkworth (MRZ of SA).

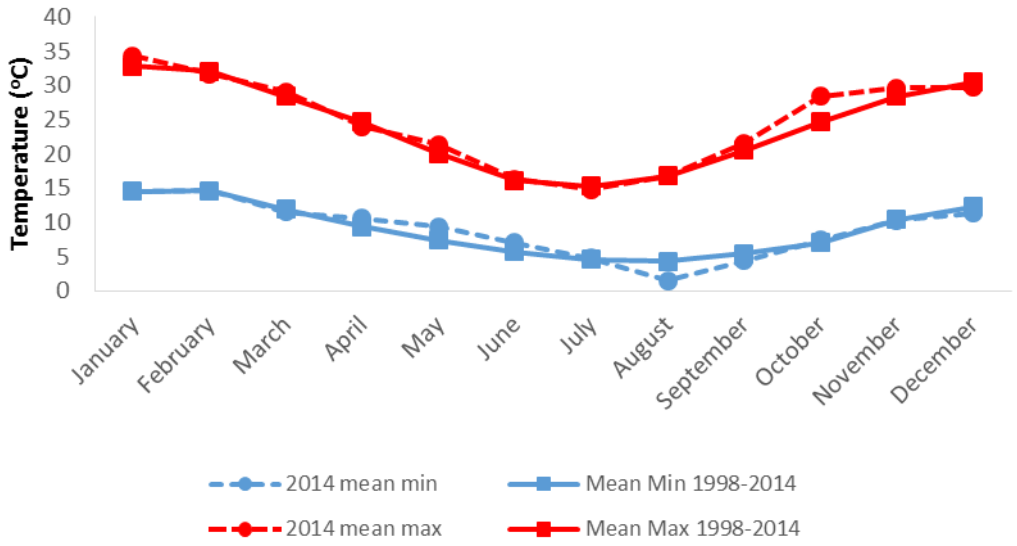

Figure 2: Mean monthly maximum and minimum temperature in 2014 at Hart (MRZ of SA) and for the period 1998-2014 at Brinkworth (MRZ of SA).

TRIAL SUMMARIES

Lentils

L1 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:	Red types - Nipper, Nugget, PBA Blitz, PBA Flash, PBA Jumbo, PBA Bolt, PBA Ace (seed source: Curyo 2013), PBA Ace (Horsham: seed source: Horsham 2013), CIPAL0901, CIPAL1301, CIPAL1405, PBA HurricaneXT, PBA Jumbo2, Green Types – Boomer, PBA Greenfield, PBA Giant. All seed for trial other than indicated was sourced from Trials at Curyo in 2013.
Sowing dates:	2 May (Early), 12 June (Mid)

Other Details

Row Spacings:	36cm
Stubble:	Standing (approximately 15 cm), sown inter-row
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing
Plant Density:	120 plants/m^2
Soil type:	Soil Type: Alkaline Sandy Loam over a heavy clay at about 40-60cm (Table 1)

Table 1. Soil characterisation at Curyo 2014

Depth (cm)	P (mg/kg)	K (mg/kg)	OC (%)	EC (dS/m)	pH ($CaCl_2$)	pH (H_20)	B (mg/kg)	$CaCO_3$ (%)
0-10	30	632	1.02	0.12	7.3	8.1	2.0	2.6
10-20	8	459	0.66	0.17	7.5	8.5	4.2	3.2
20-40	5	463		0.28	7.9	9.2	10.9	11.5
40-60	3	570		0.39	8.0	9.7	20.2	22.7
60-100	3	615		0.61	8.1	9.9	26.2	24.4

Results and Interpretation

- Key Message: Earlier sowing was significantly higher yielding for all varieties in 2014, increasing economic returns by an average of $500/ha. PBA Ace was again highest yielding sown early. The yields of PBA HurricaneXT were lower than expected and reflective of the pod drop that was observed and may also be related to its relatively early maturity.

- Plant establishment – Due to the early rainfall, emergence for both sowing dates occurred within 2 weeks of the respective sowing date. Establishment ranged between 90 and 130 plants/m^2 (data not shown). PBA Jumbo2 and PBA Bolt generally had the lowest establishment, while PBA HurricaneXT was highest.
- Plant growth, Flowering and Maturity – Growth until August was adequate and as expected given the seasonal conditions. The dry and cold conditions throughout August and September meant that growth was slowed and resulted in relatively small plants in the 12 June sown treatments. The ongoing dry conditions ensured plants experienced significant drought stress that rapidly progressed maturity and reduced grain yields. The relative flowering time and maturity of the varieties was slightly different to previously observed and somewhat compressed (Table 2). In particular it was noted that PBA HurricaneXT was relatively earlier than observed in previous agronomic trials. No major differences in maturity for the 12 June sown treatments was noted, due to the terminal drought, hence no data is shown.

- Pod Drop – At Curyo there was a significant interaction between sowing date and cultivar for pod drop score in 2014. At the May 2 sowing date PBA HurricaneXT had significantly greater pod drop than all other varieties (Fig. 1). The earliest maturing group of CIPAL0901, PBA Blitz and PBA HurricaneXT all displayed significantly greater pod drop early sown than late sown. Conversely, several of the later lines, CIPAL1405, PBA Giant and PBA Jumbo all showed higher pod drop scores in the later sown plots.

Table 2. Days to flowering and relative maturity scores (1 - Early, 4 – Late; recorded 8 Oct) of lentil varieties sown May 2 and June 12 (flowering only) at Curyo in 2014.

	Days to Flowering		Maturity Score
Variety	**2 May**	**12 June**	**2 May**
CIPAL0901	102	91	1
PBA Blitz	103	91	1
Boomer	105	94	3
PBA Bolt	105	96	2
PBA Giant	105	96	3
PBA HurricaneXT	105	94	1
PBA Jumbo2	105	94	2
Nugget	107	98	3
PBA Ace (Curyo)	107	94	2
PBA Ace (Horsham)	107	94	2
CIPAL1301	108	96	2
PBA Flash	108	94	2
PBA Greenfield	108	98	3
CIPAL1405	112	100	4
Nipper	112	99	3
PBA Jumbo	112	96	3

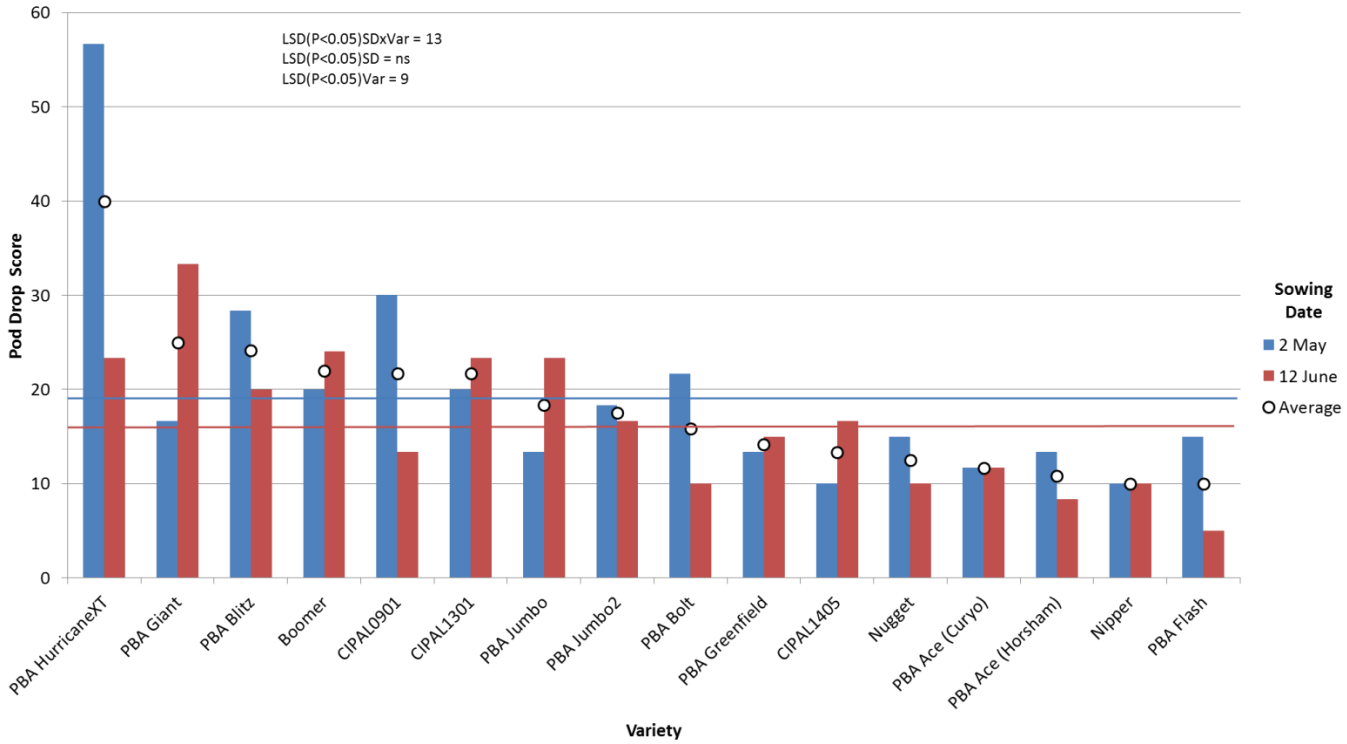

Figure 1. Prod Drop Scores (0 = No loss; 100 = All pods dropped) recorded at harvest (30 Oct and 6 Nov) of lentil varieties sown May 2 and June 6 at Curyo in 2014.

- Grain Yield, Profitability and Grain Weight – Despite the extremely dry spring, grain yields were good, ranging between 0.4 and 1.2 t/ha (Fig. 2). Treatments sown May 2 (1.03 t/ha) were generally more than double those sown June 12 (0.46 t/ha). Yield loss from delaying sowing ranged from a 63% reduction for PBA Ace to a 40% reduction for PBA HurricaneXT, even though for PBA HurricaneXT pod loss at the early sowing date was more than double that at the later sowing date. When sown early PBA Ace (from the Curyo seed source), similar to previous seasons, was highest yielding, although statistically there was no significant difference between the top 10 varieties. Across both sites the PBA Ace seed sourced from Curyo was generally higher yielding than sourced from Horsham. PBA HurricaneXT and PBA Blitz were the lowest yielding varieties sown early. Both varieties were in the earliest maturity group. At the later sowing date PBA Flash was highest yielding at 0.53 t/ha and Boomer lowest 0.38 t/ha. While these may appear relatively small differences, the economic value was high, as a 0.1 t/ha improvement in

yield was worth approximately $85/ha (Table 2). Based on 2014 harvest prices a yield of 0.3 t/ha could have broken even economically. Sowing the lentils early resulted in average returns $500/ha more than later sowing (ranging between $650/ha and $350/ha dependant on variety).

Grain weights were generally normal for most varieties and quality excellent (Table 3). There was a generally slight increase at the later sowing date, but that was inconsistent across varieties.

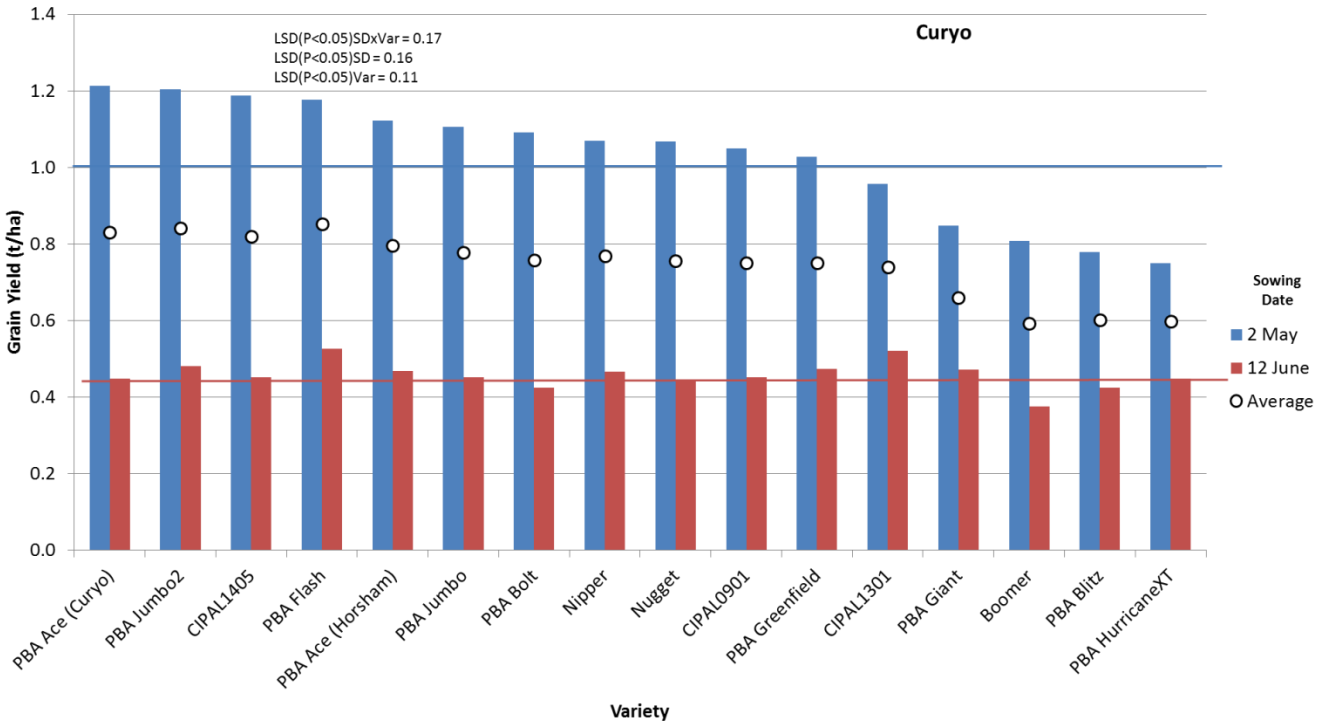

Figure 2. Grain yield (t/ha) of lentil varieties sown May 2 and June 12 at Curyo in 2014.

Table 2. Estimated Net Income ($/ha) of lentils grown at Curyo in 2014. *Net Income based on grain prices at $850/t with fixed management costs of $230/ha*.

Sowing Time	2 May	12 June	Average
PBA Ace (Curyo)	$801	$151	$476
PBA Jumbo2	$793	$178	$486
CIPAL1405	$779	$154	$467
PBA Flash	$771	$218	$494
PBA Ace (Horsham)	$724	$168	$446
PBA Jumbo	$710	$154	$432
PBA Bolt	$697	$132	$414
Nipper	$680	$166	$423
Nugget	$678	$149	$413
CIPAL0901	$663	$154	$408
PBA Greenfield	$643	$173	$408
CIPAL1301	$584	$213	$398
PBA Giant	$491	$171	$331
Boomer	$457	$90	$273
PBA Blitz	$432	$132	$282
PBA HurricaneXT	$407	$151	$279
Average	$644	$160	

Table 2. Grain weight (g/100seed) of lentils grown at Curyo in 2014.

Sowing Time	2 May	12 June	Average
PBA HurricaneXT	3.50	3.72	3.61
Nipper	3.45	3.92	3.69
PBA Ace (Curyo)	4.18	4.30	4.24
PBA Ace (Horsham)	4.19	4.38	4.29
Nugget	4.27	4.39	4.33
PBA Bolt	4.16	4.52	4.34
CIPAL1301	4.18	4.76	4.47
CIPAL0901	4.60	4.66	4.63
CIPAL1405	4.88	5.17	5.02
PBA Flash	4.92	5.25	5.09
PBA Jumbo	5.14	5.17	5.16
PBA Jumbo2	5.40	5.51	5.46
PBA Greenfield	5.42	5.62	5.52
PBA Blitz	5.32	5.72	5.52
Boomer	6.44	6.39	6.42
PBA Giant	7.18	7.09	7.14
	4.83	5.04	

$lsd(P<0.05)_{sow\ date\ x\ variety}$ = 0.18; $_{sow\ date}$ = 0.19; $_{variety}$ = 0.13.

Key Findings and Comments

- Earlier sowing was significantly higher yielding for all varieties in 2014, increasing economic returns by an average of $500/ha. PBA Ace was again highest yielding sown early. The yields of PBA HurricaneXT were lower than expected and reflective of the pod drop that was observed and may also be related to its relatively early maturity. In previous season's where terminal drought stress was not as much of an issue, PBA HurricaneXT tended to be slightly later maturing than PBA Blitz and CIPAL0901. In addition the pod drop observed in PBA HurricaneXT in 2014 has not been seen previously in agronomic trials.
- The new large seeded red variety PBA Jumbo2 performed extremely well confirming its adaptation to the southern Mallee. The medium sized green PBA Greenfield also showed adequate yields given seasonal conditions indicating potential for greens to be grown in this region as market opportunities allow. The large Green PBA Giant was still profitable with excellent seed size and quality, highlighting its potential as an alternative type for markets into the future.
- Similar to 2013 seed size and quality was significantly larger and better in the Mallee than in the Wimmera.

L2 Sowing Time, MRZ Wimmera (Pimpinio), Victoria

Aim

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

Treatments

Varieties:	Red types - Nipper, Nugget, PBA Blitz, PBA Flash, PBA Jumbo, PBA Bolt, PBA Ace (Curyo), PBA Ace (Horsham), CIPAL0901, CIPAL1301, CIPAL1405, PBA HurricaneXT, PBA Jumbo2, Green Types – Boomer, PBA Greenfield, PBA Giant.
Sowing dates:	13 May (Early), 18 June (Mid).

Other Details

Row Spacing:	30cm
Stubble:	Standing (approx. 30cm tall), sown inter-row
Fertiliser:	MAP + Zn @ 80 kg/ha at sowing
Plant Density:	120 plants/m^2
Soil Type:	Alkaline Black cracking clay (Table 1.)

Figure 1. Soil characterisation at Pimpinio 2014

Depth (cm)	P (mg/kg)	K (mg/kg)	OC (%)	EC (dS/m)	pH ($CaCl_2$)	pH (H_20)	B (mg/kg)	$CaCO_3$ (%)
0-10	22	846	1.22	0.18	7.5	8.4	2.7	2.7
10-20	10	579	0.77	0.22	7.6	8.6	4.5	4.6
20-40	6	445		0.24	7.6	8.7	6.7	6.8
40-60	5	462		0.35	7.7	9.0	12.9	5.8
60-100	5	511		0.49	7.8	9.0	20.3	6.5

Results and Interpretation

- Key Message: Yields were generally too low to draw specific conclusions about varieties and the interactions with sowing date. Despite the severe weather conditions during spring, most treatments would have produced yields that would have resulted in greater than break even economic.

- Plant establishment – Similar to Curyo, due to the early rainfall, emergence for both sowing dates occurred within 2 weeks of the respective sowing date. Establishment ranged between 80 and 110 plants/m^2 (data not shown). The May 13 sowing date generally displayed higher establishment than June 18.
- Plant Growth and Disease – Early plant growth was excellent due to the early rainfall and mild temperatures in late autumn and early winter. These conditions were also conducive to early Ascochyta blight development, particularly in treatments sown May 13. There were significant differences in Ascochyta infection observed, with PBA Flash severely affected and PBA Ace, PBA Jumbo2 and CIPAL1301 with only minor symptoms (Table 1). PBA Blitz and PBA Greenfield were more severely affected than previously observed relative to other varieties. Despite the early incursion of Ascochyta Blight, symptoms did not progress throughout spring due to the extremely dry conditions. Growth also slowed during this period and the dry conditions combined with many frosts caused significant flower and pod abortion during the reproductive phase.
- Grain Yield, Profitability and Grain Weight – The extremely dry spring with frosty conditions resulted in low grain yields ranging from 0.2 and 0.5 t/ha (Table 1). Overall there was no difference in the yields of treatments sown May 13 compared with June 18, however there was a significant interaction with variety. For example, PBA Giant sown May 13 had yield 0.27 t/ha less than sown June 18, while PBA HurricaneXT had yield 0.14t/h higher sown May 13 compared with June 18 (Table 1). Overall PBA Ace from the Curyo 2013 seed source had the highest yields, while Boomer was lowest. It was notable that all of the green varieties tended to have lower yields in this trial.

  While yields were low, based on 2014 harvest prices a yield of 0.3 t/ha could have broken even economically and yields of 0.5t/ha resulted in profits of approximately $200/ha.

Unlike Curyo, grain weights were generally lower for most varieties and quality acceptable (Table 1). There was generally an increase in seed weight at the later sowing date.

Table 1. Grain yield (t/ha) and grain weight (g/100seed) of lentil varieties sown 13 May and 18 June and Ascochyta blight score (0 – no disease; 100 – complete death; recorded Aug 26) sown 13 May at Pimpinio in 2014.

	Grain Yield			AB Score	Grain Weight		
Sowing Time	**13 May**	**18 June**	**AveGY**	**13 May**	**13 May**	**18 June**	**Ave**
PBA Ace (Curyo)	0.47	0.49	0.48	5	3.60	4.09	3.84
CIPAL1301	0.53	0.41	0.47	5	3.68	4.40	4.04
Nipper	0.46	0.46	0.46	27	2.86	3.27	3.07
PBA HurricaneXT	0.51	0.37	0.44	10	2.96	3.43	3.20
CIPAL0901	0.49	0.38	0.43	17	3.68	4.66	4.17
Nugget	0.36	0.51	0.43	23	3.54	4.12	3.83
PBA Flash	0.38	0.48	0.43	70	4.05	4.48	4.26
CIPAL1405	0.43	0.42	0.43	20	4.14	4.32	4.23
PBA Bolt	0.45	0.36	0.41	15	3.29	4.13	3.71
PBA Jumbo	0.35	0.41	0.38	28	4.23	4.87	4.55
PBA Ace (Horsham)	0.34	0.42	0.38	5	3.20	4.04	3.62
PBA Jumbo2	0.43	0.32	0.38	5	4.40	5.16	4.78
PBA Giant	0.18	0.45	0.32	17	5.54	6.46	6.00
PBA Blitz	0.29	0.33	0.31	28	4.82	4.98	4.90
PBA Greenfield	0.27	0.34	0.30	30	4.49	5.41	4.95
Boomer	0.24	0.32	0.28	13	5.44	6.52	5.98
Average	0.39	0.40	0.40	20	3.99	4.65	4.32

lsd summary for each measurement

Measure	**Sow Date**	**Variety**	**Sow Date x Variety**	**within sow date**
Grain Yield	NS	0.11	0.18	0.15
AB Score		7		
Grain Weight	NS	0.36	NS	NS

Key Findings and Comments

- Yields were generally too low to draw specific conclusions about varieties and the interactions with sowing date. Despite the severe weather conditions during spring, most treatments would have produced yields that would have resulted in greater than break even economic returns.
- PBA Blitz and PBA Greenfield were more severely affected by ascochyta blight than previously observed relative to other varieties. This has resulted in a drop in their disease ratings relative to other varieties.

L3 Herbicide Tolerance, LRZ Southern Mallee (Curyo), Victoria

Aim

To understand the genetic control in lentils relating to tolerance to the range of sulfonyl urea herbicides.

Treatments

Varieties:	PBA HurricaineXT and CIPAL1208 (Tolerant to imazethapyr, but with potential differential responses to the sulfonylurea 'su' herbicides), PBA Flash (Control, Intolerant).
Herbicides:	Twenty two herbicide treatments were applied and compared with an untreated 'control'. Three sulfonylurea herbicides (chlorsulfuron, metsulfuron-methyl, triasulfuron) and one Group I (clopyralid) were applied at four rates, and the imazadolinones (imazethapyr and imazapyr) at a high rate post-sowing pre-emergent (PSPE). Chlorsulfuron was also applied 6 weeks pre-sowing as a residual application at the four rates to mimic potential residual concentrations in soil (Table 1). *Note: All herbicide treatments used in this trial are not registered for use*

Other Details

Sowing date:	19 May
Row Spacing:	36 cm
Stubble:	Standing (approximately 15 cm), sown inter-row
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing
Plant Density:	120 plants/m^2
Soil type:	Soil Type: Alkaline Sandy Loam over a heavy clay at about 40-60cm (Table 1 in Trial L1 above)

Results and Interpretation

- Key Message: PBA HurricaneXT has improved tolerance to the sulfonylurea herbicides relative indicating significant benefits where residues may be an issue in cropping systems.

- Herbicide Damage - Visual herbicide damage symptoms recorded July 14 were moderate to severe, resulting in crop death for many treatments applied to the intolerant genotype PBA Flash, particularly the higher rates (Table 1). CIPAL1208 showed a low level of damage with application imazethapyr and imazapyr, but all SU's and clopyralid caused significant damage at all application rates. Symptoms generally increased with increasing application rate and within the SU's chlorsulfuron caused the greatest damage. In comparison, PBA HurricaneXT only had significant damage scores in the highest application rate of chlorsolfuron applied PSPE and with imazaypyr and the 3 higher rates of clopyralid. When plants were not killed by the initial herbicide application, in many cases, a level of recovery was observed throughout the season, which is reflected in the grain yields. (Table 1).
- Grain Yield - For the intolerant genotype PBA Flash, complete or significant yield loss was observed for most treatments (Table 2). Interestingly at the lower rates of triasulfuron, clopyralid and metsulfuron-methyl PBA Flash recovered sufficiently, so that grain yields were not significantly different from the 'Nil' (0.95t/ha). Within the tolerant lines, CIPAL1208, showed no significant yield loss with the application of imazapyr and imazethapyr, although yields tended to be lower (Table 2). Chlorsulfuron caused yield loss at all application rates and timings, while metsulfuron-methyl and triasulfuron, only caused loss at the highest rate. Clopyralid similar to other varieties caused yield loss at the two highest rates. PBA HurricaneXT was highest yielding (1.2 t/ha) and only showed significant yield loss when imazapyr, chlorsolfuron (PSPE) at the highest rate and cloyralid at the two highest rates were applied.
- Grain Weight – Within the tolerant lines there were no major impacts of the various herbicide treatments on grain weight.

Table 1. The effect of various Group B herbicide treatments and one Group I on visual damage score (0 – no damage, 100 – complete plant death) recorded July 14 of the imidazolinone tolerant lentil variety PBA HurricaneXT and genotypes, CIPAL1208, in comparison with an intolerant genotype, PBA Flash at Curyo, 2014. Significant damage scores have been shaded.

Herbicide[1]	App Rate	CIPAL1208	PBA Flash	PBA HurricaneXT
Nil	x0	0	0	0
Imazethapyr	x4	5	80	5
Imazapyr	x4	13	80	20
Chlorsulfuron 'res'	x0.125	40	30	7
	x0.25	53	43	3
	x0.5	53	53	0
	x1	70	77	10
Chlorsulfuron	x0.125	57	60	0
	x0.25	73	80	7
	x0.5	80	87	3
	x1	80	83	37
Metsulfuron-methyl	x0.125	17	13	0
	x0.25	23	33	0
	x0.5	47	53	3
	x1	63	57	3
Triasulfuron	x0.125	17	37	0
	x0.25	30	50	10
	x0.5	47	43	0
	x1	63	77	17
Clopyralid	x0.125	30	0	13
	x0.25	70	67	50
	x0.5	90	73	88
	x1	100	93	100

1. All herbicides applied Post Sowing Pre-emergent except Chlorsofuron, which was also applied 6 weeks pre sowing to mimic potential residual concentrations ('res')

Table 2. The effect of various Group B herbicide treatments and one Group I on grain yield (t/ha) of the imidazolinone tolerant lentil variety PBA HurricaneXT and genotypes, CIPAL1208, in comparison with an intolerant genotype, PBA Flash at Curyo, 2014.

Herbicide	App Rate	CIPAL1208	PBA Flash	PBA HurricaneXT
Nil	x0	0.83	0.95	1.20
Imazethapyr	x4	0.54	0.00	0.96
Imazapyr	x4	0.62	0.00	0.50
Chlorsulfuron 'res'	x0.125	0.47	0.26	1.10
	x0.25	0.42	0.00	1.29
	x0.5	0.53	0.00	1.48
	x1	0.32	0.00	1.18
Chlorsulfuron	x0.125	0.47	0.18	0.93
	x0.25	0.48	0.00	1.25
	x0.5	0.37	0.00	1.16
	x1	0.06	0.00	0.78
Metsulfuron-methyl	x0.125	0.69	0.79	1.15
	x0.25	0.80	0.70	1.16
	x0.5	0.71	0.30	1.01
	x1	0.31	0.22	1.16
Triasulfuron	x0.125	1.06	1.02	1.44
	x0.25	0.81	0.59	1.22
	x0.5	0.54	0.52	1.25
	x1	0.10	0.07	1.16
Clopyralid	x0.125	0.84	1.06	1.06
	x0.25	0.76	0.67	1.18
	x0.5	0.19	0.51	0.26
	x1	0.00	0.00	0.00

1. All herbicides applied Post Sowing Pre-emergent except Chlorsofuron, which was also applied 6 weeks pre sowing to mimic potential residual concentrations ('res')

Key Findings and Comments

- This data highlights the improved tolerance of PBA HurricaneXT to sulfonyl urea herbicides, particularly if they are used in a residual situation, i.e. in the preceeding cereal crop or during summer. It also creates opportunities to potentially change label recommendations for the SU's enabling them to be used within a closer period than currently indicated on, provided specific varieties of lentil are grown.
- It is important to look at these results with caution as the dry spring conditions limited grain yields and also may have prevented continued uptake of the SU's which could have resulted in larger yield losses similar to that observed in previous seasons in South Australia.
- As previously indicated the ongoing introduction and improvement of these herbicide tolerant lentils will 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. The benefit of PBA HurricaneXT is already demonstrated, with it being the largest ever release for a lentil and expected to be the dominant variety within 1-2 years. Growers must always follow label recommendations for herbicide application.

Table 3. Indicative ratings for the herbicide tolerant lentils based on all trials conducted throughout 2012 - 2014.

	PBA HurricaneXT	PBAHeraldXT	CIPAL1208	CIPAL1209
Imazethapyr	T	T	T	T
Imazamox	MT	MT	T	MT
Imazapyr	MS	MS	T/MT	T/MT
Imazapic	T/MT	T/MT	T/MT	T/MT
Flumetsulam	MT	MT	MS	MT
Metosulam	MS	MS	S	S
Metsulfuron	MS	MS	S	S
Chlorsulfuron	MS/MT	MS/MT	S	MS
Mesosulfuron	MT	T	MS	MS/MT
Triasulfuron	MS	MS	S	S

L4 Herbicide Tolerance, MRZ Wimmera (Pimpinio), Victoria

Aim

To understand the genetic control in lentils relating to tolerance to the range of sulfonyl urea herbicides.

Treatments

Varieties:	PBA HurricaneXT and CIPAL1208 (Tolerant to imazethapyr, but with potential differential responses to the sulfonylurea 'su' herbicides), PBA Flash (Control, Intolerant).
Herbicides:	Twenty two herbicide treatments were applied and compared with an untreated 'control'. Three sulfonylurea herbicides (chlorsulfuron, metsulfuron-methyl, triasulfuron) and one Group I (clopyralid) were applied at four rates, and the imazadolinones (imazethapyr and imazapyr) at a high rate post-sowing pre-emergent (PSPE). Chlorsulfuron was also applied 6 weeks pre-sowing as a residual application at the four rates to mimic potential residual concentrations in soil (Table 1). *Note: All herbicide treatments used in this trial are not registered for use*

Other Details

Sowing date:	13 May
Row Spacing:	30cm
Stubble:	Standing (approx. 30cm tall), sown inter-row
Fertiliser:	MAP + Zn @ 80 kg/ha at sowing
Plant Density:	120 plants/m^2
Soil Type:	Alkaline Black cracking clay (Table 1 in Trial L2 above)

Results and Interpretation

- Key Message: PBA HurricaneXT has improved tolerance to the sulfonylurea herbicides relative indicating significant benefits where residues may be an issue in cropping systems.

- Herbicide Damage – Trends in herbicide damage symptoms were similar to Curyo. Moderate to severe symptoms, resulting in crop death for many treatments were observed for all herbicide treatments applied to the intolerant genotype PBA Flash (Table 1).
- CIPAL1208 showed a significant damage with application imazapyr, but not imazethapyr and all SU's and clopyralid caused significant damage at most application rates. Symptoms generally increased with increasing application rate and within the SU's chlorsulfuron caused the greatest damage. In comparison, PBA HurricaneXT only had significant damage scores in the imazaypyr treatment and the 2 higher rates of clopyralid. Unlike Curyo the highest application rate of chlorsolfuron applied PSPE caused no significant crop damage. When plants were not killed by the initial herbicide application, in many cases, a level of recovery was observed throughout the season. (Table 1).
- Grain Yield – All results need to be treated with caution due to the extreme climatic conditions during spring (low rainfall and frost, see above). Yields in the 'Nil' treatment were only 0.6 t/ha for PBA HurricaneXT, 0.67 t/ha for PBA Flash and 0.33 t/ha for CIPAL1208. Unlike Curyo, even the low rates of SU's (except x0.25 rate of metsulfuron-methyl) caused significant yield loss (Table 2). A similar response was observed for CIPAL 1208, except that it had no significant yield loss with imazethapyr. Conversely PBA HurricaneXT displayed no significant yield loss in any herbicide treatment except clopyralid at the highest rate.
- Grain Weight – Within the tolerant lines there were no major impacts of the various herbicide treatments on grain weight.

Table 1. The effect of various Group B herbicide treatments and one Group I on visual damage score (0 – no damage, 100 – complete plant death) recorded July 14 of the imidazolinone tolerant lentil variety PBA HurricaneXT and genotypes, CIPAL1208, in comparison with an intolerant genotype, PBA Flash at Pimpinio, 2014. Significant damage scores have been shaded.

Herbicide	App Rate	CIPAL1208	PBA Flash	PBA HurricaneXT
Nil	x0	0	0	0
Imazethapyr	x4	10	80	0
Imazapyr	x4	35	90	30
Chlorsulfuron_res	x0.125	45	50	0
	x0.25	55	70	0
	x0.5	70	75	0
	x1	80	85	0
Chlorsulfuron_pspe	x0.125	60	70	0
	x0.25	70	80	0
	x0.5	80	80	0
	x1	90	90	5
Metsulfuron-methyl	x0.125	25	50	0
	x0.25	15	45	0
	x0.5	65	65	0
	x1	55	65	5
Triasulfuron	x0.125	15	50	0
	x0.25	50	65	0
	x0.5	50	50	0
	x1	85	80	15
Clopyralid	x0.125	35	45	0
	x0.25	5	30	0
	x0.5	60	55	55
	x1	100	100	100

Table 2. The effect of various Group B herbicide treatments and one Group I on grain yield (t/ha) of the imidazolinone tolerant lentil variety PBA HurricaneXT and genotypes, CIPAL1208, in comparison with an intolerant genotype, PBA Flash at Pimpinio, 2014.

Herbicide	App Rate	CIPAL1208	PBA Flash	PBA HurricaneXT
Nil	x0	0.33	0.67	0.60
Imazethapyr	x4	0.35	0.00	0.69
Imazapyr	x4	0.26	0.00	0.57
Chlorsulfuron_res	x0.125	0.30	0.00	0.63
	x0.25	0.30	0.00	0.55
	x0.5	0.39	0.00	0.63
	x1	0.33	0.00	0.67
Chlorsulfuron_pspe	x0.125	0.36	0.19	0.85
	x0.25	0.39	0.17	0.73
	x0.5	0.41	0.00	0.52
	x1	0.20	0.00	0.59
Metsulfuron-methyl	x0.125	0.29	0.31	0.59
	x0.25	0.33	0.50	0.71
	x0.5	0.33	0.22	0.56
	x1	0.40	0.33	0.76
Triasulfuron	x0.125	0.37	0.32	0.70
	x0.25	0.44	0.35	0.73
	x0.5	0.26	0.36	0.80
	x1	0.23	0.00	0.65
Clopyralid	x0.125	0.27	0.14	0.69
	x0.25	0.35	0.54	0.72
	x0.5	0.35	0.49	0.65
	x1	0.00	0.00	0.00

Key Findings and Comments

- Similar to previous seasons the data highlights responses to herbicide treatments can vary between sites. At Curyo we observed significant yield loss in the chlorsulfuron x1 treatment, but no response at Pimpinio. Similar to Curyo, It is important to look at these results with caution as the dry spring conditions limited grain yields and also may have prevented continued uptake of the SU's which could have resulted in larger yield losses, reflective of the crop damage symptoms, similar to that observed in previous seasons in South Australia.

L5 Green Lentil Desiccation/Harvest Timing, MRZ Wimmera (Pimpinio), Victoria

Aim

To investigate the impact of crop-topping and harvest timing on the yield and quality on new green lentil varieties.

Treatments

Varieties: Boomer, PBA Greenfield, PBA Giant, PBA Ace (red lentil, control)

Treatments:

Treatment	Detail
Nil	No desiccant applied (Harvested at correct time)
Early Crop-top	Paraquat 250 @800ml /ha applied 7-14 days pre ryegrass milky dough stage.
Mid Crop-top	Paraquat 250 @800ml /ha applied at ryegrass milky dough stage ("Recommended").
Late Crop-top	Paraquat 250 @800ml /ha applied 7-14 days post ryegrass milky dough stage.
Delay Harv 1	Harvest delayed by at least 7 days
Delay Harv 2	Harvest delayed by at least 14 days

Other Details

Sowing date: 13 May
Row Spacing: 30cm
Stubble: Standing, approximately 30 cm (sown inter-row)
Fertiliser: MAP + Zn @ 80 kg/ha at sowing.
Plant Density: 120 plants/m^2

Results and Interpretation

- Key Message: Due to climatic conditions frost and dry conditions there was no effect of crop topping and harvest timing in 2014.

- Grain Yield and Quality – No significant response to desiccation and harvest timing treatments were observed in 2014. The mean grain yield of all green lentils was approximately 0.3t/ha and PBA Ace 0.5t/ha.

Key Findings and Comments

- Research will continue in 2015

L6 Disease Management (Green Lentils), MRZ Wimmera (Pimpinio), Victoria

Aim

To investigate the impact of crop-topping and harvest timing on the yield and quality on new green lentil lines.

Treatments

Varieties: Boomer, PBA Greenfield, PBA Giant, CIPAL0708 (Novel line), red lentil controls: Nipper, PBA Ace.

Treatments:

Treatment	Detail
Nil	No fungicides applied
Fortnightly	Apply chlorothalonil 720 fortnightly @ 2L/ha from 6-8 weeks after emergence (see table below). Continue application until mid-late podding. Include carbendazim 500ml/ha at canopy closure fortnightly following with the chlorothalonil spray
Canopy Closure	Apply carbendazim 500 @ 500ml/ha at canopy closure
Early Podding	Apply chlorothalonil 720 @ 2L/ha at early podding

Other Details

Sowing date: 13 May
Row Spacing: 30cm
Stubble: Standing, approximately 30 cm (sown inter-row)
Fertiliser: MAP + Zn @ 80 kg/ha at sowing.
Plant Density: 120 plants/m^2

Results and Interpretation

- Key Message: Combined results from the sowing date and disease management trials indicated PBA Blitz and PBA Greenfield were more severely affected by ascochyta blight than previously observed relative to other varieties. This has resulted in a drop in their disease ratings relative to other varieties.

- Growth, Disease and Grain Yield – Similar to the time of sowing trial, early plant growth was excellent due to the early rainfall and mild temperatures in late autumn and early winter. These conditions were also conducive to early Ascochyta blight development with similar varietal differences in Ascochyta infection observed (see trial L2). Despite the early incursion of Ascochyta Blight, symptoms did not progress throughout spring due to the extremely dry conditions. Growth also slowed during this period and the dry conditions combined with many frosts caused significant flower and pod abortion during the reproductive phase resulting in no effect of disease management treatments. The mean grain yield of green lentils (Boomer, PBA Greenfield and PBA Giant was 0.4 t/ha), compared with CIPAL0708 (0.25t/ha), Nipper (0.5 t/ha) and PBA Ace (0.8 t/ha).

Key Findings and Comments

- Combined results from the sowing date and disease management trials indicated PBA Blitz and PBA Greenfield were more severely affected by ascochyta blight than previously observed relative to other varieties. This has resulted in a drop in their disease ratings relative to other varieties. Research will continue in 2015

L7 Varieties, HRZ South West (Westmere), Victoria

Aim

To investigate the potential of new lentil varieties in the high rainfall zone of Victoria.

Experimental Details

Sowing date:	22 May.
Stubble:	Slashed.
Row Spacing:	20 cm.
Fertiliser:	MAP @ 60 kg/ha at sowing.
Plant Density:	120 plants/m^2.

Results and Interpretation

- Key Message: Lentils again produced profitable yields in the HRZ, but production risks are high and crops such as Faba beans and Lupins remain a better option.

- Similar to previous seasons growth of lentils was generally slow and lacked vigour. In the HRZ, due to cold conditions, it is essential to sow lentils in early May to achieve some early growth and maximise potential biomass and yield. Yields ranged between 0.93 and 1.54 t/ha, which could provide returns of more than $1000/ha based on the 2014 grain prices at $850/t (fixed management costs of $230/ha). Production risks, particularly related to waterlogging and acidic soils are high and crops such as Faba beans and Lupins remain a better option.

Table 1. Grain yield (t/ha) of Lentil varieties grown at Westmere, 2014 in comparison with 2013.

Variety	2014	2013
PBA Ace	1.54	1.82
CIPAL0901	1.51	
PBA HurricaneXT	1.37	
PBA Bolt	1.21	1.98
PBA Giant	1.21	1.78
CIPAL0715	1.15	
Nugget	1.13	1.85
Nipper	0.93	1.50
PBA Blitz		1.54

$Lsd(P<0.10)_{2014}$ – 0.40; $Lsd(P<0.05)_{2013}$ – ns

L8 Sowing Date, MRZ Mid North (Pinery), South Australia

Aim

To understand the agronomic performance of new lentil varieties under varying environments of early and delayed sowing times in South Australia.

Treatments

Varieties:	Boomer, Nipper, Nugget, PBA Ace, PBA Blitz, PBA Bolt, PBA Flash, PBA Herald XT, PBA Hurricane XT, PBA Jumbo, CIPAL1104 (PBA Greenfield), CIPAL1203 (PBA Jumbo 2), CIPAL1207 (PBA Giant), CIPAL1301, CIPAL1421
Sowing dates:	7th May and 5thJune, 2014

Other Details

Row Spacing:	22.5cm (9 inches)
Plot Size:	10m
Inoculums:	Nil
Soil Type:	Sandy loam / Limestone clay
Fertiliser:	MAP + Zn (2%) @ 90 kg/ha at sowing
Seed treatment:	P-Pickle T (200 ml/100 kg seed)
Foliar Fungicides:	Canopy Closure – Carbendazim @500 ml/ha, Chlorothalonil @2L/ha Mid flowering to Early Podding – Carbendazim @500 ml/ha, Chlorothalonil @ 2L/ha
Plant Density:	120 plants/m^2

Results and interpretation

Flowering

- Table 1 presents flowering date observations of lentil varieties at different sowing dates at Pinery. The time to flowering varied between varieties and sowing dates. PBA Blitz and the advanced breeding line CIPAL0901 were the earliest flowering varieties at the two sowing dates.
- Varieties flowered within similar intervals across sowing dates (Table 1).

Table 1: Date of first flower recorded for 15 lentil varieties sown at two different dates at Pinery 2014

	Sowing date	
Variety	**7-May**	**5-Jun**
PBA Jumbo	30-Aug	12-Sep
CIPAL1104	24-Aug	6-Sep
PBA Flash	22-Aug	4-Sep
Boomer	22-Aug	4-Sep
CIPAL0901	16-Aug	29-Aug
CIPAL1203	24-Aug	5-Sep
PBA Herald XT	4-Sep	17-Sep
PBA Hurricane XT	30-Aug	12-Sep
CIPAL1301	27-Aug	9-Sep
PBA Ace	27-Aug	9-Sep
Nipper	6-Sep	20-Sep
CIPAL1207	24-Aug	6-Sep
Nugget	2-Sep	15-Sep
PBA Blitz	18-Aug	29-Aug
PBA Bolt	21-Aug	3-Sep

Maturity

- Lentil maturity was significantly affected by sowing date (P =0.002) and variety (P <0.001) indicating a consistent pattern in maturity time for all varieties across the two sowing dates.
- Generally, a delay in sowing caused a delay in maturity time across all the 15 varieties.
- Averaged across sowing dates, the pattern of maturity time was characteristic of the varieties. However the magnitude of the differences in maturity time was not always distinct between varieties as would be expected (Figure 3). This was particularly true between the early and mid-maturing varieties where the trend in maturity time was compressed leaving no real differences. For example, the early maturing line PBA Blitz was the earliest maturing line in the trial, and was also equal to a number of varieties including PBA Jumbo 2, PBA Jumbo, and Nipper which are characteristically rated as mid-maturing varieties. This compressed trend in maturing time may have resulted from haying off due to an early dry spring.

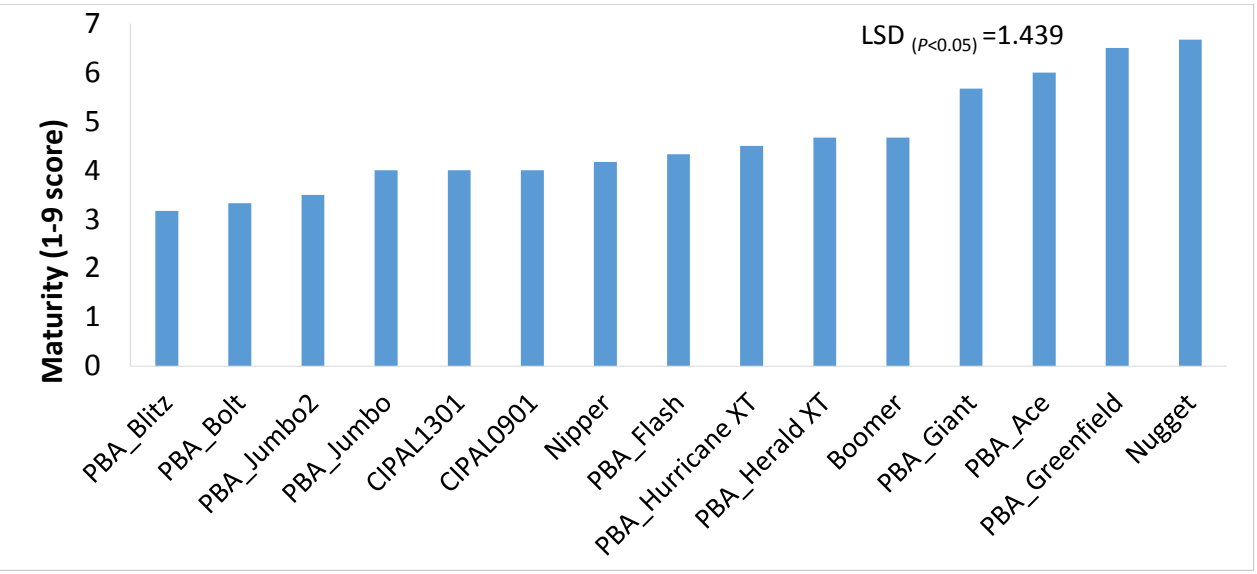

Figure 3: Maturity of 15 lentil varieties at Pinery, South Australia 2014. Varieties are ranked in order of maturity from earliest to latest. Maturity score: 1 = early, 9 = late.

Lodging

- There was a significant (P<0.001) sowing date by variety interaction for lodging resistance (9= erect, 1 = flat). This suggests that varieties differed in their levels of lodging resistance however the differences were dependent on sowing date (Figure 4).
- The early sowing date increased plant lodging greatly over the delayed sowing treatment in all varieties, with no variety showing acceptable standing ability (score of 6 or greater at this timing). All varieties exhibited an acceptable standing ability at the later sowing date.
- Across both sowing dates, PBA Blitz showed the most lodging, but generally variety discrimination in this trial was low.

Grain Yield

- A sowing date by variety response (P <0.001) was identified for grain yield indicating that there was a significant difference in grain yields between varieties however the magnitude of these differences differed with the time of sowing (Figure 5).
- The mid maturing PBA Jumbo 2 and early/mid maturing PBA Flash were the highest yielding varieties with 2.81 t/ha and 2.7t/ha at the early time of sowing respectively. The mean yields of these two varieties were however statistically similar to PBA Bolt (2.75), CIPAL1301 (2.66), PBA Hurricane XT, CIPAL0901 (2.57) and PBA Greenfield (2.53) at this sowing.
- A delay in sowing saw no yield advantage for these high yielding varieties and varieties like PBA Flash incurred the highest yield penalty with the delay in sowing (24%).
- The mid/late maturing Boomer yielded significantly lower than all varieties at the early time of sowing.
- The mid/late maturing Boomer and mid maturing PBA Jumbo were shown to have a slight yield advantage when sown late, a result which was dissimilar from all other varieties.

- On the other hand, mid/late maturing PBA Herald XT had the lowest yields compared to all the varieties at the later time of sowing.

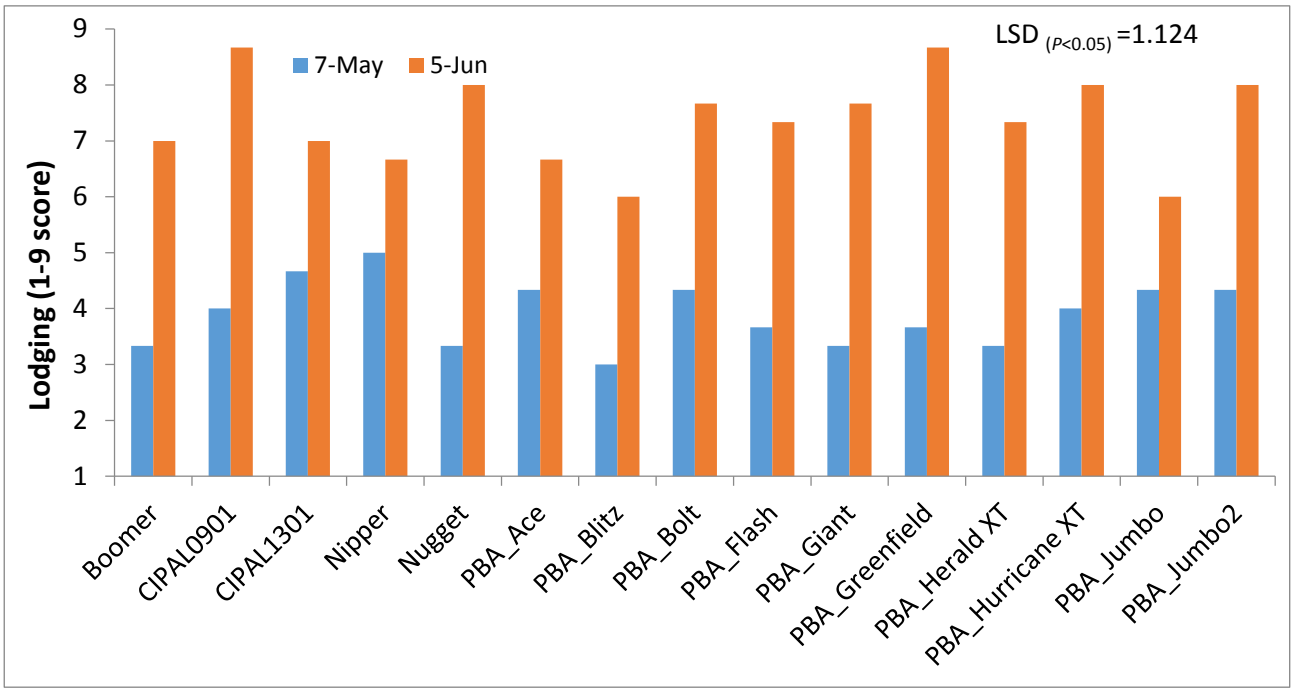

Figure 4: Lodging scores of 15 lentil varieties at two different times of sowing; Early (7th May) and Late (5th June) at Pinery, South Australia 2014. Lodging score:1=flat, 9= erect.

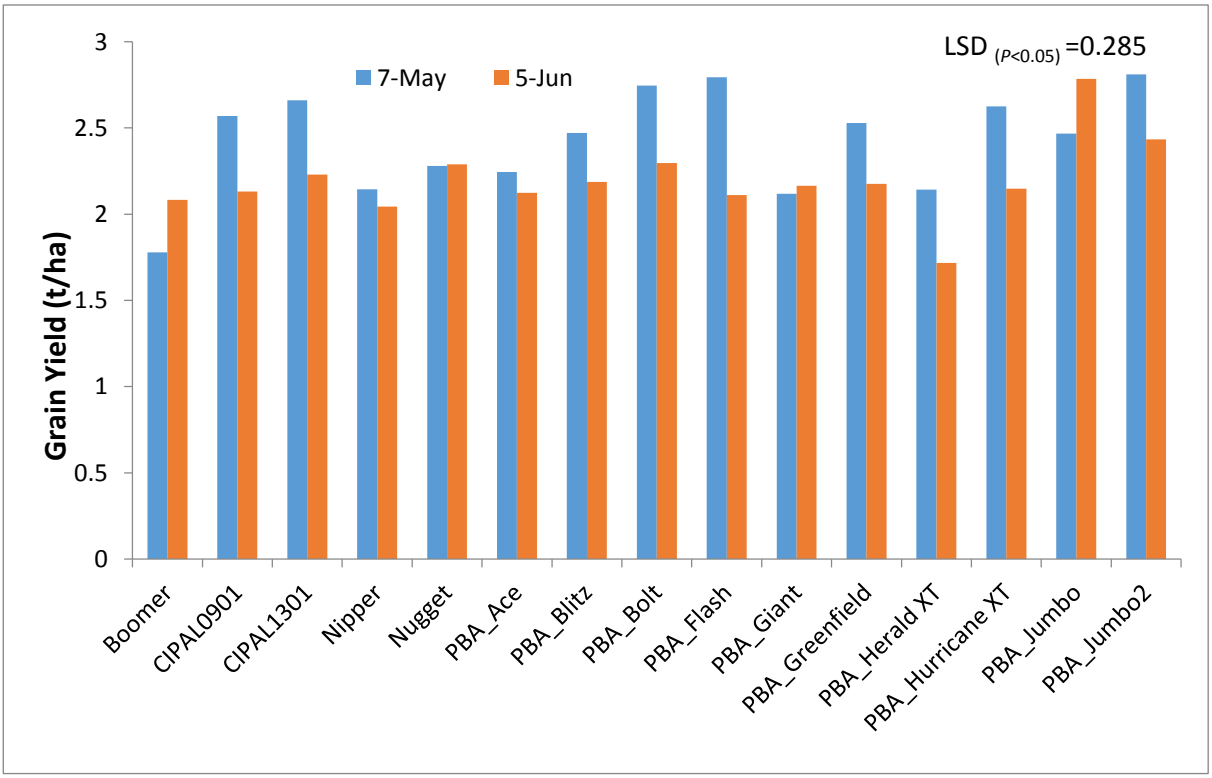

Figure 5: Grain yield (t/ha) of 15 lentil varieties sown at two different sowing times Early (7th May) and Late (5th June) at Pinery, South Australia 2014.

Key findings and comments

- Under quick dry spring finishing conditions, varieties may not always finish characteristic to their maturity rating. Differences between varieties in terms of early, mid and late maturity rating may not always be clearly defined. Instead, there is a trend of varieties to 'hay off' with selected mid-maturing varieties including PBA Jumbo 2 maturing similar to the early maturing varieties.
- The sowing date by variety response for grain yield showed that in the environment tested, varieties yielded differently depending on time of sowing whereby some: a) yielded higher when sown early with no real yield advantage when sown late (PBA Jumbo 2, PBA Hurricane XT, PBA Greenfield, PBA Flash, CIPAL0901 and CIPAL1301); b) had a yield advantage at a later sowing as opposed to early sowing (Boomer and PBA Jumbo) and c) showed no yield response to varying sowing date (Nipper, Nugget, PBA Ace and PBA Giant). This result is consistent with previous findings and suggest some varieties are poorly suited to early sowing.
- Plant lodging at maturity was increased past unacceptable levels in all varieties when sown at the early date. This is likely to reduce harvestability, increase harvest times and potentially affect yield and disease levels and must be considered when sowing lentils early.

L9 Sowing Density X Sowing Date, MRZ Mid North (Pinery) and MRZ Yorke Peninsula (Melton), South Australia

Aim

To evaluate the optimum sowing density of new 'high biomass' lentil varieties alongside older varieties at two sowing dates.

Treatments

Varieties:	Nugget, PBA Ace, CIPAL1203 (PBA Jumbo 2), CIPAL 1207 (PBA Giant), CIPAL1104 (PBA Greenfield), Boomer
Sowing dates:	Pinery - 7th May and 5th June and Melton - 16th May and 18th June
Sowing densities:	60, 80, 100, 120 and 140 plants/m^2.

Other Details

Row Spacing:	22.5cm (9 inches)
Plot Size:	12m
Fertiliser:	MAP + Zn (2%) @ 90 kg/ha at sowing
Foliar Fungicides:	Canopy Closure –Carbendazim @500 ml/ha, Chlorothalonil @2 L/ha Mid flowering to Early Podding – Carbendazim @500 ml/ha, Chlorothalonil @ 2 L/ha
Soil type:	Pinery-Sandy loam / limestone clay; Melton- Sandy clay loam over light clay
Inoculums:	Nil
Seed treatment:	PPT

Results and interpretation

Maturity

- A significant sowing time by variety response was identified for maturity time at the two sites indicating that the maturity time of the six varieties differed and was dependent on time of sowing.
- PBA Jumbo 2 was the earliest maturing variety at the early time of sowing. This variety also showed the greatest delay in maturity when sowing was delayed across all densities at the two sites, but was still relatively early (Figure 1 & 2).
- Nugget and PBA Greenfield were the equal later maturing varieties at the early time of sowing. Nugget matured significantly later than all other varieties across the two sites.
- As sowing densities were increased the maturity time of varieties was advanced, this was observed at both sites (data not shown).

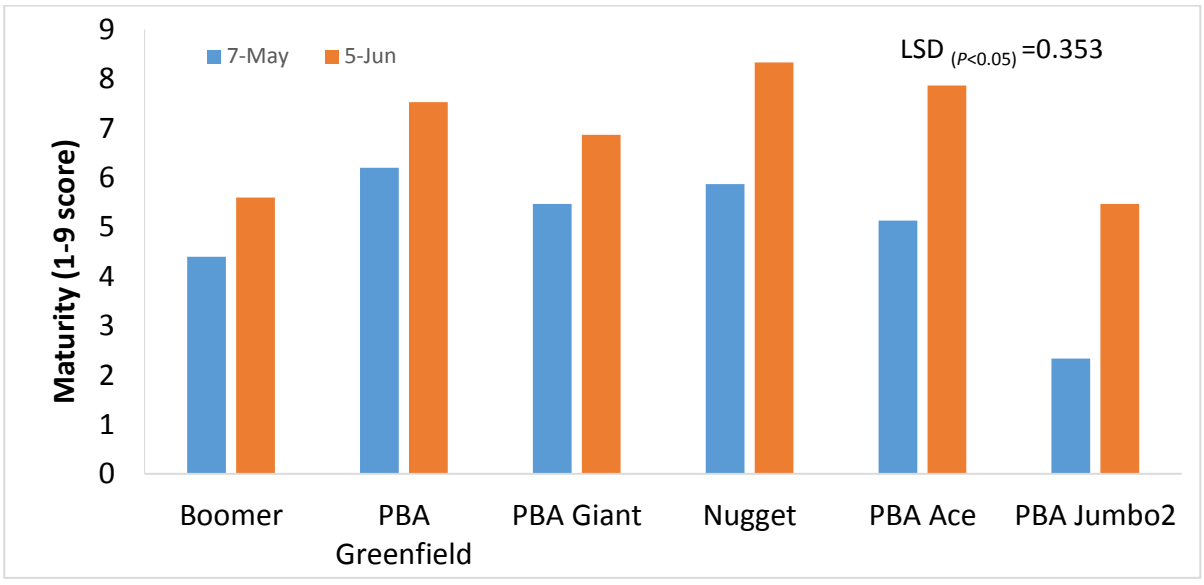

Figure 1: Maturity of 6 lentil varieties sown at Pinery, South Australia, 2014. Maturity score: 1 = early, 9 = late.

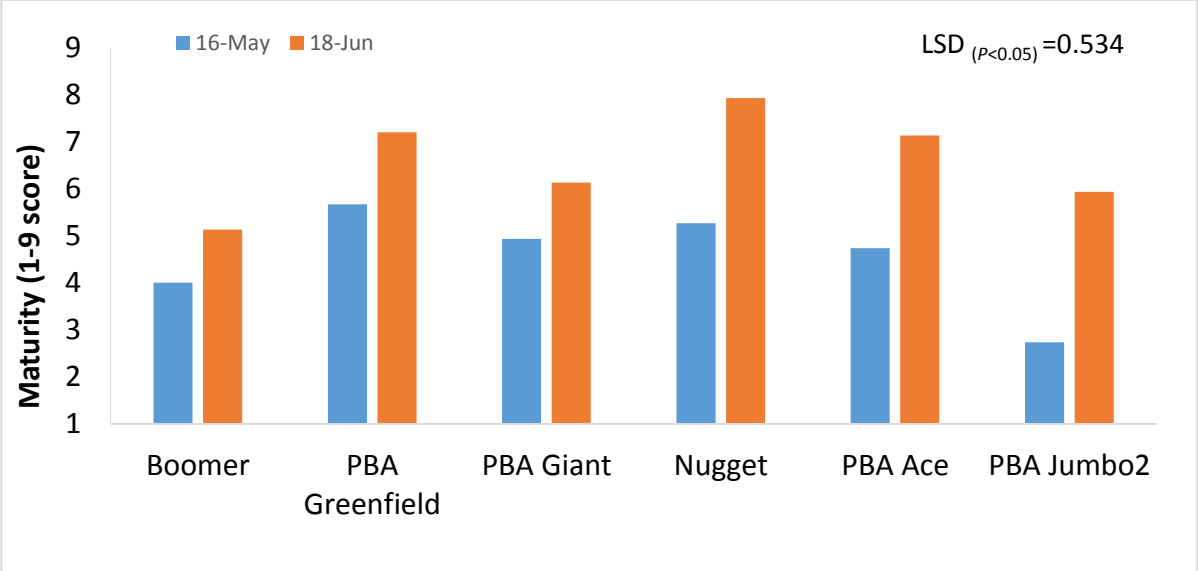

Figure 2: Maturity of 6 lentil varieties sown at Melton, South Australia, 2014. Maturity score: 1 = early, 9 = late

Lodging

- Lodging resistance scores at Pinery, showed significant time of sowing (P<0.001) and variety type (P=0.002) effects suggesting that the differences in the levels of lodging resistance between varieties remained similar across the two sowing times.
- Resistance to lodging was improved by 72% across all varieties when sowing was delayed at Pinery.
- PBA Jumbo 2 and PBA Greenfield showed equal higher lodging resistance to other varieties while Boomer had the lowest level of lodging resistance compared only to the these two varieties at Pinery (Figure 3).
- A significant time of sowing by variety response (P<0.001) was observed for lodging resistance at Melton. This indicates that there were differences in levels of lodging between varieties and that these differences were dependent on time of sowing.
- At the early time of sowing, Boomer showed lower lodging resistance to PBA Greenfield and PBA Jumbo 2 and to all varieties with delayed sowing. This variety showed less improvement in lodging from delayed sowing.
- Increasing sowing densities significantly (P=0.001) increased the susceptibility to lodging for all varieties at Melton (data not shown). At Pinery, varying sowing density had no effect on lodging resistance and on average varieties were rated as having acceptable standing ability of 6.
- Generally, all varieties showed reduced lodging from delayed sowing across the two sites.

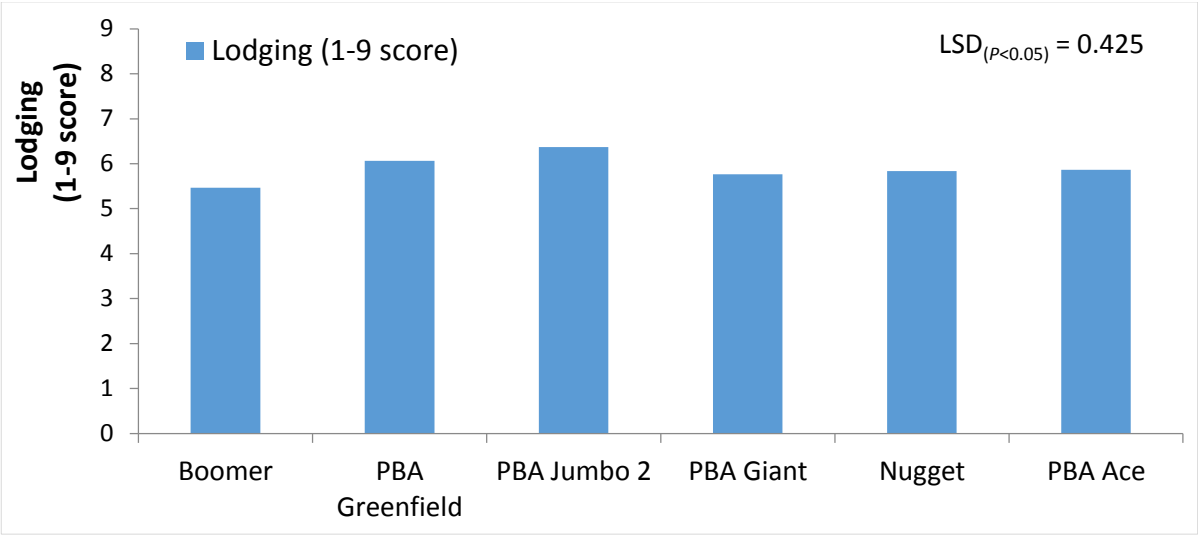

Figure 3: Lodging resistance of 6 lentil varieties sown at Pinery, South Australia, 2014. Lodging score score: 1 = flat, 9=erect

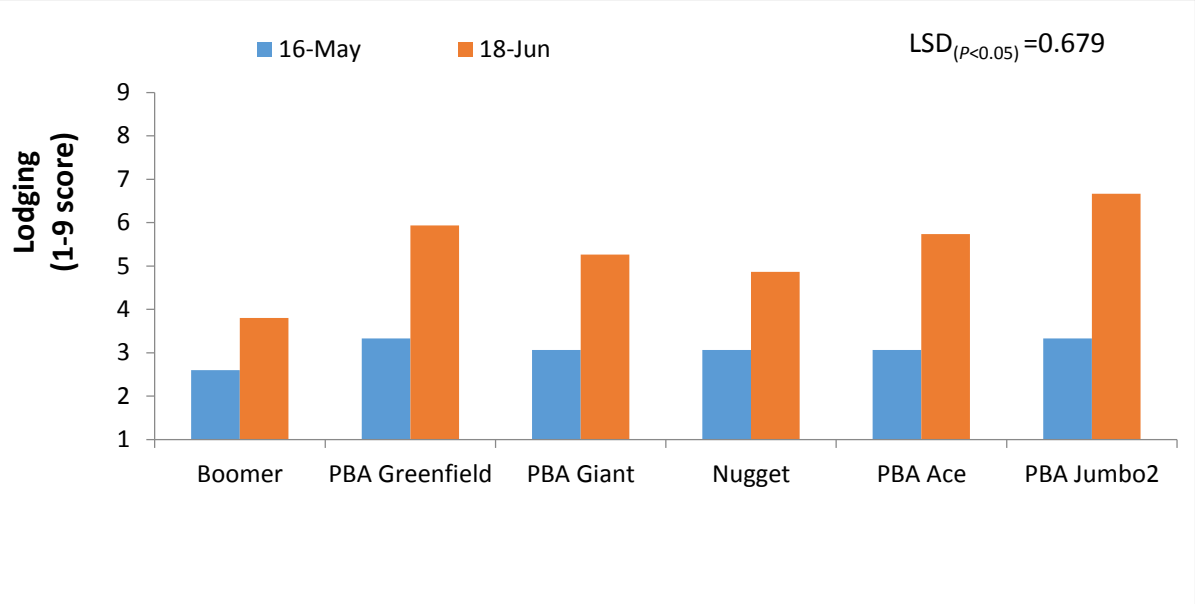

Figure 4: Lodging resistance of 6 lentil varieties at two different sowing times at Melton, South Australia, 2014. Lodging score score: 1 = flat, 9=erect

Grain Yield

- Grain yield was affected by a number factors showing different significant two way interactions across the two sites. At Pinery, these interactions were a) timing by variety (P<0.001, b) timing by density (P=0.003), and variety by density (P =0.024). At Melton these interactions were a) timing by variety (P =0.018) and b) timing by density (P=0.044).
- At Pinery, PBA Greenfield, PBA Giant, PBA Ace, PBA Jumbo 2 and Nugget yielded higher and equal when sown early, with a mean yield of 2.24 t/ha, compared with Boomer (1.61 t/ha). Delayed sowing led to a yield penalty for PBA Greenfield (40%), Nugget (36%) and PBA Jumbo 2 (39%) (Figure **5**5).
- At Melton, PBA Greenfield (3.06 t/ha) and PBA Jumbo 2 (2.71 t/ha) yielded higher when sown early and were significantly higher than the other four varieties which showed no sowing date response (Figure6).
- Sowing time by density interactions were found for grain yield at both Pinery and Melton however, these interactions showed only low and inconsistent differences between the densities evaluated. The current recommendation of 120 live plants/m^2 achieved relatively similar yields to other densities across all varieties and sowing times.
- At Pinery, Boomer showed a trend of declining yields at high densities averaged across sowing times (Figure 7). Lower sowing densities (100 plants/m^2) may be considered to maintain yields in this variety which is prone to increased lodging and reduced yields from early sowing over other varieties.

Key findings and comments

- The recommended sowing density targeting 120 live plants/m^2 maintained high yields for all varieties at both sowing timings across the two sites.
- Lower sowing densities of 100 plants/m^2 may be considered for Boomer at Pinery where yields were found to decline as plant density increased.

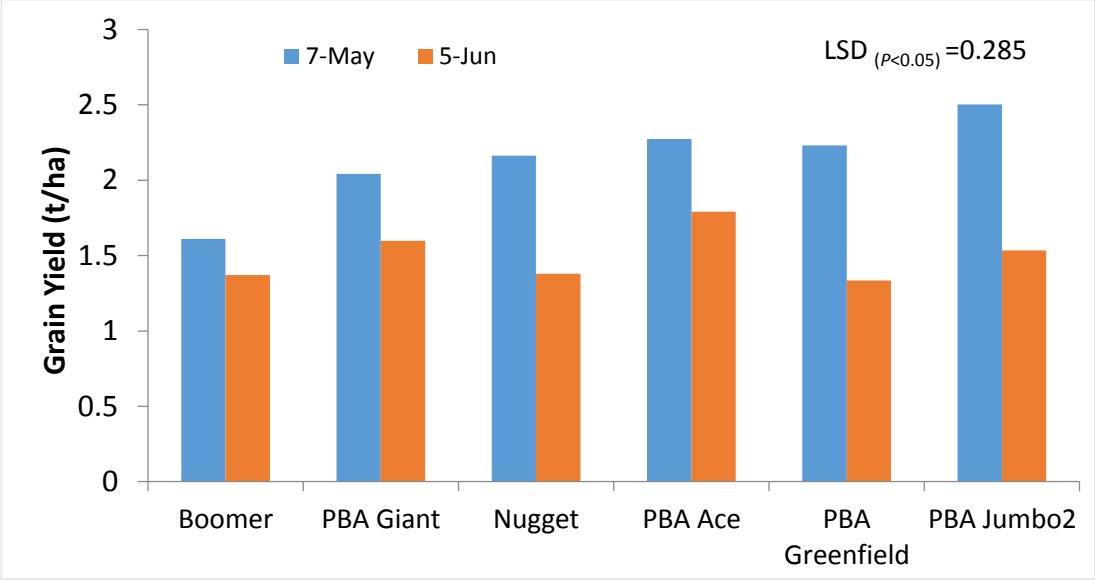

Figure 5: Grain yield (t/ha) of 6 lentil varieties at different sowing times at Pinery South Australia, 2014.

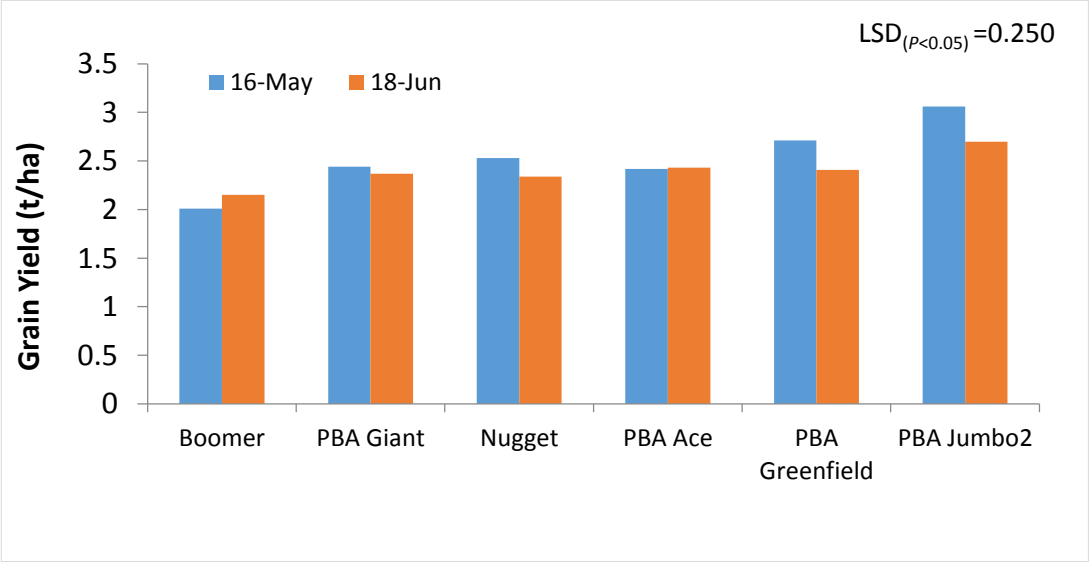

Figure 6: Grain yield (t/ha) of 6 lentil varieties at different sowing times at Melton South Australia, 2014.

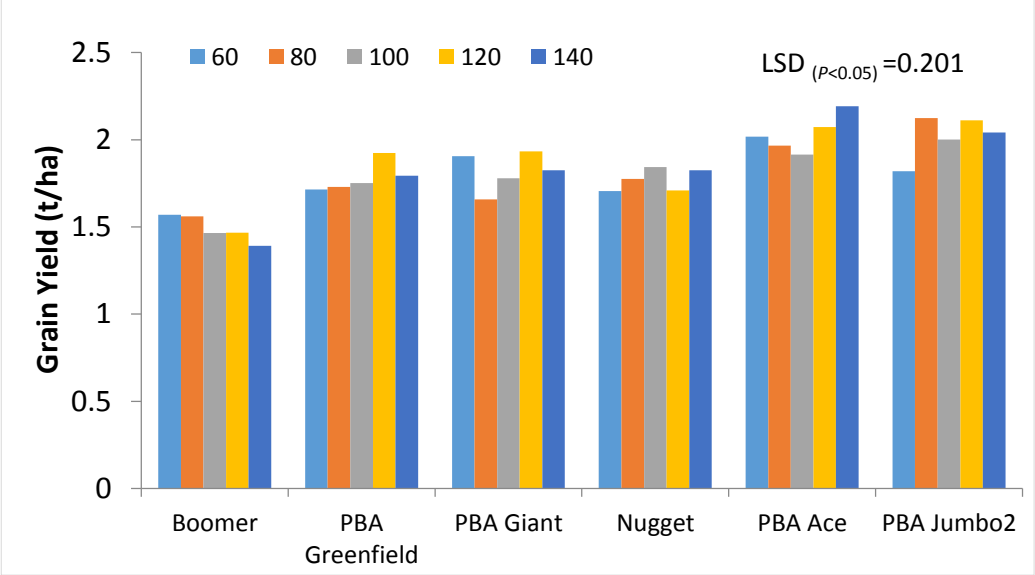

Figure7: Grain yield (t/ha) of 6 lentil varieties under different sowing densities averaged across two sowing times at Pinery, South Australia, 2014.

L10 Group B Residual Herbicide Tolerance, MRZ Mid North (Pinery), South Australia

Aim

1. To assess the effect of various residual group B chemistries on growth and yield of tolerant and susceptible lentil varieties, and
2. To confirm in-crop tolerance of some group B chemistries applied post-emergence on Group B herbicide improved XT varieties and advanced lentil breeding lines compared with conventional standards.

Treatments

Varieties, Nipper (rated susceptible to Group B herbicides); PBA Hurricane XT, CIPAL1208, CIPAL1209, CIPAL1423 (improved tolerance to some Group B herbicides).

Residual group B Chemistry and application details are presented in Table 1 – Residue levels of Group B carry-over were simulated by allocating half, quarter and eighth rates of an appropriate application rate for each chemistry in cereals but applied pre-sowing on the 25th of March 2014. Post sowing pre-emergence (PSPE) and post-emergence (PE) treatments were also included.

*****Some of the herbicide treatments in this research contain unregistered herbicide, application rates and timings and were undertaken for experimental purposes only. The results within this document do not constitute a recommendation for that particular use by the author or author's organisation.***

Table 1: Treatments (applied as residual, post sowing pre-emergent (PSPE) and post-emergent (PE), timing and application dates for lentil Group B herbicide tolerance trial sown at Pinery South Australia, 2014.

Active Ingredient	Application Timing	Application Rate
Nil	-	-
Chlorsulfuron	PSPE	0.5x
Chlorsulfuron	Residual	0.5x
Chlorsulfuron	Residual	0.75x
Chlorsulfuron	Residual	1x
Chlorsulfuron	Residual	1.25x
Chlorsulfuron	Residual	1.5x
Metsulfuron	PSPE	0.5x
Metsulfuron	Residual	0.5x
Metsulfuron	Residual	1x
Metsulfuron	Residual	1.5x
Metsulfuron	Residual	2x
Metsulfuron	Residual	3x
Imazethapyr	PE	1x
Imazethapyr	PE	4x
Imazapyr	PE	1x
Imazapyr	PE	4x

Other Details

Row Spacing: 22.5cm (9 inches)
Stubble: Nil
Fertiliser: MAP + Zn (2%) @ 90 kg/ha at sowing
Seed Treatment: P-Pickel T (200ml/100kg seed)
Foliar Fungicides: Canopy Closure –Carbendazim @500ml/ha, Chlorothalonil @2L/ha
Mid flowering to Early Podding – Carbendazim @500ml/ha, Chlorothalonil @ 2L/ha
Plant Density: 120 plants/m^2
Soil Type: Sandy loam / Limestone clay
Plant damage assessment timings: 18th August 2014; 28th October 2014

Results and interpretation

Plant damage

- A significant (*P*<0.001) treatment by variety interaction was found for plant damage which showed that varieties differed in the level of plant damage and was dependent on the herbicide chemistry.
- PBA Hurricane XT and the advanced lentil breeding line CIPAL1421 showed similar and significantly lower damage with chlorsulfuron, at both PSPE and residual rates, compared to other varieties whose level of damage differed amongst each other. Nipper and CIPAL1208 showed similar and significantly higher damage from the application of all rates of chlorsulfuron (both residual and PSPE), while CIPAL1209 showed an intermediate level of damage (Figure 6).
- Nipper showed significant plant damage from post emergence application of all rates of imazethapyr and imazapyr compared to other varieties which generally had similar damage.
- Imazethapyr (low and high rates) and imazapyr (low rates) applied post emergence caused no damage to PBA Hurricane XT along with the two breeding lines CIPAL1421 and CIPAL1209 whereas low (<10%) but equal damage was observed in CIPAL1208.
- Imazapyr chemistry applied post emergence is the only treatment that caused a somewhat high level of damage (30%) to PBA Hurricane XT compared to all other chemistries tested.

Grain yield

- There was a significant (*P*<0.001) treatment by variety response for grain yield which indicated that varieties yielded differently and the nature of these differences depended on herbicide chemistry.
- PBA Hurricane XT and CIPAL1421 yielded similarly across most of the treatments including their respective nil treatments, although not always the case in some treatments (Figure2). This indicates that these two varieties are likely to be under the same genetic control for herbicide tolerance. Notably, neither variety yielded differently to their respective Nil treatments.
- PBA Hurricane XT and CIPAL1421 were the equal higher yielding varieties compared to other varieties in nil treatments.
- The intolerant Nipper variety suffered over 90% yield loss from the application of PSPE and residual rates of chlorsulfuron. In comparison, PBA Hurricane XT suffered no yield loss at similar rates and treatment.
- At rates evaluated chlorsulfuron caused a greater level of plant damage and grain yield loss than on conventional lentils than metsulfuron. A linear response for yield loss to metsulfuron rate was observed in the conventional variety Nipper, this was opposed to chlorsulfuron treatment where yields of Nipper remained consistently low across all rates (**Error! Reference source not found.**).

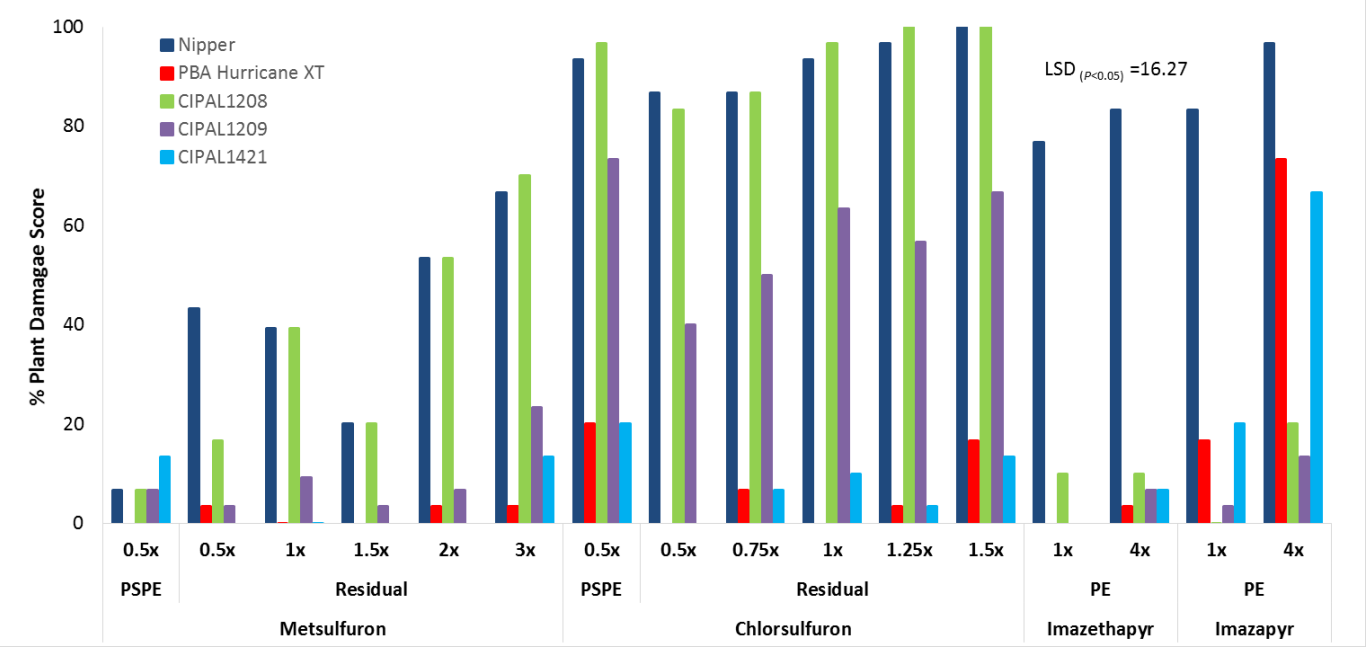

Figure 6: Effect of various Group B chemistries and application rates on damage score of four lentil lines at Pinery, 2014. Damage score: 0-50 = increasing levels of chlorosis. 50-100 = increasing levels of necrosis and plant mortality. 100 = whole plot dead.

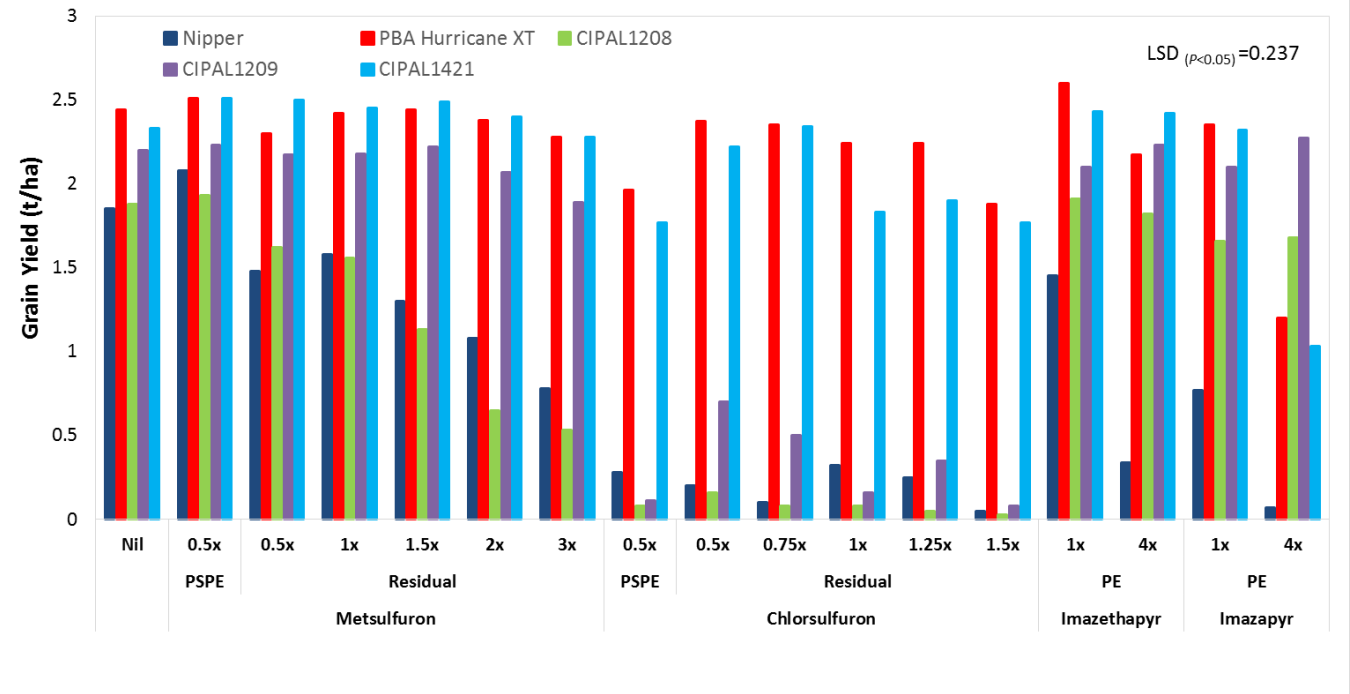

Figure 2: Effect of various Group B chemistries and application rates on grain yield of five lentil lines at Pinery, 2014.

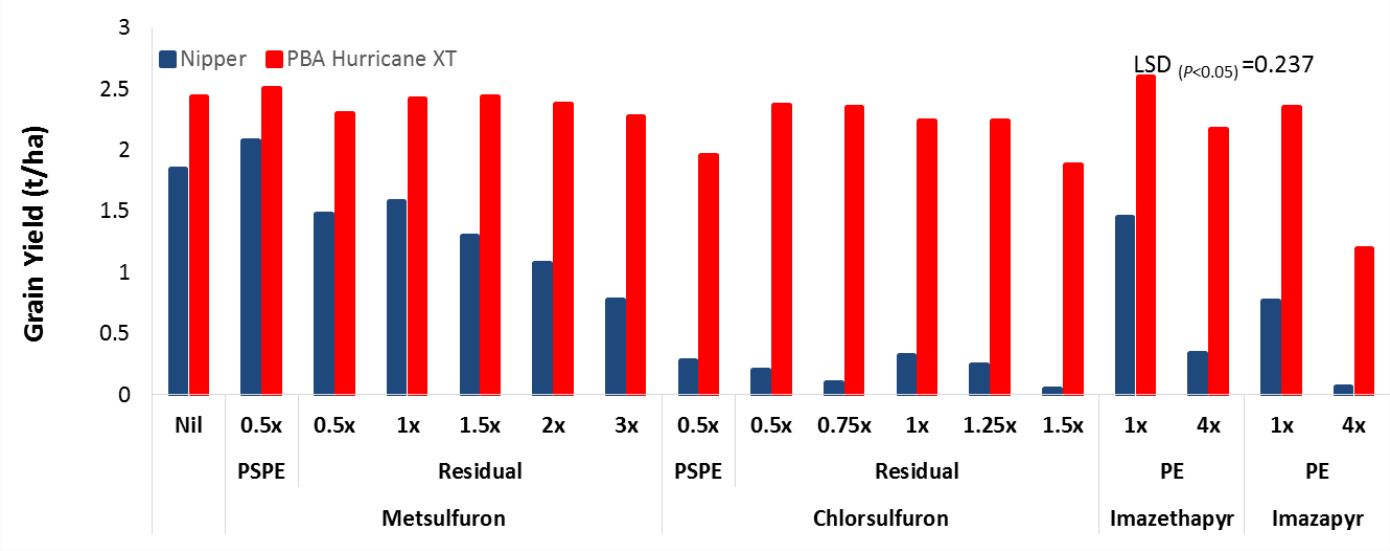

Figure 3: Effect of various Group B chemistries and application rates on grain yield of PBA Hurricane XT (tolerant variety) and Nipper (Intolerant variety) at Pinery, 2014.

Key findings and comments *(incorporating findings from previous experiments in 2012 & 2013 at Arthurton, Pinery and in Victoria)*

- Response of lentils to herbicide treatments varied with seasonal conditions, method of herbicide incorporation, stubble coverage, soil texture and fertility.
- Treatments that showed high plant damage generally incurred high yield losses, however low levels of chlorosulfuron plant damage still resulted in significant yield loss in some trials.
- XT lentil varieties showed improved tolerance compared to conventional lentil varieties to all treatments, however they still incurred yield loss to some chemistries under certain conditions, indicating low safety margins to these chemistries.
- Imazethapyr chemistry caused variable losses to the conventional varieties. Previous trials have reported between 6 and 52% yield loss from the application of the lowest rate of imazethapyr whilst highest rates (4x), though not recommended, have shown no yield loss in XT varieties.

- High rates of imazapyr have caused significant yield losses in XT varieties in previous trials but has had less effect on tolerant lines under different genetic control such as CIPAL1209, indicating a potential different registration opportunity for these lines if released.
- Chlorsulfuron and triasulfuron were the most damaging treatments in the trials. Metsulfuron was found to be the safest of the sulfonylurea chemistries tested.
- **Importantly, existing product labels, plant-back periods and directions for use must still be adhered to. Although the current and previous results indicate that XT varieties show improved tolerance to residual Group B chemistries compared to conventional varieties, it is worth noting that a yield loss was still incurred in some situations such as application of high rates of imazapyr as observed in this trial. This indicates a low safety margin to this chemistry. As such further research is required to identify if sufficient crop safety exists in XT lentils to seek changes to label recommendations for other Group B herbicides.**

L11 Lentil Crop-topping, MRZ Yorke Peninsula (Melton), South Australia

Aim

To assess the agronomic practice of 'crop topping' at multiple application timings on grain yield and grain weight of lentil varieties varying in plant maturity.

Treatments

Varieties:	see Table 1.
Treatments:	see Table 1 for crop topping application timing and dates Nil - no desiccant applied Early - applied approximately two weeks prior to the ryegrass milky dough stage Mid/Recommended - applied at the ryegrass milky dough stage NB: A late treatment was not applied in 2014 due to the dry and rapid finish to the season.

Other Details

Sowing date:	29th May
Fertiliser:	MAP + Zn (2%) @ 90 kg/ha at sowing
Seed Treatment:	P-Pickel T (200ml/100kg seed)
Foliar Fungicides:	Canopy Closure –Carbendazim @500 ml/ha, Chlorothalonil @2 L/ha Mid flowering to Early Podding – Carbendazim @500 ml/ha, Chlorothalonil @ 2 L/ha
Plant Density:	120 plants/m^2
Soil Type:	sandy clay loam over light clay

Results and Interpretation

Grain yield

- A significant treatment effect was found for grain yield. Grain yields were high and averaged 3.01 t/ha across the trial.
- All varieties showed a yield penalty from crop-topping eight days prior to the recommended timing (ryegrass milky dough stage), averaging a 21% yield loss for all varieties compared to the nil treatment. PBA Ace showed the highest yield loss at this application timing.
- Mid to late maturing varieties PBA Hurricane XT, CIPAL1423, CIPAL1422 and mid maturing variety (CIPAL1404) were the only varieties to show a yield loss at the recommended crop-top timing (highlighted in Table 1).

Grain weight

- All varieties showed a reduced grain weight from crop topping eight days prior to the recommended timing, averaging a 13% loss in grain weight.
- Crop topping at the recommended time had no effect on grain weight in any variety.

Key findings and comments

- Most varieties yielded did not incur yield loss from crop topping at the recommended timing indicating that they were well suited to crop topping at the recommended timing for rye grass control in 2014 where the season finished rapidly due to dry conditions.
- As found in previous seasons there is not always a direct correlation between variety flowering and maturity timing and yield loss due to crop-topping.
- The four varieties that incurred yield loss at the recommended crop top timing in 2014 were rated as mid to late maturing as were a number of other varieties which did not incur yield loss in 2014. Further assessment of these varieties and other mid to late maturing varieties under seasonal conditions with more favourable finishes is required.

Table 1: Effect of crop-top timing on grain yield and grain weight of lentil varieties at Melton, South Australia 2014. Varieties are ranked in order 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	- 2 wks (15/10)	Recommended (23/10)	Nil	- 2 wks (15/10)	Recommended (23/10)
PBA Blitz	E-M	E	2.97	75	95	4.8	89	100
CIPAL1401	M	E	3.33	75	101	3.9	89	101
CIPAL1403	M	M	3.15	77	96	3.6	86	102
CIPAL1402	M	M	3.12	72	98	3.3	86	99
CIPAL1301	M	M	3.23	73	101	4.0	87	101
CIPAL1421	E-M	M	2.90	73	103	5.1	86	100
PBA Jumbo2	M-L	M	3.43	73	100	4.5	90	104
CIPAL1404	M-L	M	3.05	76	84	4.1	87	103
CIPAL1405	M-L	M-L	3.03	66	99	4.2	81	103
PBA Jumbo	M	M-L	2.68	74	107	4.5	81	102
PBA Hurricane XT	M-L	M-L	3.07	70	88	3.4	88	102
PBA Ace	M	M-L	3.04	54	90	4.4	83	98
CIPAL1423	E-M	M-L	2.71	73	88	3.8	86	100
CIPAL1422	M	M-L	3.18	65	85	4.1	86	99
Boomer	E-M	M-L	2.47	71	96	5.7	93	104
CIPAL1207	E-M	M-L	2.83	73	99	6.2	93	103
CIPAL1104	M	M-L	3.08	64	98	5.1	86	99
Mean			**3.01**	**71**	**96**	**4.4**	**87**	**101**

LSD $_{(P<0.05)}$ Treatment 0.200 (grain yield)

NB: shading indicates a significant difference from the nil treatment.

Field Peas

F1 Historic Varieties, LRZ Southern Mallee (Curyo), Victoria

Aim

To compare the growth, grain yield and gross margins of recently released field pea varieties with historical varieties.

Treatments

Varieties:	See Table 1 below

Other Details

Sowing date:	2 May
Row Spacing:	36 cm
Stubble:	Standing (approximately 15 cm), sown inter-row
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing
Plant Density:	120 plants/m^2
Soil type:	Soil Type: Alkaline Sandy Loam over a heavy clay at about 40-60cm (Table 1 in Trial L1 above)

Results and Interpretation

- Key Message: The trial highlights the advancements made through breeding, with most modern varieties at least 25% higher yielding than Dundale, despite the extreme weather conditions (dry spring and frosts). In most cases this resulted in gross margins improved by more than 100% in 2014.
- Plant establishment – Similar to lentil trials at Curyo, emergence occurred within 2 weeks of sowing, due to the early rainfall. Establishment ranged between 30 and 40 plants/m^2 (data not shown).
- Plant growth, Flowering and Maturity – Growth until August was good, however the dry and cold conditions throughout August and September slowed growth and reduced grain yields. Generally there was little or no disease present. Flowering dates ranged from August 2 for PBA Percy to August 21 for Kaspa, with frost event in early August causing some loss of flowers in the earlier flowering lines. Maturity groupings showed a very different trend to flowering, with some of the earlier flowering types like Sturt and PBA Percy having a mid-maturity rating similar too or only slightly earlier than the later flowering Kaspa and Morgan.
- Grain Yield and Profitability – Grain yields ranged from 0.60 to 1.20 t/ha, with varieties that are known to perform well in dry seasons (eg Sturt and PBA Oura) having the highest yields in this trial (Table 1). Generally, the more recently released varieties were highest yielding, significantly more than the traditional older varieties such as Dundale and Parafield. For example PBA Pearl and PBA Wharton were 27% and 32% higher yielding that Dundale, respectively. This results in a much greater gain in gross margins, where PBA Pearl and PBA Wharton were 108% and 90% greater than Dundale. Gross margins for all varieties were above break even level ranging from $22/ha to $212.

Key Findings and Comments

- Significant advancements have been made through breeding as highlighted in this trial. Despite the extreme weather conditions (dry spring and frosts), most modern varieties were at least 25% higher yielding than Dundale. In most cases this resulted in gross margins improved by more than 100% in 2014.
- Sturt has been one of the most stable yielding varieties and is always one of the highest yielding in dry seasons or those with extreme weather events. In higher yielding season it tends to drop behind many other varieties.

Grain yields were not well correlated with flowering time, flowering duration maturity. There was a slight trend towards the higher yielding varieties having earlier flowering and maturity.

Table 1. Flowering, Maturity, Grain Yield, Grain Weight and Gross Margins of field pea varieties at Curyo in 2014. Percentage increase in Grain yield and Gross Margins relative to Dundale indicated. *Gross Margin based on grain prices at $330/t with fixed management costs of $180/ha*.

Variety	Anthesis (date)	Maturity (grouping)	Grain Yield (t/ha)	% inc	Grain Weight (g/100seed)	Gross Margin ($/ha)[1]	% inc
Sturt	6/8	3	1.19	53	18.3	212	177
PBA Oura	14/8	1	1.18	51	20.6	209	172
OZP1208	19/8	5	1.11	43	21.5	187	143
Mukta	19/8	6	1.08	38	20.5	175	128
PBA Percy	2/8	3	1.06	36	22.9	168	120
PBA Coogee	15/8	5	1.03	33	21.2	161	110
PBA Pearl	11/8	1	1.03	32	20.5	160	108
Alma	13/8	5	0.99	27	20.9	146	90
PBA Wharton	17/8	3	0.99	27	20.6	146	90
OZB1308	14/8	4	0.93	19	18.7	126	64
Bluey	5/8	2	0.91	17	20.2	121	57
Parafield	14/8	5	0.88	13	21.1	109	43
Snowpeak	4/8	4	0.85	9	18.1	99	29
PBA Gunyah	17/8	3	0.84	8	21.8	98	28
King	19/8	6	0.81	4	20.1	86	12
Kaspa	21/8	4	0.80	3	21.1	85	11
Dundale	13/8	6	0.78	0	17.5	77	0
Bohatyr	6/8	5	0.78	0	21.3	76	-1
Morgan	18/8	3	0.75	-3	17.9	69	-10
Excell	5/8	6	0.61	-21	22.0	22	-71
lsd (*P*<0.05)			0.36		1.17		
cv			7.8		1.2		

F2 Crop Topping/Harvest timing (Blue pea focus), LRZ Southern Mallee (Curyo), Victoria

Aim

To compare the growth, grain yield of potential new blue field varieties.

Treatments

Varieties: OZB1308, OZB1310, OZB1311, OZB1315, OZB1324, Excell (blue, control), PBA Pearl (White), Kaspa (Dun).

Treatments:

Treatment	Detail
Nil	No desiccant applied (Harvested at correct time)
Mid Crop-top	Paraquat 250 @800ml /ha applied at ryegrass milky dough stage ("Recommended").
Delay Harv 1	Harvest delayed by approximately 7 days
Delay Harv 2	Harvest delayed by approximately 14 days

Other Details

Sowing date: 2 May
Row Spacing: 36 cm
Stubble: Standing (approximately 15 cm), sown inter-row
Fertiliser: MAP + Zn @ 60 kg/ha at sowing
Plant Density: 40 plants/m^2
Soil type: Soil Type: Alkaline Sandy Loam over a heavy clay at about 40-60cm (Table 1 in Trial L1 above)

Results and Interpretation

- Key Message: The new blue lines showed yield 30% to 75% higher than Excell, with some lines having better or similar quality characteristics to Excell.
- Plant establishment – Establishment ranged between 30 and 40 plants/m^2 (data not shown).
- Plant growth, Flowering and Maturity – Growth until August was good, however the dry and cold conditions throughout August and September slowed growth and reduced grain yields. As with other trials, there was little or no disease present. All of the new blue lines appeared to have excellent growth and plant habits, much better than Excell. Flowering dates were generally within 2-3 days of PBA Pearl (see Table 1, trial F1). Maturity, except OZB1315, was slightly later than PBA Pearl.
- Grain Yield and Grain Weight – Due to the extremely dry finish to the season there was no significant impact of harvest treatment on grain yield, weight and seed quality. Grain yields of the new blues ranged from 0.93 to 1.25 t/ha, all significantly higher than Excell (0.71t/ha) and Kaspa (0.79t/ha) (Table 1). In this trial, PBA Pearl had yields of 1.56t/ha, which is 0.5t/ha higher than in the variety trial (F1. Above); reasons for this difference are unclear. Unfortunately, the higher yielding blue peas were the smallest seeded lines.

Table 1. Grain Yield and Grain Weight new blue field pea lines at Curyo in 2014 compared with Excell (Blue), PBA Pearl (White), and Kaspa (Dun).

Variety	Grain Yield (t/ha)	Grain Weight (g/100seed)
PBA Pearl	1.56	20.0
OZB1315	1.26	18.5
OZB1324	1.20	18.3
OZB1308	1.19	18.9
OZB1310	1.17	21.3
OZB1311	0.93	21.6
Kaspa	0.79	19.2
Excell	0.71	20.9
Lsd (P<0.05)	0.09	0.5

Key Findings and Comments

- The new blue lines showed yield 30% to 75% higher than Excell, with some lines having better or similar quality characteristics to Excell. Some of the lines still have quite mixed seed colour (darker and lighter blue), which needs to be investigated and sorted in trials for 2015.

F2 Sowing Time, MRZ Wimmera (Pimpinio), Victoria

Aim

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

Treatments

Varieties:	White Peas: PBA Pearl, Sturt. Dun peas: Kaspa, PBA Gunyah, PBA Oura, PBA Percy, OZP1208, OZP1101. Blue peas: OZB1308.
Sowing dates:	13 May (Early), 18 June (Mid).

Other Details

Row Spacing:	30cm
Stubble:	Standing, approximately 30 cm (sown inter-row)
Fertiliser:	MAP + Zn @ 80 kg/ha at sowing.
Plant Density:	40 plants/m^2
Soil Type:	Alkaline Black cracking clay (Table 1 in Trial L2 above)

Results and Interpretation

- Key Message: PBA Pearl continued to show its broad adaption, producing profitable yields at both sowing dates. Earlier sowing was not beneficial for field peas at Pimpinio in 2014, with all varieties showing a yield decline

- Plant establishment – Similar to lentils, due to the early rainfall, emergence for both sowing dates occurred within 2 weeks of the respective sowing date. Establishment ranged between 28 and 54 plants/m^2 (Table 1). The May 13 sowing date had significantly higher establishment than June 18, probably due to early mouse activity and the white (PBA Pearl and Sturt) and blue (OZB1308) peas where generally lower than other varieties.
- Plant Growth and Disease – Early plant growth was good due to the early rainfall and mild temperatures in late autumn and early winter. These conditions were also conducive to early Ascochyta blight development, particularly in treatments sown May 13. Ascochtya scores recorded Aug 26 showed significant differences between varieties, with Kaspa and PBA Gunyah showing the worst symptoms and OZ1308 and PBA Percy least (Table 1). In addition, hail in July followed by severe frosts in August lead to the early development of bacterial blight. Despite the early incursion of Bacterial Blight, symptoms did not rapidly progress throughout spring due to the extremely dry conditions. A disease score recorded Oct 9 again showed PBA Gunyah and Kaspa to be significantly worse than other varieties, which only showed slight differences. PBA Gunyah and Kaspa generally displayed poorer growth throughout the whole season. Growth of all varieties slowed during through August to October as a result of the dry and frosty conditions. The frosts also caused significant flower and pod abortion during the reproductive phase.
- Grain Yield, Profitability and Grain Weight – The extremely dry spring with frosty conditions resulted in low grain yields ranging from 0.3 and 0.9 t/ha (Table 2). Generally the yields of treatments sown June 18 were higher than May 13. PBA Pearl and PBA Oura had the highest yields and Kaspa and PBA Gunyah lowest. These results are indicative of the dry finish to the season and the presence of disease. Grain weights were generally low and quality poor (Table 2). There was a significant increase in seed weight at the later sowing date. Economically, while yields were low, based on 2014 harvest prices a yield of 0.55 t/ha could have broken even. Only four varieties (Sturt, OZB1308, PBA Oura, PBA Pearl), would have proved profitable at both sowing dates.

Table 1. Establishment (pl/m^2) of field pea varieties sown 13 May and 18 June and Ascochyta blight and disease score (0 – no disease; 100 – complete death; recorded Aug 26 and Oct 9, respectively) sown 13 May at Pimpinio in 2014. Disease score was primarily ascochyta blight, with slight bacterial blight.

	Establishment (pl/m^2)			Ascochyta Score	Disease Score
Sowing Time	**13 May**	**18 June**	**Ave**	**Aug 26**	**Oct 9**
PBA Pearl	28	38	*33*	30	20
PBA Oura	34	49	*42*	27	18
OZB1308	31	39	*35*	10	23
Sturt	29	40	*34*	27	12
PBA Percy	33	48	*41*	20	23
OZP1208	28	54	*41*	25	28
OZP1101	35	42	*38*	30	33
PBA Gunyah	29	46	*38*	38	57
Kaspa	28	45	*37*	38	47
Average	*31*	*45*	*38*	*41*	*39*

Lsd's
Establishment - $(P<0.05)_{\text{sow date x variety}}$ = ns; $_{\text{sow date}}$ = 4; $_{\text{variety}}$ = 7.
AB Score(Aug 26) - $(P<0.05)_{\text{variety}}$ = 8.
AB Score(Oct 9) - $(P<0.05)_{\text{variety}}$ = 6.

Table 2. Grain yield (t/ha) and grain weight (g/100seed) of field pea varieties sown 13 May and 18 June at Pimpinio in 2014.

	Grain Yield (t/ha)			***Grain Weight (g/100seed)***		
Sowing Time	**13 May**	**18 June**	*Ave*	**13 May**	**18 June**	*Ave*
PBA Pearl	0.76	0.93	*0.84*	14.4	17.5	*16.0*
PBA Oura	0.76	0.91	*0.84*	15.7	19.0	*17.3*
OZB1308	0.68	0.88	*0.78*	14.3	15.9	*15.1*
Sturt	0.65	0.80	*0.73*	12.7	14.9	*13.8*
PBA Percy	0.42	0.66	*0.54*	15.9	21.4	*18.6*
OZP1208	0.36	0.72	*0.54*	15.9	15.6	*15.7*
OZP1101	0.36	0.62	*0.49*	14.8	16.1	*15.5*
PBA Gunyah	0.38	0.58	*0.48*	15.5	16.5	*16.0*
Kaspa	0.28	0.62	*0.45*	16.0	16.7	*16.3*
Ave	*0.52*	*0.75*	*0.63*	*15.0*	*17.1*	*16.0*

Lsd's
Grain Yield - $(P<0.05)_{\text{sow date x variety}}$ = ns; $_{\text{sow date}}$ = 0.13; $_{\text{variety}}$ = 0.11.
Grain Weight - $(P<0.05)_{\text{sow date x variety}}$ = 1.8; $_{\text{sow date}}$ = 1.3; $_{\text{variety}}$ = 1.2.

Key Findings and Comments

- PBA Pearl continued to show its broad adaption, producing profitable yields at both sowing dates. Kaspa and PBA Gunyah performed poorly in 2014 indicating susceptibility to frosty and disease conducive conditions.
- Earlier sowing was not beneficial for field peas at Pimpinio in 2014, with all varieties showing a yield decline. It is likely that disease and frost damage the first sowing date significantly restricted grain yields.

F4 Crop Topping/Harvest timing (Blue pea focus), MRZ Wimmera (Pimpinio), Victoria

Aim

To compare the growth, grain yield of potential new blue field varieties.

Treatments

Varieties: OZB1303, OZB1308, OZB1309, OZB1310, OZB1311, OZB1315, OZB1324, Maki, Bluey, Excell (blue, control), PBA Pearl (White), Kaspa (Dun).

Treatments:

Treatment	Detail
Nil	No desiccant applied (Harvested at correct time)
Mid Crop-top	Paraquat 250 @800ml /ha applied at ryegrass milky dough stage ("Recommended").
Delay Harv 1	Harvest delayed by approximately 7 days
Delay Harv 2	Harvest delayed by approximately 14 days

Other Details

Sowing date: 14 May
Row Spacing: 30cm
Stubble: Standing, approximately 30 cm (sown inter-row)
Fertiliser: MAP + Zn @ 80 kg/ha at sowing.
Plant Density: 40 plants/m^2
Soil Type: Alkaline Black cracking clay (Table 1 in Trial L2 above)

Results and Interpretation

- Key Message: The new blue line OZB1309 displayed yields equivalent to PBA Pearl, which is generally the highest yielding pea in many NVT and breeding trials in Victoria.
- Plant establishment – Establishment was generally consistent across varieties, although there was some mouse damage.
- Plant growth, Disease, Flowering and Maturity – Similar to Curyo growth until August was good, however the dry and frosty conditions throughout August and September slowed growth and significantly reduced grain yields. Ascochyta blight was observed earlier in the season at significant levels. All the new blue lines showed less damage than current cultivars with OZB10308 and OZB1309 looking particularly good (Table 1). Bluey and Excell showed quite severe ascochyta blight damage. Severe frosts caused major flower drop and pod loss at various stages throughout the season. There appeared to be no major differences between varieties visual in response to these events, probably due to the severity and frequency of events. Both flowering and maturity were impossible to accurately assess due to the severe weather events. In addition to all this, a hail storm in August caused further crop damage and initial signs of bacterial blight were observed. Symptoms did not progress, probably due to the lack of rain.
- Grain Yield and Grain Weight – Due to the extensive frost events during flowering and podding and extremely dry finish to the season there was no significant impact of harvest treatment on grain yield, weight and seed quality. However, there were significant differences in the yields of varieties. Grain yields of the new blues ranged from 0.35 to 0.83 t/ha, all significantly higher than Excell (0.20t/ha) and most higher than Kaspa (0.40t/ha) (Table 1). The white pea PBA Pearl was the highest yielding line at 0.85t/ha. Grain weights were generally 20 – 30% lower than observed in the similar trial at Curyo and quality was relatively poor.

Table 1. Ascochyta Blight Scores, Grain Yield and Grain Weight of new blue field pea lines at Pimpinio in 2014 compared with Excell (Blue), PBA Pearl (White), and Kaspa (Dun).

Variety	AB Score (0-100)[1]	Grain Yield (t/ha)	Grain Weight (g/100seed)
PBA Pearl	26	0.85	14.3
OZB1309	15	0.83	14.2
OZB1315	20	0.74	14.0
OZB1308	15	0.71	13.3
OZB1324	21	0.69	13.8
OZB1310	18	0.65	16.1
OZB1303	20	0.55	14.0
Kaspa	37	0.40	15.5
Maki	30	0.37	15.0
OZB1311	20	0.35	15.5
Bluey	46	0.21	15.5
Excell	47	0.20	15.8
lsd	6	0.09	0.9

1. 0-100 score where 0 = 'No Disease', 100 = 'Crop death'

Key Findings and Comments

- The ascochyta blight resistance of the new blue lines appears to be significantly better than the commercial blue varieties, Bluey and Excell and the dun variety, Kaspa. Most of the new lines also appear better than PBA Pearl and commercial white variety.
- Despite the extreme weather events during spring, including a multitude of frosts, most of the new blue lines produced yields above a potential break even yield of 0.55t/ha (based on grain prices at $330/t with fixed management costs of $180/ha). Bluey and Excell were barely worth harvesting, with yields less than half of most of the new blue lines. Similar to Curyo several lines have quite mixed seed colour (darker and lighter blue), which needs to be investigated and sorted in trials for 2015.

F5 Disease Management, HRZ South West (Inverleigh), Victoria

Aim

To investigate the adaptability of a range of field pea varieties to varying disease management strategies.

Treatments

Varieties:	White Peas: PBA Pearl, Sturt. Dun peas: PBA Wharton, PBA Coogee, Kaspa, PBA Gunyah, PBA Oura, PBA Percy, Morgan, OZP1208, OZP1101. Blue peas: OZB1308. Marrowfat: OZP0911. Maple: OZP0916.
Disease Control	Fortnightly: chlorothalonil 500 @ 2 L/ha plus mancozeb @ 2kg applied fortnightly starting 6 weeks after emergence. A total of 6 applications were made throughout the season. Early: mancozeb @ 2kg applied 9 Node + early flower.

Other Details

Stubble:	Slashed
Row Spacing:	20 cm.
Fertiliser:	MAP @ 100 kg/ha at sowing.
Plant Density:	20 plants/m^2.

Results and Interpretation

- Key Messages: New varieties are available for southern Victoria, offering a range of grain types and forage options, associated with excellent yield potential. Disease had little impact on yields in 2014. PBA Pearl was the highest yielding variety producing, 2.3t/ha and estimated profit of $500/ha.

- In 2014 there was very little disease observed in field peas, due to the drier season. There were no obvious differences in the amount of disease observed in the fungicide treatments or among varieties.

  Grain yields of commercial cultivars ranged between 1.80 t/ha for Morgan to 2.30 t/ha for PBA Pearl (Fig 1). While there was no significant difference between the disease management treatments, there was a trend, in that, the 'Fortnightly' and the 'Early' treatments had average yields of 2t/ha across all varieties, while the 'Nil' treatment was 1.87t/ha.

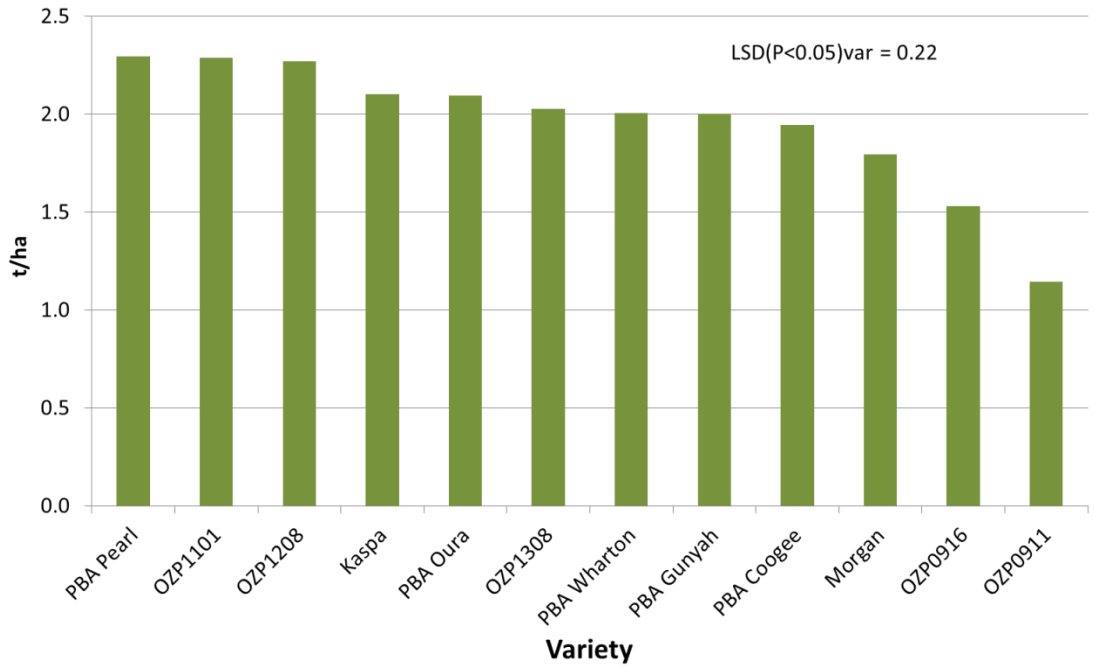

Figure 1. Grain yield (t/ha) of field pea varieties grown at Inverleigh in 2014.

Key Findings and Comments

- PBA Pearl, consistent with all other trial sites performed extremely well at Westmere in 2014, displaying yield significantly higher than most other commercial varieties.
  The new breeding line OZP1101, similar to 2013, produced similar yield to PBA Pearl. While there was no response to disease management in 2014, there continued a similar trend to 2013 where significantly higher yields and profitability were achieved with disease management. Based on yields achieved (2.3t/ha) peas could have achieved a net profit of approximately $500/ha based on management costs of $250/ha and grain price at $330/t.

F6. Blackspot Management, MRZ Mid North (Hart), South Australia

Aim

To assess the use of fungicides for the control of blackspot (ascochyta blight) and effect on yield in field pea.

Treatments

Variety: Kaspa
Sowing dates: 3rd May
Fungicide treatments: see Table .

Other Details

Row Spacing:	25cm (10 inches)
Seeding system:	Knife point cone seeder
Seeding rate:	120 pl/m^2
Fertiliser:	Impact on DAP +Zn (2%) @ 100 kg/ha at sowing
Inoculum:	Nil
Soil Type:	Sandy clay loam/clay loam

Table 1: Fungicide treatments, rates and application timings for a field pea blackspot management trial, Hart 2014.

Treatment	Chemical active	Application rate	Application timing
Nil	Nil	0	Nil
Fluid injection 1	Flutriafol	400ml/ha	at sowing
Fluid injection 2	Triadmefon	1L/ha	at seeding
Impact on fertiliser	Flutriafol	400ml/ha	at seeding
P-Pickel T® (PPT)	thiram + thiabendazole	200ml/100kg	seed dressing
PPT + 2x Mancozeb	thiram + thiabendazole & Mancozeb in crop	= 200ml/ha 2kg/ha	seed dressing In crop (10 node; early flower)

Results and interpretation

- Disease - Due to a relatively cold winter, low spring rainfall and moderate crop biomass, disease pressure was low in this trial. As such there were no measurable levels of ascochyta blight to warrant disease rating.
- Grain Yield – There was no significant yield response from application of fungicide treatments. A mean yield of 2.0 t/ha was obtained across all treatments.

Key findings and comments

- The risk of blackspot is influenced by many factors of which seasonal conditions play a significant role in disease outbreak as was observed in this trial. Fungicide use to control blackspot is one of the strategies to minimise the disease. Although there was no effect of fungicide treatment on yield, previous trials have shown that crops sown into high blackspot risk and with a high yield potential can benefit from a fungicide strategy of P-Pickel T seed dressing combined with a mancozeb spray at 9 nodes growth stage followed by a second spray at early flowering.
- Overall, it is important for growers to implement an integrated approach to manage the disease every year in order to maintain high yields.

F7. Field Pea Crop-topping, MRZ Yorke Peninsula (Melton), South Australia

Aim

To assess the agronomic practice of 'crop topping' at multiple application timings on grain yield and grain weight of field pea varieties varying in plant maturity.

Treatments

Varieties: see Table .

Treatments: see Table 1 for crop topping application timing and dates

- Nil - no desiccant applied
- Early - applied approximately two weeks prior to the ryegrass milky dough stage
- Mid/Recommended - applied at the ryegrass milky dough stage

NB: A late treatment was not applied in 2014 due to the dry and rapid finish to the season.

Other Details

Sowing date:	29th May
Fertiliser:	MAP + Zn (2%) @ 90 kg/ha at sowing
Seed Treatment:	P-Pickel T (200ml/100 kg seed)
Foliar Fungicides:	Canopy Closure –Carbendazim @500ml/ha, Chlorothalonil @2L/ha Mid flowering to Early Podding – Carbendazim @500ml/ha, Chlorothalonil @ 2L/ha

Results and Interpretation

Grain yield

- Significant timing and variety responses for grain yield were observed indicating that varieties performed similarly across the three crop timings.
- Across all varieties, a 24% yield loss was incurred from crop topping two weeks prior to the recommended timing (rye grass milk dough stage) compared to the recommended and Nil treatments which yielded similar.
- PBA Oura and OZP1101 were the equal higher yielding varieties while Kaspa was the lower yielding variety than all other varieties except Parafield and PBA Coogee (**Error! Reference source not found.**).

Grain weight

- Significant two way interactions (timing by variety) were observed for grain weight.
- Crop topping two weeks prior to the recommended timing (rye grass milk dough stage) led to lower grain weights compared to the recommended and Nil treatments which yielded similar.
- On average a 17% grain weight reduction was observed from early crop topping across all varieties varying from 6% (PBA Oura) to 28% (Kaspa).

Key findings and comments

- All varieties showed similar levels of yield loss from crop topping two weeks prior to the recommended timing (rye grass milk dough stage) and no yield loss at the recommended timing under dry finishing conditions in 2014 and therefore no one variety was more or less suited to this agronomic practice.

Previous research has suggested that all field pea varieties with early maturity ratings or early to mid-maturity ratings are well suited to the practice of crop topping in SA even in seasons with longer and more favourable finishes. Varieties rated mid maturity or later require more caution with this practice in some seasons.

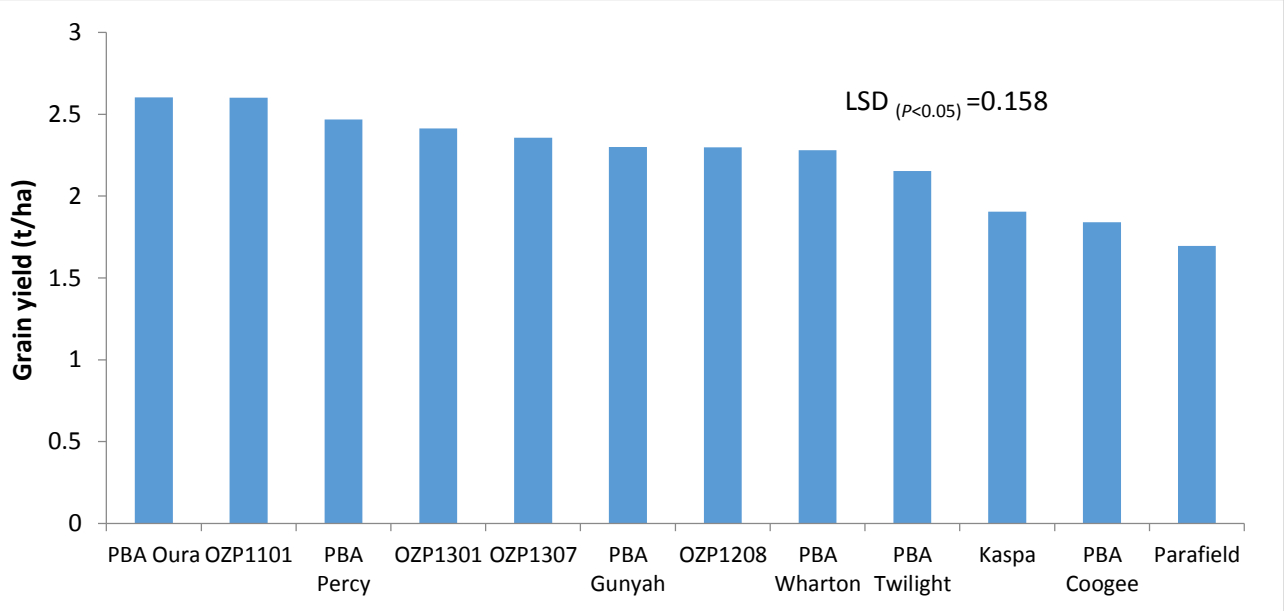

Figure 7: Grain yield (t/ha) of 12 field pea varieties averaged across two crop topping regimes at Melton, South Australia, 2014.

Table 1: Effect of crop-top timing on grain yield and grain weight of field pea varieties at Melton, South Australia 2014. Varieties are ranked in order 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		- 2 wks[a] (15/10)	Recommended 23/10)	Nil	- 2 wks[a] (15/10)	Recommended 23/10)
PBA Twilight	E	E	2.15	76	97	18.9	85	99
PBA Percy	VE	E	2.47			21.5	84	98
PBA Wharton	E	E	2.28			18.6	85	97
PBA Oura	E-M	E	2.60			19.7	94	105
PBA Gunyah	E-M	E	2.30			19.5	85	101
OZP1301	M-L	M	2.41			15.6	83	100
OZP1307	M-L	M	2.36			18.9	81	99
OZP1101	L	M	2.60			18.6	81	95
OZP1208	L	M	2.30			19.1	80	102
Kaspa	L	M	1.90			17.4	72	100
PBA Coogee	L	M	1.84			17.9	81	100
Parafield	M-L	M-L	1.70			16.0	85	102
Mean			**2.24**	**1.87**	**2.40**	**18.48**	**83**	**100**

LSD $_{(P<0.05)}$ variety 0.158 (grain yield), timing 0.404 (grain yield)

NB: shading indicates a significant difference from the nil treatment.

Chickpeas

C1 Sowing Date, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the adaptability of a range of kabuli chickpea varieties to sowing date.

Treatments

Varieties:	Kabuli - Genesis090, PBA Monarch, Kalkee, Almaz, CICA1156, CICA1352, CICA1451, CICA1452, CICA1453, CICA1454, CICA1455. Desi - PBA Striker
Sowing dates:	1 May (Early), 12 June (Mid)

Other Details

Row Spacings:	36 cm
Stubble:	Standing (approximately 15 cm), sown inter-row
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing
Plant Density:	35 plants/m^2
Soil type:	Soil Type: Alkaline Sandy Loam over a heavy clay at about 40-60cm (See Table 1 in L1)

Results and Interpretation

- Key Message: This research demonstrated the potential to continue improving profitability of kabuli chickpea, with one breeding line (CICA1352) showing improved profitability over PBA Monarch. Earlier sowing was significantly higher yielding for all varieties in 2014, increasing economic returns by an average of $220/ha. Similar to previous seasons PBA Monarch ($400/ha) produced the highest net returns of all commercial varieties when sown early.
- Plant establishment – Establishment for all chickpea varieties was generally slightly lower than targeted ranging between 25 and 33 plants/m^2 (data not shown). All of the CICA14** series lines displayed spindly growth in early establishment, with very fine leaves. Normal plant structure had recovered by mid season, however biomass development always appeared less than other varieties. In addition the CICA 14** series lines generally had marginally lower establishment than other varieties 25-28 plants/m^2 compared with 28-33 plants/m^2.
- Plant growth – Growth until August was adequate and as expected given the seasonal conditions. The dry and cold conditions throughout August and September meant that growth was slowed. The ongoing dry conditions ensured plants experienced significant drought stress that rapidly progressed maturity and reduced grain yields.
- Grain Yield – Despite the extremely dry spring, grain yields were good, ranging between 0.34 and 1.00 t/ha (Fig. 1). Treatments sown May 2 (0.86 t/ha) were about 40% higher than those sown June 12 (0.53 t/ha). Yield loss from delaying sowing ranged from a 57% reduction for CICA1453 to a 17% reduction for Genesis090. When sown early PBA PBA Striker, CICA 1452 and CICA 1455 were equal highest yielding (1 t/ha) with CICA 1451 and Kalkee lowest (0.74 t/ha). At the later sowing date Genesis090 had the highest yields of 0.64t/ha and CICA1453 lowest, 0.34 t/ha.
- Profitability - Focussing on the earlier sowing date, despite having slightly lower grain yield, the estimated net income of CICA1352 ($420/ha) and PBA Monarch ($400/ha) was higher, because of the increased grain size and potentially higher prices received for grain (Fig. 2). Delaying sowing resulted in significant reduction in profitability for all varieties, ranging between $340/ha for Almaz to $70/ha for Genesis090. Both Almaz and CICA1453 had negative returens when sowing was delayed.
- Grain weights and Seed Size Distribution - Quality in 2014 was generally excellent and seed size slightly smaller than term averages (Data not shown). There was a generally slight increase at the earlier sowing date, but that was inconsistent across varieties. Seed size distribution for each of the varieties and sowing dates is shown in Figure 3. In the larger Kabuli's Kalkee, CICA1352 and CICA1451, generally more than 80% of the grain was in greater than 8mm class with 20-40% greater than 9mm. In comparison, Genesis090 only produced about 20% of seed greater than 8mm. Similar to previous seasons PBA Monarch produced seed mostly in the 8-9mm class. CICA1156 appeared to produce the most variable seed with approximately 20% in the less than 7mm class, 35% in 7-8mm, 40% in 8-9mm and 5% above 9mm.

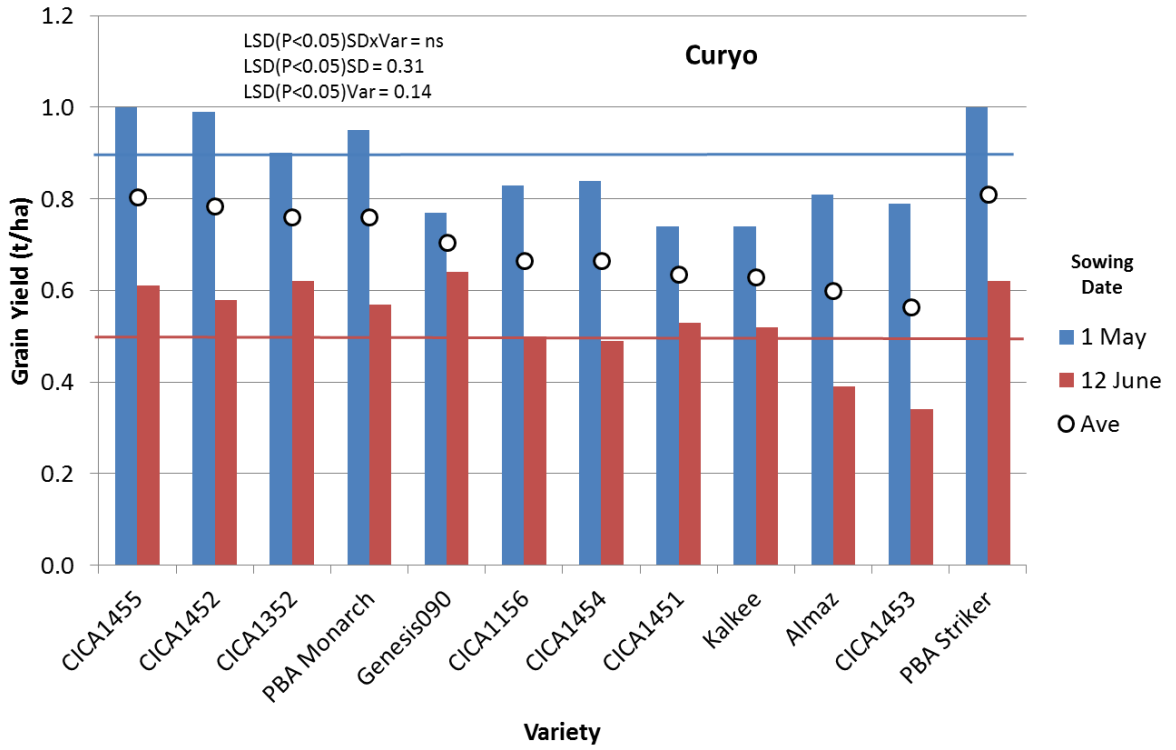

Figure 1. The effect of the interaction between sowing date and chickpea variety on grain yield at Curyo in 2014. Mean sowing date grain yield indicated by horizontal lines; mean variety grain yield indicated by circles.

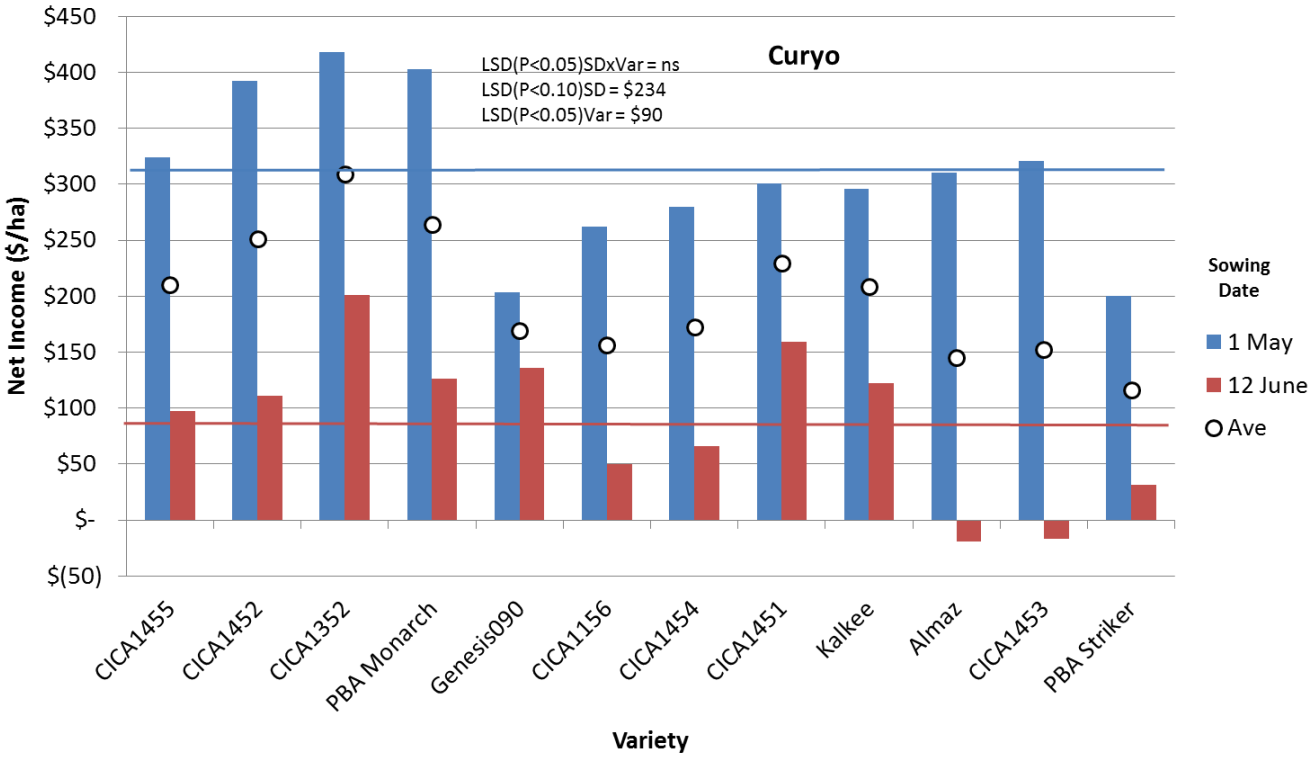

Figure 2. Net Income ($/ha) of chickpeas sown May 1 and June 12 at Curyo in 2014. *Net Income based on the following grain prices: Desi = $450/t; Kabuli = <7mm-$330, 7-8mm-$550, 8-9mm-750, 9-10mm-$850, 10-11mm-$1000 with fixed management costs of $220/ha and fungicides at $15/ha per application (No. of sprays based on varietal resistance: resistant = 1, moderately resistant = 2, moderately susceptible = 3).*

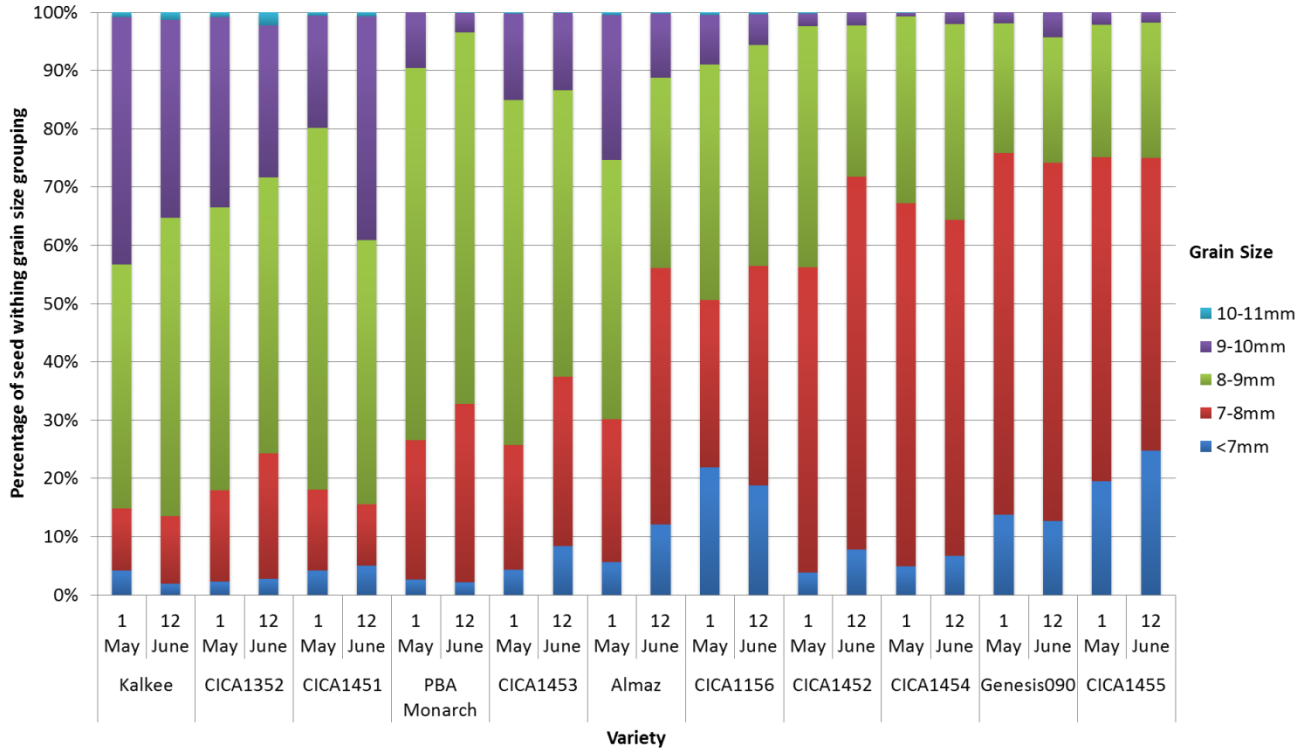

Figure 3. Proportion of grain within each grain size category for kabuli chickpea varieties grown at each sowing date at Curyo in 2014.

Key Findings and Comments

- Earlier sowing was significantly higher yielding for all varieties in 2014, increasing economic returns by an average of $220/ha. Compared to previous seasons, Genesis090 produced unusually low yield when sown early compared with PBA Striker and PBA Monarch. It was, however, the highest yielding variety at the later sowing date.
- Similar to previous seasons PBA Monarch ($400/ha) produced the highest net returns of all commercial varieties when sown early. This trial also demonstrates the gains being made by the breeding program with CICA1352, a new larger sized Kabuli (slightly larger than PBA Monarch) showing net returns slightly higher than PBA Monarch and yields similar to PBA Monarch.
- Seed size and quality was significantly larger and better in the Mallee than in the Wimmera.
- Further research is ongoing to investigate this range of medium Kabulis and their adaptation and yield stability in a range of environments. If consistent seed size and grain yields can continue to be replicated across seasons, the medium 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.

C2 Sowing Date, MRZ Wimmera (Pimpinio), Victoria

Aim

To investigate the adaptability of a range of kabuli chickpea varieties to sowing date.

Treatments

Varieties:	Kabuli - Genesis090, PBA Monarch, Kalkee, Almaz, CICA1156, CICA1352, CICA1451, CICA1452, CICA1453, CICA1454, CICA1455. Desi - PBA Striker
Sowing dates:	13 May (Early), 18 June (Mid)

Other Details

Row Spacing:	30cm
Stubble:	Standing (approx. 30cm tall), sown inter-row
Fertiliser:	MAP + Zn @ 80 kg/ha at sowing
Plant Density:	35 plants/m^2
Soil Type:	Alkaline Black cracking clay (Table 1 in Trial L2 above)

Results and Interpretation

- Key Message: Yields were generally too low to draw specific conclusions about varieties and the interactions with sowing date due to the extreme climatic conditions (frosts and dry) in spring.
- Plant establishment – Establishment for all chickpea varieties was generally lower than targeted ranging between 17 and 32 plants/m^2 (Table 1). Similar to Curyo all of the CICA14** series lines displayed spindly growth in early establishment, with very fine leaves. Normal plant structure had recovered by mid season, however biomass development always appeared less than other varieties. In addition the CICA 14** series lines generally had marginally lower establishment than other varieties 17-24 plants/m^2 compared with 19-32 plants/m^2.
- Plant growth – Growth until August was adequate and as expected given the seasonal conditions. Growth slowed during the August to October period and the dry conditions combined with many frosts caused significant flower and pod abortion during the reproductive phase. The ongoing dry conditions ensured plants experienced significant drought stress that rapidly progressed maturity and reduced grain yields.
- Grain Yield – All results need to be treated with caution due to the extreme climatic conditions during spring (low rainfall and frost, see above). The were no major differences in yield between sowing dates. Overall grain yield ranged between 0.36t/ha for CICA1454 and 0.13t/ha for Almaz. Grain weights and size distribution not calculated due to low yields

Table 1. Establishment (pl/m2) and Grain Yield (t/ha) of chickpea at Pimpinio in 2014.

Variety	Establishment	Grain Yield
CICA1454	24	0.36
CICA1455	21	0.32
PBA Striker	*31*	*0.29*
CICA1451	17	0.25
Kalkee	28	0.23
CICA1453	22	0.23
CICA1452	17	0.23
CICA1156	21	0.20
CICA1352	19	0.20
Genesis090	32	0.20
PBA Monarch	31	0.17
Almaz	25	0.13
lsd	*5*	*0.07*

Key Findings and Comments

- Yields were generally too low to draw specific conclusions about varieties and the interactions with sowing date.

C3 Disease Management, MRZ Wimmera (Pimpinio), Victoria

Aim

To investigate optimum disease management strategies across a range of chickpea varieties, differing in ascochyta blight susceptibility.

Experimental Treatments

Varieties: Resistant - Genesis090, Ambar, Neelam, PBA Slasher; Moderately resistant - PBA Striker, PBA Maiden, CICA1016, CICA1156; Moderately susceptible - PBA Monarch, Kalkee, Almaz.

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 18th July

Other Details

Sowing date: 14 May.
Row Spacing: 30cm
Stubble: Standing (approx. 30cm tall), sown inter-row
Fertiliser: MAP + Zn @ 80 kg/ha at sowing
Plant Density: 35 plants/m^2
Soil Type: Alkaline Black cracking clay (Table 1 in Trial L2 above)

Results and Interpretation

- Key Message: Due to extreme weather events there was no major effect of disease management in 2014.
- Ascochyta Blight Damage and Grain Yield: No damage was seen from acochyta blight in 2014. All results need to be treated with caution due to the extreme climatic conditions during spring (low rainfall and frost, see above). The were no major differences in yield between disease management treatments. Overall grain yield was higher than the sowing time trial and ranged between 0.50t/ha for CICA1156 and 0.37t/ha for Genesis090. Grain weights and size distribution were not calculated due to low yields.

Table 1. The main effect of chickpea variety on grain yield in the disease management trial at Kalkee in 2013.

Variety	Grain Yield (t/ha)
CICA1156	0.50
CICA1016	0.48
PBA Striker	0.47
Ambar	0.47
Kalkee	0.45
PBA Maiden	0.43
Almaz	0.40
PBA Slasher	0.40
Naleem	0.39
Howzat	0.38
PBA Monarch	0.38
Genesis090	0.37
lsd	*0.07*

Key Findings and Comments

- Yields were generally too low to draw specific conclusions about varieties.

C4 Varieties, HRZ South West (Westmere), Victoria

Aim

To investigate the potential of new chickpea varieties in the high rainfall zone of Victoria.

Experimental Details

Sowing date:	22 May.
Stubble:	Slashed.
Row Spacing:	20 cm.
Fertiliser:	MAP @ 100 kg/ha at sowing.
Plant Density:	120 plants/m^2.

Results and Interpretation

- Key Message: Chickpeas produced profitable yields in the HRZ, but production risks are high and crops such as faba beans, field peas and lupins remain a better option.

- Similar to lentils growth of chickpeas was generally slow and lacked vigour. In the HRZ, due to cold conditions, it is essential to sow lentils in early May to achieve some early growth and maximise potential biomass and yield. Yields ranged between 0.63 and 1.00 t/ha, which could provide returns of $200-$600/ha based on the 2014 grain prices. Production risks, particularly related to waterlogging and acidic soils are high and crops such as faba beans, field peas and lupins remain a better option.

Table 1. Grain yield (t/ha) of Chickpea varieties grown at Westmere, 2014 in comparison with 2013.

Variety	2014	2013
PBA Striker	0.80	2.35
Almaz	0.63	2.28
PBA Monarch	0.85	2.22
Kalkee	0.65	1.89
Genesis090	0.93	1.43
PBA Maiden	0.75	
Neelam	1.00	
PBA Slasher	0.85	1.27

$Lsd(P<0.10)_{2014}$ – 0.24; $Lsd(P<0.05)_{2013}$ – 0.78

C5 Sowing Date, MRZ Yorke Peninsula (Melton), South Australia

Aim

To maximise chickpea production through the identification of optimum variety and sowing dates.

Treatments

Varieties:	Desi – Neelam, PBA Slasher, PBA Striker, PBA Maiden, CICA1016, 07079-1101 Kabuli – Genesis™ 079, Genesis™ 090, Genesis™ Kalkee, PBA Monarch, CICA1156, CICA1352
Sowing dates:	May 16 and June 18

Other Details

Fertiliser:	MAP + 2% Zn @ 90 kg/ha at sowing
Plant Density:	Desi = 50 plants/m^2, Kabuli = 35 plants/m^2
Inoculant:	Group N
Fungicides:	Chlorothalonil at 8 weeks, early flower and early podding
Seed treatment:	P-Pickel T (200 ml/ 100 kg seed)

Results and interpretation

Lodging

- There was a significant (P<0.001) sowing date by variety response for lodging. All varieties except for Genesis™ Kalkee showed increased lodging by sowing early (Table 1). Neelam, PBA Striker, PBA Maiden, Genesis™ 079 were most susceptible to lodging, however Neelam and PBA Maiden showed the largest improvement in lodging from delayed sowing. Genesis™ Kalkee showed the lowest level of lodging, along with CICA1016, Genesis™ 090, PBA Monarch, CICA1156 and CICA1352.
- No significant level of lodging occurred in any variety at the late sowing date.

Yield

- Grain yield averaged 1.17 t/ha at Melton across all varieties and sowing dates. All varieties showed a yield penalty from delayed sowing, ranging from 46% (Genesis™ 079) to 16% (PBA Maiden).
- PBA Striker was the highest yielding variety across both sowing dates (Figure 8).
- Genesis™ 079, 07079-1101 and PBA Slasher yielded similarly to PBA Striker when sown early. PBA Slasher also yielded well at the late sowing date, along with PBA Maiden.
- Genesis™ 079 was the highest yielding of the kabuli varieties at the early sowing date, however PBA Monarch was the highest yielding kabuli at the late sowing date.

Key findings and comments

- Early sowing showed increased lodging across all varieties except for Genesis™ Kalkee, which remained consistent across the sowing dates, although only Genesis 079, Striker, Neelam and PBA Maiden were found to have levels which might be deemed to be commercially unacceptable.
- All varieties showed a sowing date response in 2014, with a severe yield penalty for a delayed sowing date of mid June.
- Relative variety rankings across sowing dates were generally similar although PBA Maiden and PBA Monarch were relatively better sown later and surprisingly Genesis 079 relatively poorer. The reason for the latter is unclear but it may be linked to its short height characteristic which is likely to have been exacerbated in the late sowing treatment under the dry spring conditions of 2014.
- Despite the yield penalty from delayed sowing in 2014 it is generally recommended that chickpeas are sown later than other pulses, particularly in favourable areas, due to poor pod set in cold weather conditions, and excessive lodging in favourable regions and seasons where vegetative growth is high. However a mid June sowing time under these recent run of dry spring conditions is likely to be too late in most districts and a target of late May to early June is recommended.

Table 1: Effect of sowing date on lodging of desi and kabuli chickpea varieties at Melton, 2014. Lodging score: 1 = prostrate, 9 = erect

Sowing Date		May-16	Jun-18
Desi	Neelam	6	9
	PBA_Slasher	7	9
	PBA_Striker	6	8
	PBA_Maiden	6	9
	CICA1016	8	9
	07079-1101	7	9
Kabuli	Genesis079	6	8
	Genesis090	8	9
	Kalkee	9	9
	PBA_Monarch	8	9
	CICA1156	8	9
	CICA1352	8	9
LSD (P<0.05)		**0.9**	

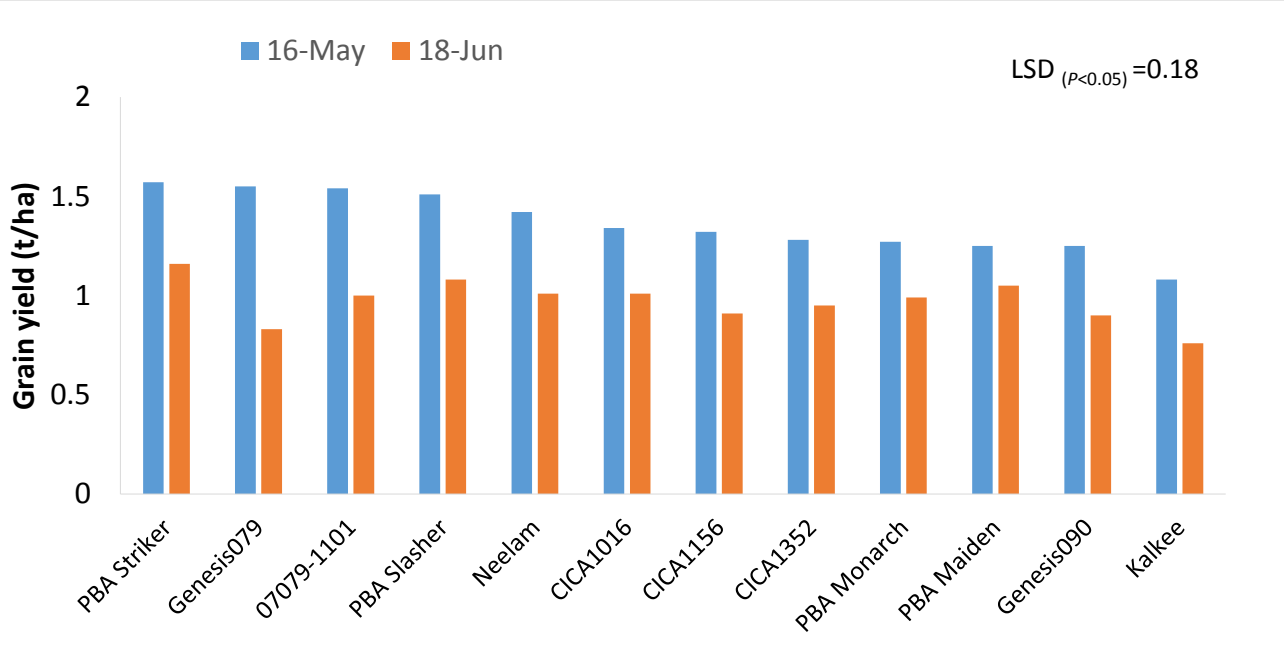

Figure 8: Effect of sowing date on grain yield of desi and kabuli chickpea varieties at Melton South Australia, 2014

C6 Crop-Topping, MRZ Yorke Peninsula (Melton), South Australia

Aim

To understand the required maturity timing in chickpea for successful crop-topping practice of rye grass in South Australia.

Treatments

Varieties:	Refer to Table 1.
Treatments:	Nil - no desiccant applied
	Early - applied 8 days pre-ryegrass milky dough stage (15th Oct)
	Recommended - applied at ryegrass milky dough stage (23rd Oct)
	Late - applied 14 days post-ryegrass milky dough stage (6th Nov)

Other Details

Sowing date:	29th May
Fertiliser:	MAP + Zn (2%) @ 90 kg/ha at sowing
Inoculant:	Group N
Seed Treatment:	P-Pickel T (200ml/100 kg seed)
Canopy Closure –	Carbendazim @500 ml/ha, Chlorothalonil @2 L/ha
	Mid flowering to Early Podding – Carbendazim @500 ml/ha, Chlorothalonil @ 2 L/ha
Plant Density:	Desi = 50 plants/m^2, Kabuli = 35 plants/m^2
Soil Type:	sandy clay loam over light clay

Results and interpretation

Grain yield

- All varieties showed a yield penalty from crop-topping 8 days prior to the recommended timing (ryegrass milky dough stage), averaging a 35% yield loss compared to the nil treatment. Later maturing varieties (except for CICA1156) also showed a yield loss at the recommended crop-top timing (highlighted in Table 1). Mid to late maturing kabuli varieties PBA Monarch, Genesis™ 090 and Genesis™ Kalkee showed a yield loss from crop-topping 14 days after the recommended timing. Late maturing kabuli breeding lines CICA1352 and CICA1156 showed no significant yield loss at the late crop-top timing. CICA1156 also showed no yield loss at the recommended timing.
- Early maturing varieties have shown a lower incidence of yield loss. This suggests that the early maturing varieties are better suited to the practice of crop topping than later maturing varieties.

Grain weight

- All varieties showed a reduced grain weight from crop topping 8 days prior to the recommended timing, averaging a 19% loss in grain weight. Out of the 6 latest maturing varieties all but the desi variety PBA Slasher showed a reduction in grain weight from crop-topping at the recommended timing. The 2 latest maturing varieties, the kabuli types CICA1352 and Genesis™ Kalkee, showed a reduction in grain weight from crop-topping 14 days post recommended timing.

Lodging

- There was a significant varietal response for lodging. CICA1007 proved to be very erect for an early maturing desi variety. CICA1352, CICA1107, Genesis™ 090 and Genesis™ Kalkee proved to be the most erect while PBA Striker and D07073 were the most sensitive to lodging.

Table 1. Effect of crop-top timing on grain yield and grain weight of chickpea varieties at Melton, 2014. Varieties are ranked in order 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 15-Oct	Rec. 23-Oct	Late 6-Nov	Nil	Early 15-Oct	Rec. 23-Oct	Late 6-Nov
D07073	E	E	2.67	73	88	104	25.2	78	94	99
PBA Striker	E	E	2.92	71	91	105	22.2	83	99	103
CICA1442	E	E	2.79	73	99	93	20.0	82	94	101
CICA1007	E	E	2.15	76	96	108	24.8	73	83	99
Genesis079	E	E-M	2.53	72	99	112	25.2	72	91	99
CICA1016	E	E-M	2.65	63	77	96	22.8	83	92	104
PBA Monarch	E	E-M	2.66	56	69	80	37.9	76	92	107
PBA Slasher	M	M	2.87	60	76	100	19.5	79	93	99
Genesis090	M	M	2.15	59	74	74	31.2	86	83	94
CICA1156	M	M	2.32	58	87	106	37.7	81	76	97
CICA1352	M	M-L	2.09	64	72	99	44.4	85	78	87
Kalkee	M-L	L	2.17	56	69	59	43.2	92	81	80
Mean			**2.50**	**65**	**83**	**95**	**29.5**	**81**	**88**	**97**

LSD $_{(P<0.05)}$ timing by variety 0.42 (grain yield), 2.7 (grain weight)
NB: shading indicates a significant difference from the nil treatment.

Key findings and comments

- Early maturing desi chickpea varieties incurred the least yield loss at the recommended timing for crop-topping. Later varieties and kabuli types showed significant yield loss at the recommended timing and three later kabuli varieties showed yield loss at the late timing.
- Despite PBA Striker and Genesis 079 not incurring a yield loss or grain weight reduction at the recommended timing in 2014 it is still recommended to use extreme caution if using this practice on these varieties. Yield loss has occurred in previous years at this timing in these varieties particularly in seasons where the finish has been longer and more favourable.
- All chickpea varieties showed an average grain weight reduction of 19% from early crop-topping. Some later varieties as well as CICA1007 incurred a grain weight loss at the recommended timing, while CICA1352 and Genesis^{TM} Kalkee also incurred a loss at the late crop-top timing. This again suggests that the later maturing varieties are more sensitive to crop-topping and are more likely to incur a grain weight loss as well as a yield loss.
- The performance of the medium sized experimental kabuli line CICA1156 was encouraging in 2014 and requires further evaluation.
- Due to the relative late maturity of chickpeas and regular finding of yield loss in these trials even at the late timing they are generally not considered suitable for the practice of crop-topping at the recommended timing for ryegrass control in SA.

C7 Ascochyta Blight Susceptibility, HRZ Mid North (Turretfield), South Australia

Aim

To evaluate ascochyta blight (AB) response of new varieties and advanced breeding lines by comparing their susceptibility to known varieties

Treatments

Varieties:	Presented in Table 1.
Treatments:	Fungicide applied fortnightly (Chlorothalonil 720g/L at 2L/Ha) Nil – no fungicide applied All treatments were inoculated with ascochyta blight infected chickpea straw early in the season.

Table 1: Ascochyta blight ratings of kabuli and desi chickpea varieties sown at Turretfield 2014.

Variety	Foliar Ascochyta Blight Rating#
CICA1156	R *
Genesis™ 090	R
Ambar	R
Genesis™ 079	R
Neelam	R
CICA1016	R *
PBA Slasher	R
PBA Monarch	MS
CICA1352	MR*
PBA Maiden	MR
PBA Striker	MR
Genesis™ Kalkee	MS
Sonali	S
07079-1101	?
LSD (*P*<0.05)	

S = susceptible MS = Moderately susceptible, MR = Moderately Resistant, R = Resistant

*= limited evaluation

#ascochyta blight foliage rating is currently under review as a result of AB infection of previously R rated varieties such as Genesis™ 090 (SA Sowing Guide, 2016)

Other Details

Sowing date:	6th June
Fertiliser:	MAP + Zn (2%) @ 90 kg/ha at sowing
Innoculant:	Group N
Seed Treatment:	P-Pickel T (200ml/100 kg seed)
Plant Density:	Desi = 50 plants/m^2, Kabuli = 35 plants/m^2

Disease Assessment

AB disease was assessed visually at two intervals 27th August and 17th September during the growing season. Assessment at both intervals was done as the percentage of leaf area diseased (% LAD), percentage of side branches broken (% SBB) and on a 1 to 9 categorical scale; 1 = no disease symptoms and 9 =highest disease symptoms.

Results and interpretation

- Disease was scored as being low to moderate during the two assessment intervals with the highest disease symptoms observed at the second assessment and only data from this period has been presented in this report.
- A significant (*P*<0.001) varietal response was observed for AB disease infection indicating that varieties differed in the level of AB infection, both foliar infection and stem breakage.
- Sonali was rated as having the highest level of disease symptoms (foliar, stem breakage and on 1-9 scale) compared to all the other varieties (Table 2).

- There was no interaction between fungicide treatment and variety for grain yield across all varieties in this trial as opposed to the findings in the previous year. This result was surprising given the significant foliar disease infection observed between varieties and may have been due to the dry spring conditions which halted disease progression and limited grain yield. However, although interactions were not significant, it was noted that the line with the highest foliar AB infection level, Sonali, incurred a yield reduction from 2.43 t/ha to 1.96 t/ha in the fortnightly spray to the unsprayed treatment respectively.
- There was no significant effect of fortnightly foliar spray fungicide treatment on grain yield and lodging resistance at maturity. However, significant differences in grain yield and levels of lodging resistance between varieties were observed.
- Grain yields ranged between 1.81 t/ha in the moderately susceptible Genesis™ Kalkee and 2.54 t/ha in the moderately resistant PBA Striker.
- PBA Striker and the advanced breeding line CICA1016 yielded higher than all other varieties except 07079-1101, Genesis™ 079, PBA Slasher, Neelam and CICA156 (Table **3**3).
- Genesis™ 079 was the highest yielding Kabuli variety, but equal to CICA1156 and Genesis090.
- PBA Striker and Genesis™ 079 showed the lowest level of lodging resistance to all the other varieties, consistent with previous findings.

Table 2: AB disease infection of 14 chickpea varieties scored as % Leaf Area Damaged (LAD), % Stem Branch Broken (SBB) and scored on 1-9 categorical scale; 1=no disease symptoms 9= highest disease symptoms at the second assessment interval (17 September) at Turretfield, South Australia, 2014.

Variety	% LAD		Variety	% SBB		Variety	Score 1-9
Sonali	27.46	a...	Sonali	42.77	a...	07079-1101	2.00
Kalkee	19.8	a...	Kalkee	17.72	.b..	Ambar	2.00
Neelam	8.12	.b..	PBA Slasher	4.67	..c.	CICA1016	2.00
PBA Slasher	8.12	.b..	Neelam	3.31	..c.	CICA1156	2.00
Genesis079	7.34	.bc.	PBA Monarch	3.31	..c.	CICA1352	2.00
PBA Maiden	6.45	.bc.	CICA1016	2.96	..c.	Genesis090	2.00
PBA Striker	6.45	.bc.	Ambar	2.86	..c.	Neelam	2.00
CICA1016	5.02	.bcd	Genesis079	1.99	..c.	PBA Maiden	2.00
CICA1352	5.02	.bcd	PBA Striker	1.99	..c.	PBA Monarch	2.00
PBA Monarch	5.02	.bcd	CICA1352	1.93	..cd	Genesis079	2.33
Ambar	3.84	.bcd	07079 1101	1.17	..cd	PBA Slasher	2.33
CICA1156	2.4	.bcd	PBA Maiden	1.17	..cd	PBA Striker	2.33
Genesis090	1.99	..cd	CICA1156	0	...d	Kalkee	2.67
07079-1101	1.17	...d	Genesis090	0	...d	Sonali	4.00

*Square root back transformed data; letters indicate significance within an assessment category only.
#Varieties ranked according to the highest level of disease symptoms for leaf area damage and stem breakage.

Table 3: Grain yields (t/ha) and lodging scores (1-9) of of kabuli and desi chickpea varieties sown at Turretfield, 2014 (ranked by yields).

Variety	Grain Yield (t/ha)	Lodging (1-9 score)
PBA_Striker	2.54	7
CICA1016	2.53	9
07079-1101	2.52	8
Genesis™ 079	2.46	7
PBA_Slasher	2.46	9
Neelam	2.45	8
CICA1156	2.43	9
Ambar	2.33	9
PBA_Maiden	2.29	8
Genesis™ 090	2.28	9
PBA_Monarch	2.25	8
Sonali	2.19	8
CICA1352	2.06	9
Genesis™ Kalkee	1.81	9
LSD (P<0.05)	**0.20**	**0.75**

Faba Beans

B1 Row Spacing, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the adaptability of a range of faba bean varieties to varying row spacing.

Treatments

Varieties:	Farah, Nura, PBA Samira, AF07125, AF05095-1, AF09167, AF09169, AF10089.
Row Spacing:	18cm, 36cm, 72cm.

Other Details

Sowing Date:	May 1
Stubble:	Standing (approximately 15 cm), sown inter-row
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing.
Plant Density:	20 plants/m^2.

Results and Interpretation

- Key Message: Grain yield of beans at Curyo in a dry season were up to 1.20 t/ha results in estimated net returns of between $300/ha. New drought tolerant varieties are likely to have substantial yield advantage (20%) over current varieties.

- Plant establishment – Establishment ranged between 17 plants/m^2 for AF09167 to 32 plants/m^2 for AF05095-1. There was no impact of row spacing on establishment of faba beans (Table 1).

  Table 1. Average establishment (plants/m^2) of faba beans in varying row space and sowing rate treatments at Curyo in 2014.

Variety	Establishment
PBA Samira	26
AF05095-1	32
AF07125	26
AF09167	17
AF09169	22
AF10089	27
Farah	24
Nura	29

LSD(P<0.05)Var = 7.

- Plant growth and Frost Damage scores – Early growth was generally vigorous, although AF09169 and AF09167 were poorer than other varieties. The wider row plots always tended to look the best and produced the tallest plants. Growth until August was adequate and as expected given the seasonal conditions. However, it slowed during the August to October period and the dry conditions combined with many frosts caused significant flower and pod abortion during the reproductive phase. The frost damage which is basically an assessment of stem snapping, showed marked differences between varieties and row space (Figure 1). Generally symptoms were worse in the wider rows. AF07125 was the worst affected variety, followed by AF05095-1 and Farah. Several new drought tolerant lines showed significantly fewer symptoms from the frost. The ongoing dry conditions ensured plants experienced significant drought stress that rapidly progressed maturity and reduced grain yields. All plots 'necked' following high temperatures in late September and early October.

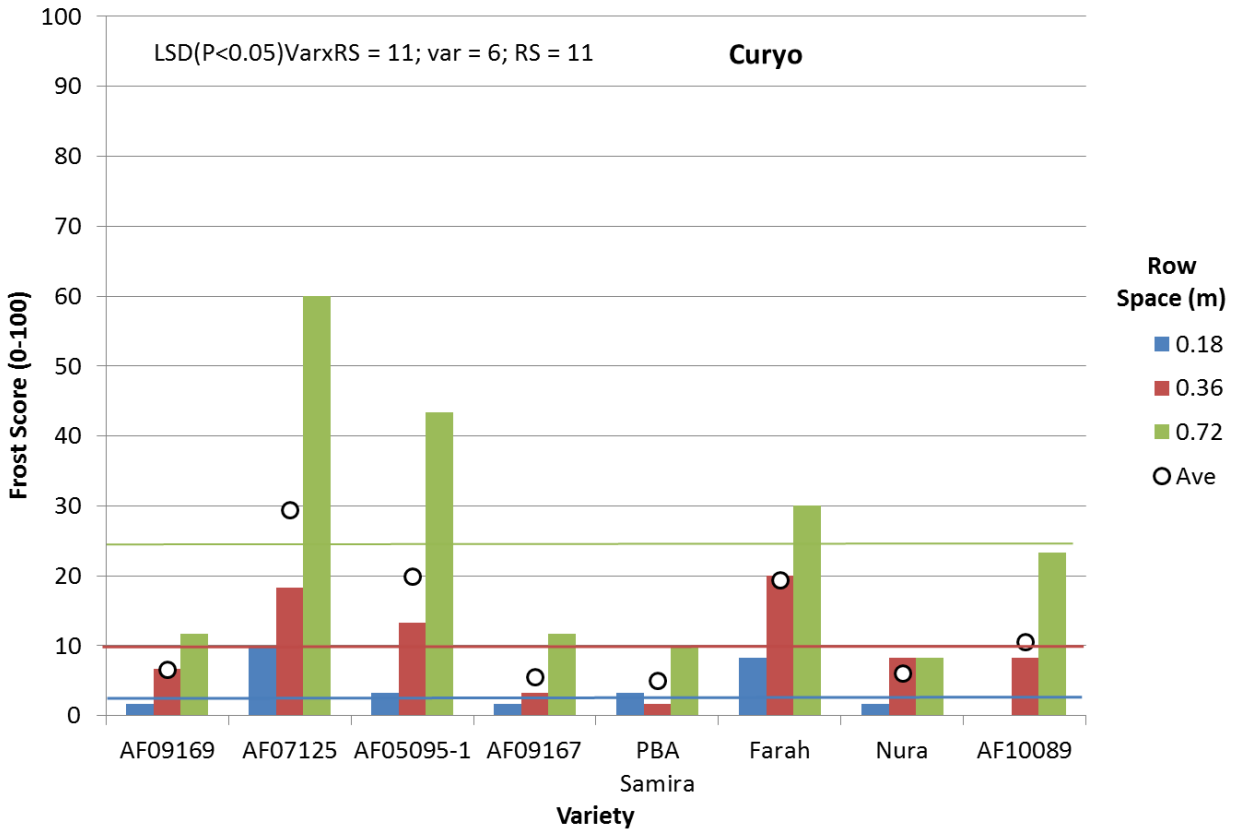

Figure 1. The effect of (A) the interaction between row spacing and faba bean variety on frost damage score (0-100) at Curyo in 2014. Mean row space damage score indicated by horizontal lines; mean variety or plant density damage score indicated by circles.

- Grain Yield and Profitability – Despite the extremely dry spring and the resultant necking of plots, grain yields were good, ranging between 0.9 to 1.2 t/ha, similar to lentils (Fig. 2). There was no significant impact of row spacing on yield, however there was a general trend towards higher yields in wider rows. The new drought tolerant line AF09169 (1.20 t/ha) had grain yields 20% higher than PBA Samira and Farah (0.98 t/ha). Based on production costs of $200/ha and grain income of $420/t, the 20% improvement in yield is equivalent to $100/ha.

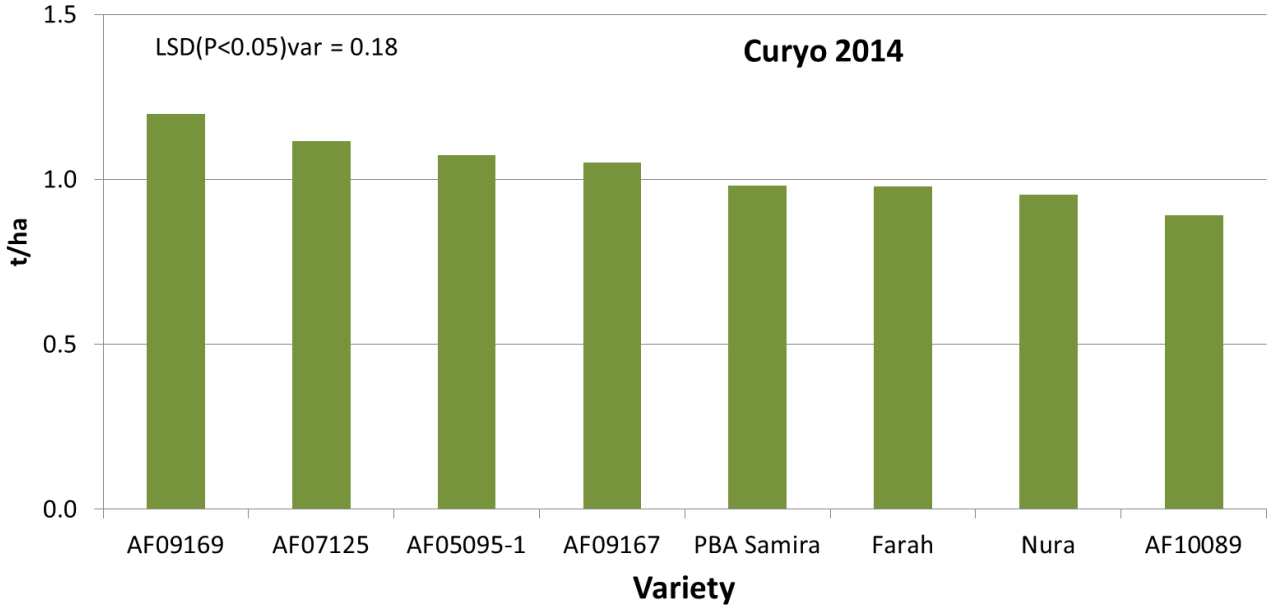

Figure 2. Grain yield (t/ha) of faba beans grown in the row space trial at Curyo in 2014.

Key Findings and Comments

- The grain yield of beans at Curyo, again highlights their potential in mallee conditions provided soil types are carefully selected and the crop is appropriately managed. The yield of AF09169 (1.20 t/ha) results in estimated net returns of between $300/ha are achievable. Additionally, we would expect significant nitrogen input back into the farming system. Potential estimates could be as high as 60kgN/ha.
- New varieties being developed by the breeding program could offer substantial yield improvements, further enhancing their economically viability as a crop and part of the farming system.
- The poor vigour observed in AF09169 and AF09167 are likely to be related to a different seed source to other lines used in this trial.
- Frost damage did not appear related to resultant grain yields
- Similar to 2013, 'Necking' is a major concern in the mallee, but the response again appeared only cosmetic and may make harvest more difficult (a bit like harvesting lentils). In this trial, it appeared that 'necking', did not result in any yield loss as in most cases that proportion of the stem above the point where it bends will not be killed, thus any pods formed in this zone will mature and set seed normally. Unlike 2013 there was no difference in the varietal response to necking, possible due to the severity of the season.

B2 Canopy Management MRZ Wimmera (Pimpinio) and HRZ South West (Westmere), Victoria

Contributions by Keshia Savage

Aim

To determine the effect of agronomic practices, various herbicides and a plant growth regulant canopy architecture and grain yield of faba bean.

Treatments

1. Nil

Agronomy

2. Mechanical (Hedge Trimmer - cut to half height), Flowering
3. Mechanical (Hedge Trimmer - tips cut), Flowering
4. Mechanical (Slashed), 8 node
5. Lime White Wash (Low), 8 node
6. Lime White Wash (High), 8 node
7. Wick Wiper (Glyphosate), Flowering

Herbicides #

1. Glyphosate (r1), 8 node
2. Glyphosate (r2), 8 node
3. Glyphosate (r3), 8 node
4. Flumetsulam (r1), 8 node
5. Flumetsulam (r2), 8 node
6. Imazamox (r1), 8 node
7. Imazamox (r2), 8 node
8. Imazamox (r3), 8 node
9. Imazethapyr (r1), 8 node
10. Imazethapyr (r2), 8 node
11. Imazethapyr (r3), 8 node

Plant Growth Regulator (PGR) Hormones #

1. Ethephon (r1), 8 node
2. Ethephon (r2), 8 node

All treatments are unregistered for use on Faba bean, and chemical rates are experimental only.

Other Details

Varieties:	AF05095-1 & AF07125
Sowing date:	9th May (Pimpinio); 18th May (Westmere)
Fertiliser:	MAP + Zn (2.5%) @ 60 kg/ha (Pimpinio); 100 kg/ha (Westmere)
Plant Density:	20 plants/m^2
Row Spacing:	36cm (Pimpinio), 20cm (Westmere).
Stubble:	Pimpinio - Standing (approximately 15 cm), sown inter-row; Westmere – worked, no stubble.

Background

Large bean canopies can cause significant management issues resulting in increased disease, necking and lodging, lower grain yield and quality. Manipulation of faba bean crop height and canopies could potentially allow for greater pod set, improved fungicide penetration, and encourage more resources to be put into seed production rather than biomass, potentially increasing grain yield.

Results and Interpretation

- Key Message: No canopy management treatments had a positive effect on grain yield in 2014, and many caused a significant yield reduction.
- Establishment and Growth – At both sites establishment and early plant growth was excellent. At Pimpinio growth until August was adequate and as expected given the seasonal conditions. However, it slowed during the August to October period and the dry conditions combined with many frosts caused significant flower and pod abortion during the reproductive phase. The ongoing dry conditions ensured plants experienced significant drought stress that rapidly progressed maturity and reduced grain yields. Necking occurred following high temperatures in late September and early October, with

AF5095-1 showing worse symptoms than AF07125. At Westmere, dry conditions and extreme weather events were not as severe as at Pimpinio, meaning little necking was observed and frosts had little impact on flowering and pod set. The dry and hot finish, did however reduce grain yields.

- Crop Damage – Both varieties performed similarly in terms of crop damage. At Pimpinio, crop damage scores were recorded about 4 and 9 weeks after application of the '8 node' treatments (1-6 weeks after flowering). All mechanical treatments and the glyphosate and flumetsulam herbicide treatments caused significant crop damage symptoms Aug 14 (4 weeks after application). However, the mechanical treatments had recovered by Sept 18 and the Ethephon high rate treatment had developed significant damage (Table 1). At Westmere, all treatments displayed significant crop damage symptoms, except, the lime applied at the lower rate. In addition, to crop damage it was observed that disease (primarily chocolate spot) was more prevalent in herbicide and mechanical treatments.
- Grain yield – Similar to crop damage, both varieties performed similarly in terms of crop damage, however overall yield of the varieties was significantly different. For example in the 'Nil' treatment AF05095-1 had yields of 2.72t/ha at Westmere and 0.75 t/ha at Pimpinio, while AF07125 was 1.77t/ha and 0.83t/ha. The untreated control of two varieties, AF05095-1 and AF07125 produced an average grain yield of 0.76t/ha and 0.85t/ha. There was no significant difference between varieties. There were significant yield losses compared with the Nil treatment across most Mid and High Herbicide treatments (excluding Raptor) and higher biomass cut backs (hedge trimming at half height and slashing).

Key Findings and Comments

- No canopy management treatments had a positive effect on grain yield in 2014. Many treatments caused significant crop damage and a significant yield reduction. The relative differences in yield between varieties again highlight the adaption of AF05095-1 to the HRZ, but not lower rainfall environments.
- The use of herbicides at sub-lethal doses for canopy management was assessed as low rates of certain products may significantly reduce plant height with little or no effect on grain yield. It may have the added benefit of providing some level of weed control. Imazamox at all rates and imazethapyr at the low rate were the only treatments to not result in a significant yield loss across both sites, but significant crop damage was observed at Westmere. The was some improvement in weed control in the herbicide treatments, but these benefits are unlikely to outweigh the losses from the reduced growth and yield.
- The plant growth regulator unfortunately caused significant crop damage and yield reduction in this trial. It is unclear why this occurred and further investigation needs to occur at a broader range of application rates and timings.
- None of the novel agronomic treatments showed significant potential to improve grain yield in faba beans.

Table 1. Effect of canopy management treatments (agronomic, herbicides and plant growth regulator) on crop damage score (0, no damage; 100, crop death) and grain yield. *Shading denotes significant difference relative to the Nil treatment.*

Canopy Treatment	Westmere		Pimpinio		
	Damage Score (0-100)	Grain Yield (t/ha)	Damage Score (0-100)		Grain Yield (t/ha)
	15-Oct		14-Aug	18-Sep	
Nil	0	2.24	**0**	**0**	**0.79**
Agronomy					
Mech (Half), Fl	52	1.31	49	3	0.50
Mech (Tips), Fl	12	2.40	18	1	0.59
Mech (Slash), Fl	17	1.51	37	8	0.47
Lime (x1), 8N	3	2.40	3	17	0.62
Lime (x2), 8N	7	2.15	0	1	0.83
Wick Wiper, Fl	94	0.19	0	9	0.56
Herbicides					
Glyphosate (r1), 8N	80	0.40	10	13	0.52
Glyphosate (r2), 8N	74	0.37	23	39	0.38
Glyphosate (r3), 8N	91	0.18	33	72	0.19
Flumetsulam (r1), 8N	32	1.53	22	6	0.64
Flumetsulam (r2), 8N	42	1.30	53	24	0.47
Imazamox (r1), 8N	28	1.91	2	1	0.63
Imazamox (r2), 8N	23	2.18	3	5	0.73
Imazamox (r3), 8N	22	1.88	2	0	0.64
Imazethapyr (r1), 8N	23	1.95	2	0	0.65
Imazethapyr (r2), 8N	40	1.43	4	0	0.50
Imazethapyr (r3), 8N	55	1.02	5	3	0.50
Plant Growth Regulator					
Ethephon (r1), 8N	62	1.30	10	14	0.54
Ethephon (r2), 8N	62	0.89	8	33	0.39
LSD (P<0.05)	4	0.47	11	15	0.24

B3 Disease Management, MRZ Wimmera (Pimpinio), Victoria

Aim

To investigate the effect of chocolate spot and rust management strategies across a range of faba bean varieties in standing and slashed stubble treatments.

Experimental Treatments

Varieties: PBA Samira, AF05095-1, AF06125, AF07125, AF09167, 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: 9 May.
Row Spacing: 30 cm.
Fertiliser: MAP @ 80 kg/ha at sowing.
Plant Density: 20 plants/m^2.
Stubble: Standing (approximately 15cm tall)

Results and Interpretation

- Key Message: Disease was not significant in 2014. AF05095-1 continued to show increased susceptibility to brackling compared other varieties.
- Establishment, Plant Growth and Disease – Establishment was generally adequate, although some mouse damage occurred throughout the trial. Early plant growth was good, but due to the dry conditions, disease development was slow. Early chocolate spot and cercospera were noted, but did not progress to epidemic levels as conditions dried out in spring and several frosts were experienced. A heat wave in late spring resulted in brackling (necking). AF05095-1, showed significantly worse symptoms than all other varieties in the trial, similar to observations in previous seasons (Figure 1).
- Grain Yield– Due to low disease levels there was not grain yield response observed across the disease management treatments in these trials. The main effect of variety was significant with AF07125, highest yielding and PBA Rana lowest.

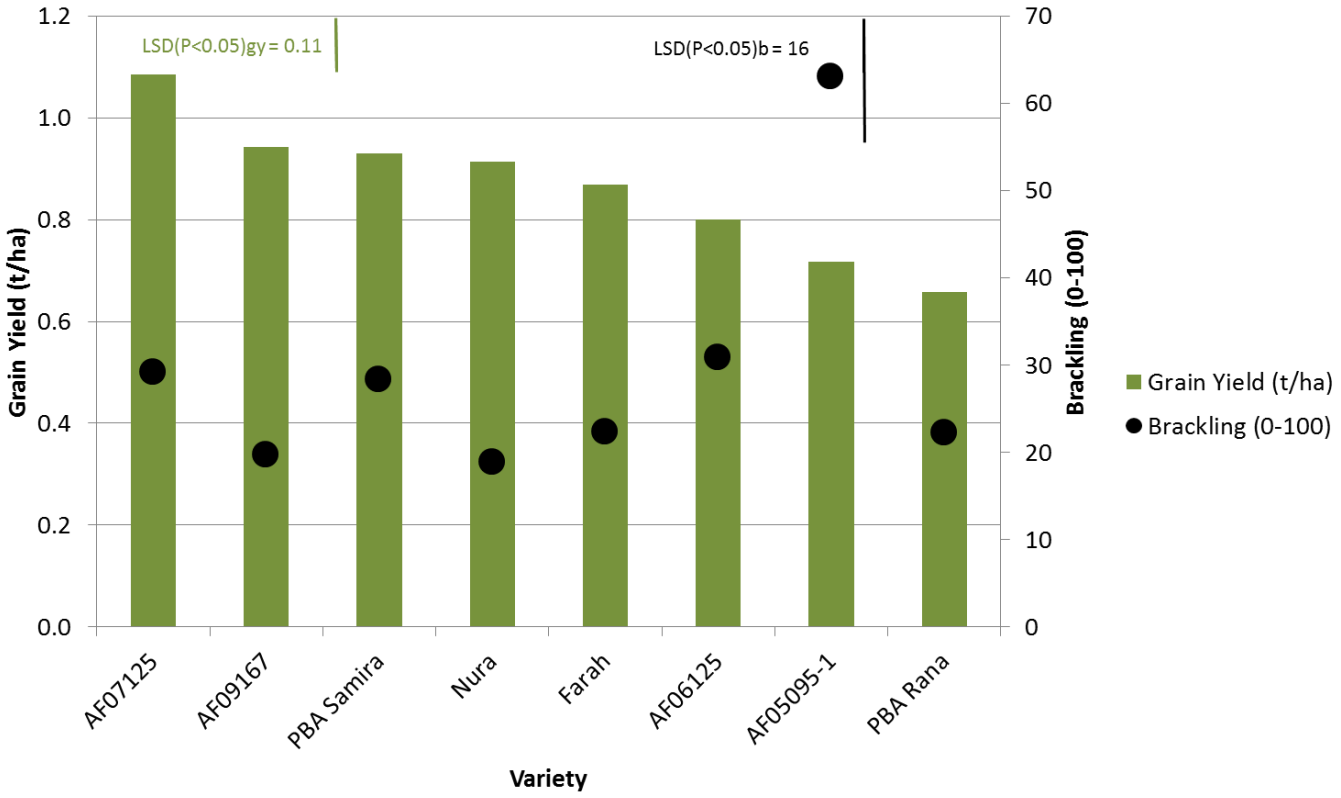

Figure 1. Brackling Score (0, no symptoms; 100, crop fully brackled) and grain yield (t/ha) of faba bean varieties grown at Pimpinio in 2014 in a disease management trial.

B4 Row Space and Sowing Rate, HRZ South West (Westmere), Victoria

Aim

To investigate the optimum row spacing for range of faba bean varieties and the interaction withg sowing rate for one variety.

Experimental Treatments

Varieties:	PBA Samira, AF05095-1, AF07125, AF07125, AF09167, Farah, Nura.
Plant Density:	15, 25 and 35 plants/m^2 AF5095-1 only.
Row Spacing:	20 cm (8 rows) and 40 cm (4 rows).

Other Details

Sowing date:	8 May.
Stubble:	none - worked.
Fertiliser:	MAP @ 100 kg/ha at sowing.
Plant Density:	25 plants/m^2.

Results and Interpretation

- Key Message: row spacing and sowing rate had no impact on grain yield in 2015.

  - Note – There was a missing row 40 cm (4 row) plots. While a covariate accounting for the missing row has been used to statistically assess to trials, it is advised to treat results with due caution.
  - Establishment – Establishment was generally close to target densities for all treatments in the trial. Early growth and vigour was good. The dry and hot finish, did reduce potential grain yields.
  - Grain Yield – Row spacing had no significant impact on grain yield with the 20cm treatment averaging 2.73t/ha across all varieties and the 40cm treatment averaging 2.94t/ha. In AF05095-1 sowing rate also had no impact at either row space with yield of 3.20, 3.10 and 3.15t/ha, respectively in the 15, 25 and 35 plants/m^2 treatments. In terms of varieties, grain yields were excellent considering the season, ranging from 2.14t/ha to 3.09t/ha. Similar to previous years 2012, AF05095 was the highest yielding variety (3.09t/ha),, but its yield advantage over Farah was only 5% compared with 37% in 2013 and 2012.

Table 1. Grain yield (t/ha) of faba bean varieties grown at Westmere in 2014 in comparison to 2013 and 2012.

Variety	2014	2013	2012
AF05095	3.09	3.94	5.53
AF06125		3.40	4.49
PBA Rana		3.38	4.49
AF05073		3.32	5.00
PBA Samira	3.05	2.97	5.14
Farah	2.95	2.88	4.04
Nura	2.71	2.85	4.14
AF07125	3.06	2.72	4.49
AF09167	2.14		

lsd(P<0.05)2014 = 0.49; $lsd(P<0.05)_{2013}$ = 0.30; $lsd(P<0.05)_{2012}$ = 0.37

Key Findings and Comments

- Growing conditions were relatively dry for faba beans in 2014, showing that the yield advantage of AF05095-1 is best demonstrated in higher rainfall season. The results with row spacing and sowing rate indicate the flexibility of faba beans to these practices and growers should consider the relative costs and agronomic implications within their own farming systems.
- Based on yields achieved (3.1t/ha) beans could have achieved a gross profit of approximately $1000/ha based on management costs of $250/ha and grain price at $400/t.

B5 Canopy Management, HRZ South East (Bool Lagoon), South Australia

Aim

To determine the effect of various plant growth regulant (PGR) hormones, herbicides, fungicides and agronomic practices on canopy architecture and grain yield of faba bean.

Treatments

As described in Table 1.

Table 1. Treatments, rates and application dates for faba bean canopy management trial sown at Bool Lagoon, South Australia.

 # Treatments not registered for use on faba bean, and chemical rates are experimental only. Product identification and application rate details have been withheld.

Herbicides #		Application Date	Plant Growth Regulator (PRG) Hormones #		Application Date
1.	Atrazine	28/08/2014	1.	Chlormequat	26/08/2014
2.	Clomazone	26/08/2014	2.	Chlormequat	9/09/2014
3.	Glyphosate - Low	26/08/2014	3.	Ethephon	26/08/2014
4.	Glyphosate - Medium	26/08/2014	4.	Ethephon	9/09/2014
5.	Glyphosate -High	26/08/2014	5.	Paclobutrazol	28/08/2014
6.	Imazamox – Low	26/08/2014	6.	Paclobutrazol	9/09/2014
7.	Imazamox – Medium	26/08/2014	7.	Trinexapac-Ethyl	26/08/2014
8.	Imazamox – High	26/08/2014	8.	Trinexapac-Ethyl	9/09/2014
9.	Paraquat + Diquat -Low	26/08/2014	9.	Product A	26/08/2014
10.	Paraquat + Diquat -High	26/08/2014	10.	Product A	9/09/2014
Fungicides #		**Application Date**	**Agronomy Practices**		**Application Date**
1.	Tebuconazole – Low	26/08/2014	1.	Low density sowing - 6 plants/m^2	10/06/2014
2.	Tebuconazole – High	26/08/2014	2.	Wide row sowing – 30cm spacing's	10/06/2014
Control Treatment			3.	Delayed sowing	3/07/2014
1.	Nil - no treatment applied	-	4.	Delayed sowing + wide row (30 cm spacing's)	3/07/2014
			5.	Simulated grazing	28/08/2014

Other Details

Variety:	PBA Kareema
Sowing Date:	10 June 2014
Delayed Sowing Date:	3 July 2014
Fertiliser:	Grain Legume Zn 2% @ 150kg/ha at sowing
Plant Density:	12 plants/m^2
Low Plant Density:	6 plants/m^2
Fungicides:	14 August Mancozeb @ 1 kg/ha; 29 September Mancozeb @ 2 kg/ha

Results and interpretation

- The site experienced average rainfall through April-July, with dry conditions post July. As a consequence of the dry conditions yields were considerably down on previous seasons.
- The Nil treatment produced a grain yield of 2.58 t/ha, compared to 5.43 t/ha in 2013. Similar low yields were recorded at trials nearby.
- Disease was kept to a minimum at the site by implementing a fungicide regime representative of local grower practice.
- Plant height (cm) (8th October), grain yield (t/ha) and 100 grain weight (gm) (9th December) were measured (Table 2).
- The Nil treatment measured 71.6 cm in height and had a 100 grain weight of 136.8 g.

- Heights across treatments did vary significantly with the lowest height measured, simulating grazing treatment, at 33.3 cm. This treatment also recorded the lowest grain yield, 0.85 t/ha, and 100 grain weight 122.0 gm, significantly less than the Nil.
- Delayed sowing, Glyphosate (medium) and Glyphosate (high) reduced height by 33-35%, but resulted in a significant yield penalty.
- Wide row spacing did not decrease height nor did it have a yield or 100 grain weight penalty. Delayed sowing and wide row spacing did decrease height, but resulted in a yield penalty.
- Both delayed sowing treatments had significantly reduced 100 grain weight compared to the Nil.
- Four treatments reduced height from the Nil, without a significant yield penalty; Clomazone, Paraquat + Diquat (High), Ethephon (26 Aug) and Ethephon (9 Sept). Paraquat + Diquat (High) and Ethephon (26 Aug) did not differ in 100 grain weight from the Nil. Clomazone and Ethephon (9 Sept) had significantly lower 100 grain weights compared to the Nil.

Key findings and comments

- The concept of canopy management for improved disease control, fertiliser use efficiency and grain yield has been well documented in cereals, however limited research has been conducted on this concept in pulse crops, including faba beans.
- While large bean canopies are beneficial from a nitrogen fixation perspective, these often pose a number of problems, such as shading of flowers, poor fungicide penetration, increase disease intensity, increased plant lodging, decreased harvestability and the potential for haying off in seasons with a sharp finish.
- This trial compliments work that has been undertaken in South Australia's Mid North (Tarlee) and builds on previous work in the South East. It expands the products tested and agronomic practices evaluated, such as evaluating Clomazone and wide row spacing.
- This study has shown (and supports 2013 findings) that grazing and different rates of Glyphosate suppress plant height. These treatments were however associated with a significant yield penalty in 2014, compared with 2013 where there was no significant yield loss.
- Paraquat + Diquat (high) reduced height more than Paraquat + Diquat (medium) without a significant yield penalty. This demonstrates the need to evaluate chemicals at various rates to maximise their potential.
- In 2014 as in 2013, Ethephon reduced plant height without a yield penalty. The later application slightly increased yield, decreased 100 grain weight and had a lesser impact on height, showing that timing of application needs to be considered. The repeated application of PGR hormones has not been tested in current trial work and is a possible area for further research.
- These results suggest that there may be the potential to use chemicals to manipulate plant architecture without yield penalty. Identifying a chemical or rate that reduces plant height with little or no effect on grain yield could potentially have significant benefits to fungicide penetration and efficacy, disease intensity, grain yields and harvestability.

Table 2. Effect of applied treatments on height (cm) (% of Nil treatment) recorded 8 Oct 2014, grain yield (t/ha) and 100 grain weight (gm) (harvested 9 Dec 2014) at Bool Lagoon, South Australia.

Treatment	Height (% of Nil)	Yield (t/ha)	100 grain weight (gm)
Nil - no treatment applied	100 (71.6 cm)	2.58	136.8
Herbicides			
Atrazine	77	1.90	137.9
Clomazone	77	2.50	123.5
Glyphosate – Low	79	1.56	133.9
Glyphosate – Medium	67	1.50	136.2
Glyphosate –High	65	1.30	130.0
Imazamox – Low	95	2.50	134.3
Imazamox - Medium	91	2.44	135.9
Imazamox – High	93	2.40	142.9
Paraquat + Diquat -Low	91	2.39	134.5
Paraquat + Diquat -High	84	2.21	135.5
Fungicides			
Tebuconazole - Low	98	2.68	139.7
Tebuconazole - High	98	2.82	136.4
Plant Growth Regulator PGR) Hormones			
Chlormequat - 26 Aug	102	2.73	138.5
Chlormequat - 9 Sept	95	2.56	135.8
Ethephon - 26 Aug	81	2.16	133.4
Ethephon - 9 Sept	86	2.39	127.7
Paclobutrazol - 28 Aug	100	2.62	135.2
Paclobutrazol - 9 Sept	95	2.50	132.7
Trinexapac-Ethyl - 26 Aug	98	2.49	133.0
Trinexapac-Ethyl - 9 Sept	95	2.45	135.2
Product A - 26 Aug	100	2.70	136.2
Product A - 9 Sept	98	2.79	137.7
Agronomy Treatments			
Low density sowing	93	2.22	135.8
Wide row sowing	102	2.30	138.9
Delayed sowing	65	1.61	124.2
Delayed sowing + wide row	72	1.95	124.7
Simulated grazing	47	0.85	122.0
	Site Average	2.25	133.9
	LSD (P<0.001)	0.44	7.73

B6 Crop-Topping/Desiccation, HRZ Mid North (Tarlee), HRZ Eyre Peninsula (Wangary) and HRZ South East (Bool Lagoon), South Australia

Aim

To determine the correct maturity timing for successful crop-topping practice and to identify lines suitable for crop-topping, showing minimal yield loss in faba bean.

Treatments

Sites: Bool Lagoon (South East) – AR = 500mm, Soil type: clay
Tarlee (Mid North) – AR = 500mm, Soil type: loam
Wangary (Eyre Peninsula) Soil type: loamy clay over sandy clay

Varieties: As listed in Table 1.

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

Variety	Flowering	Maturity
Farah*	E-M	E-M
Fiesta	E-M	E-M
Nura	M	E-M
PBA Rana	M-L	M-L
PBA Samira	E-M	E-M
AF07125	E-M	E
AF08161	M	E-M
AF09167	E-M	E-M
AF05095-1*	M-L	M-L
AF06104-1*	E	E
AF06125-2*	M	M
AF08035*	E	E
AF09062*	E-M	E-M
AF09169*	E-M	M
AF10089*	M	E-M
* Varieties sown in Tarlee trial only		

Treatments: Dates as provided in Table 2.

Nil – no desiccant applied
Early – applied 10-14 days pre ryegrass milky dough stage
Mid – applied at ryegrass milky dough stage
Late – applied 10-14 days post ryegrass milky dough stage

Other Details

Fertiliser: MAP + ZN 2% @ 90 kg/ha at sowing (Tarlee and Wangary)
Grain Legume Zn 2% @ 150kg/ha at sowing (Bool Lagoon)
Plant Density: 24 plants/m^2
Fungicides: Carbendazim pre flowering/canopy closure and mid-September, 500 ml/ha
Procymidone early October (Tarlee and Wangary)
14 Aug Mancozeb 1 kg/ha + 29 Sept Mancozeb 2 kg/ha (Bool Lagoon)

Results and interpretation

- Bool Lagoon and Tarlee showed a crop-top timing response and a variety response, but no crop-top timing by variety interaction.
- The Wangary site was highly variable and experienced waterlogging. No late crop-topping treatment was applied. There was a variety response, but no crop-top timing response nor crop-top timing by variety interaction at this site.
- Crop-topping at the early time caused significant yield loss at Bool Lagoon and Tarlee (Table 2). The Tarlee and Bool Lagoon trials showed yield losses of 5% and 17% respectively from crop-topping at the early treatment compared to the Nil. No yield loss occurred at the mid (recommended) timing at either trial.
- Crop-topping at the early timing caused a significant reduction in grain weight at all three sites (Table 2).
- Crop-topping at the mid timing and late timing (Bool Lagoon and Tarlee only) had no effect on grain weights in these trials.
- Dry spring conditions post July resulted in lower yields than previous years. Fiesta was the highest yielding variety at Bool Lagoon (2.14 t/ha) and was similar to PBA Samira (1.99 t/ha), both of which yielded significantly more than Nura (1.64 t/ha) and the lowest yielding variety PBA Rana (1.50 t/ha). At Wangary, AF09167 was the highest yielding variety (1.51 t/ha) and was similar to Fiesta (1.41 t/ha) and PBA Samira (1.39 t/ha). Nura was the lowest yielding variety (0.90 t/ha) and was significantly lower yielding than Fiesta and PBA Samira. PBA Rana yielded 1.16 t/ha.
- At Tarlee a larger cohort of varieties were evaluated. AF10089 (3.71 t/ha), AF08035 (3.57 t/ha) and AF09062 (3.55 t/ha) out yielded all the commercial varieties. PBA Samira and Farah yielded the same (3.23 t/ha) and Fiesta, PBA Rana and Nura were similar (3.11 t/ha, 3.07 t/ha and 3.00 t/ha respectively). AF09167 was the lowest yielding line at 2.86 t/ha.

Table 2. Effect of crop-top timing on grain yield (% Nil) and grain weight (% of Nil) of faba bean varieties at Bool Lagoon, Tarlee and Wangary, South Australia.
Shaded figures represent significant differences to the corresponding Nil treatment.

Site	Timing		Yield (% of Nil)	LSD (P<0.05) (% of Nil)	Grain Weight (% of Nil)	LSD (P<0.05) (% of Nil)
Bool Lagoon	**Early**	**24-Oct**	83	11	86	2
	Mid	**6-Nov**	94		100	
	Late	**19-Nov**	99		98	
	Nil		1.93 t/ha		63 g/100 seeds	
Tarlee	**Early**	**24-Oct**	95	4	96	1
	Mid	**5-Nov**	98		101	
	Late	**12-Nov**	103		100	
	Nil		3.31 t/ha		67 g/100 seeds	
Wangary	**Early**	**16-Oct**		NS	92	3
	Mid	**30-Oct**			101	
	Nil		1.35 t/ha		66 g/100 seeds	

Key findings and comments

- Similarly to previous (2013) trials, there was no interaction between crop-top timing and variety. This means that the varieties evaluated in these trials had the same grain yield response at the different crop-top timings; therefore no variety was better suited to crop-topping than another. This finding has been consistent in faba beans over time but different to all other crops (lentil, field pea, chickpea).
- Yield losses associated with crop-toping were lower than experienced in previous seasons. This is most noted at the Eyre Peninsula site where in 2013 a 33% grain yield penalty was observed at the early timing, compared to no penalty in 2014. This is likely a result of the dry spring conditions and the moisture stress experienced in 2014.
- Crop-topping prior to ryegrass milky dough stage caused significant yield loss of 5% at Tarlee and 17% at Bool Lagoon but crop-topping at ryegrass milky dough stage and post ryegrass milky dough stage did not cause yield losses at Bool Lagoon or Tarlee.
- Variation in crop-topping responses between the sites, particularly Wangary, may be a result of a combination of differences in sowing dates, site yields, seasonal conditions, waterlogging and the maturity profiles of the local ryegrass biotype.
- Previous research has shown that sensitivity to crop-topping in pulse crops is generally related to variety maturity, where later maturing varieties generally show higher yield losses when crop-top is applied too early. These trial results showed no relationship between variety maturity and yield loss from crop-topping in 2014 (the same as in 2013 and 2012 research). Work will be on-going to identify varieties or plant types better suited to crop-topping for weed control in faba bean and to try and understand this lack of variety response.
- A reduction in grain weight from crop-topping prior to the ryegrass milky dough stage at all three sites supports previous trial results and research findings that untimely crop-topping of beans can result in reduced grain weight.

F7 Sowing Date, HRZ Mid North (Tarlee), South Australia

Aim

To identify the optimal sowing date for current and potential new faba bean varieties.

Treatments

Varieties: Nura, Farah, PBA Rana, PBA Samira, AF03001-1, AF05095-1, AF06125-2, AF07125, AF08108
Sowing Dates 2014: early - 28 April, mid - 12 May, late - 26 May

Other Details

Fertiliser: MAP + ZN 2% @ 90 kg/ha at sowing
Plant Density: 24 plants/m^2
Fungicides: Carbendazim pre flowering/canopy closure and mid-September, 500 ml/ha
Procymidone early October
Measurements: Grain yield (t/ha), maturity, lodging (score) and necking (%)

Results and interpretation

Grain Yield

- Sowing date significantly affected grain yield. Early time of sowing (28 April) had a 7% increase in grain yield compared to mid time of sowing (12 May) and a 12% grain yield increase compared to late time of sowing (26 May).
- There was a significant difference in grain yields between varieties. AF05095-1 was the highest yielding variety (4.22 t/ha) and was significantly greater than all other lines, except for AF07125 (4.11 t/ha). PBA Samira (3.93 t/ha) and Farah (3.73 t/ha) had similar grain yields. PBA Samira had a 7% grain yield increase compared to Nura and an 11% increase compared to PBA Rana.
- Overall PBA Samira was the highest yielding commercial variety. It was the highest yielding commercial variety at the early time of sowing (4.33 t/ha) and the late time of sowing (3.68 t/ha) (Figure 9). Farah was the highest yielding commercial variety at the mid time of sowing (3.85 t/ha). Of the four commercial varieties PBA Samira had the greatest decrease in grain yield from the early to the mid time of sowing, 13%. The grain yield of PBA Rana decreased by 17% from the early time of sowing to the late time of sowing.

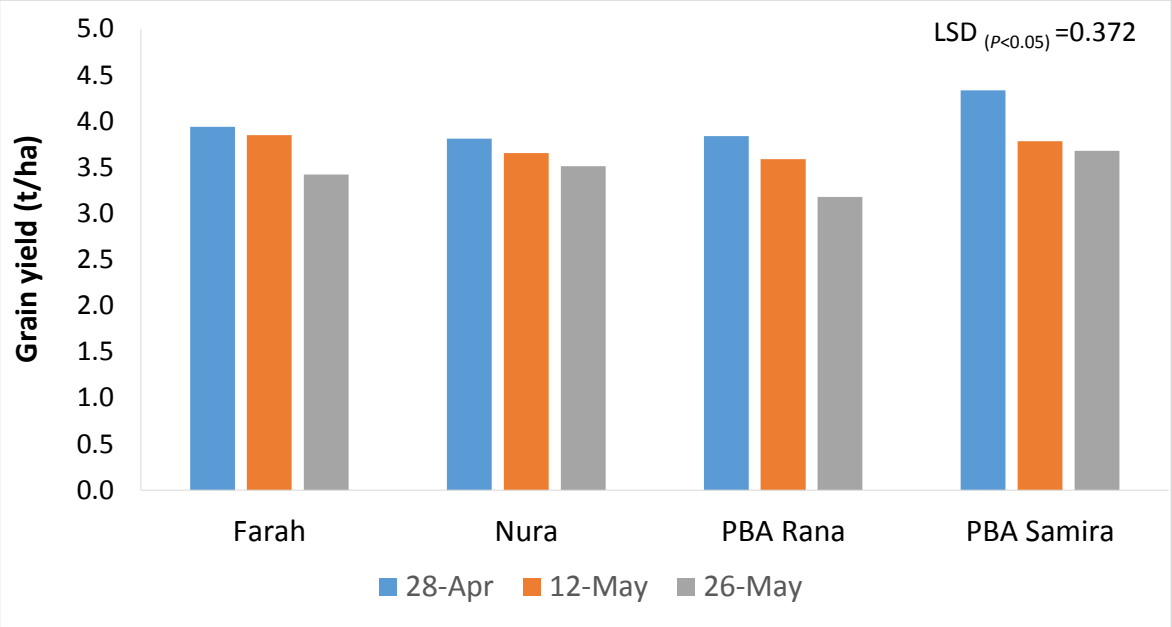

Figure 9: Grain yield (t/ha) of commercial faba bean varieties at three different sowing dates; early (28th April), mid (12th May) and late (26th May) at Tarlee, South Australia

Maturity

- There was a significant interaction between sowing date and variety maturity. The maturity of all varieties was delayed from the early time of sowing to the mid time of sowing and to the late time of sowing.
- AF08108 had significantly earlier maturity at all three times of sowing and AF07125 was significantly the latest maturing line at the mid and late times of sowing.
- PBA Samira, PBA Rana and Nura maturities were the same at the three different times of sowing, with Farah significantly earlier.

Lodging

- Lodging resistance was scored on a 1-9 scale, with 9 = erect plants and 1 = flat plants.
- There was a significant interaction between variety, time of sowing and lodging resistance. The early maturing line AF08108 had significantly reduced lodging resistance at the early time of sowing compared to all other varieties.
- Lodging resistance scores over the times of sowing remained consistent for the varieties AF03001-1, PBA Samira, AF07125, Farah, PBA Rana. The late time of sowing resulted in an increase in lodging resistance in AF05095-1 and AF06125-2.
- AF08108 and Nura lodging resistance increased significantly from the early time of sowing to the mid time of sowing.
- Apart from the early time of sowing, Nura, PBA Rana and PBA Samira had greater lodging resistance than Farah. This is consistent with the rating of Farah as moderately susceptible for lodging resistance compared to moderately resistant for the other varieties. Nura had decreased lodging resistance at the early sowing compared to PBA Rana and PBA Samira.

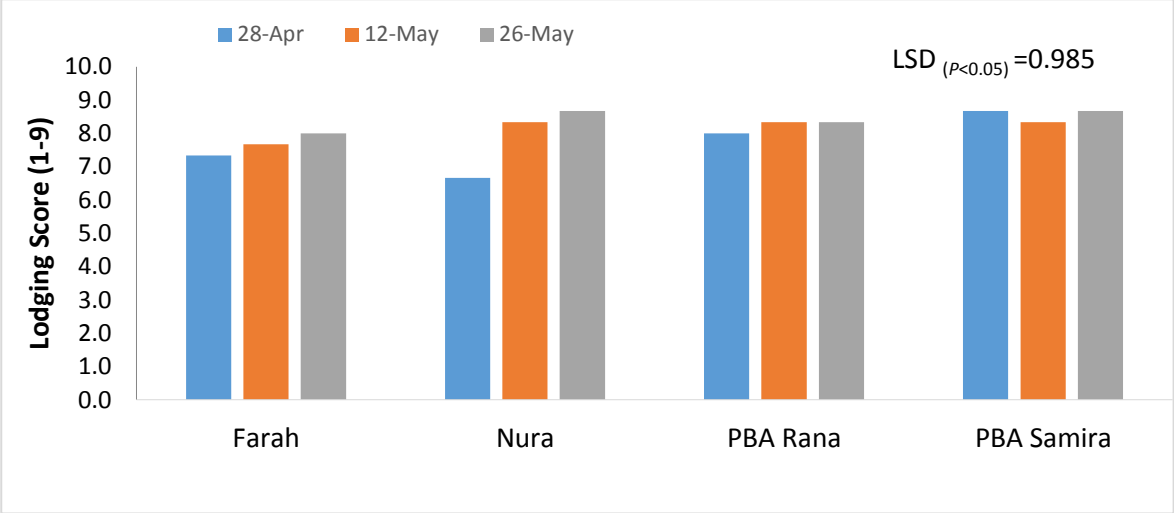

Figure 2: Lodging scores of faba bean varieties, Farah, Nura, PBA Rana and PBA Samira at three different times of sowing; Early (28th April), Mid (12th May) and Late (26th May) at Tarlee, South Australia. Lodging was scored on a 1-9 scale, with 9 =erect plants and 1=flat plants.

Necking

- Necking was measured as % of plot affected.
- Necking, where the lower stem of the faba bean plant remains erect but a proportion of the stem 'necks' over between 90 and 180 degrees in the podding zone, was prevalent in research trials and commercial crops in 2014. This phenomenon is thought to be due to moisture stressed plants being subjected to heat and wind events during the reproductive phase. The effect of necking on grain yield and seed size is largely unknown although harvestability is often reduced.
- The results from this trial found no interaction between necking and time of sowing. Necking was greatest in varieties AF07125 (58.9%) and AF05095-1 (47.8%), which also had the highest grain yields; indicating necking had no impact on grain yields in this trial.
- PBA Samira (24.4%), PBA Nura (20.0%) and Farah (18.9%) all had significant levels of necking compared to RBA Rana (7.2%). AF03001-1 (1.7%) and AF08108 (7.2%) were relatively unaffected by necking.

Key findings and comments

- The trial results show that time of sowing has a significant impact on grain yields. Varieties need to be sown at the optimum time to maximize grain yield which in this experiment was at the early time of sowing (late April).
- PBA Samira was the highest yielding variety sown early and due to a good combination of disease and lodging resistance appears well suited to this practice when compared with other current faba bean options.
- Time of sowing also affects the maturity of varieties, with delayed sowings resulting in delayed maturities.
- There was an interaction between variety by time of sowing and lodging resistance. Overall lodging resistance tended to increase with later times of sowing, corresponding to a decrease in grain yields. Lodging results tended to be consistent with commercial guides for varieties.
- Previous work has suggested that necking may only be visual and not make harvest more difficult or reduce grain yields. This trial supports these findings as necking had no influence on grain yields. Time of sowing did not affect the occurrence of necking on varieties. PBA Rana had reduced necking compared to the other commercial varieties.

MultiCrop Trials

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

Aim

To assess the agronomic benefits of seeding pulses into standing cereal stubble and identify optimum standing stubble retention management strategies for maximising yields.

Treatments

Crop and variety agronomic features: presented in Table 1.

Table 1: Agronomic characteristics of crops and varieties sown at Pinery, 2014.

Crop	Variety	Maturity	Lodging resistance at Maturity	Plant type	Ascochyta Resistance Foliar / Seed
Chickpea	Genesis™ 090	Mid	MR	Kabuli	R*
	Genesis™ Kalkee	Late	R	Kabuli	MS*
	PBA Monarch	Early	MS	Kabuli	MS*
	Sonali	Early	MS	Desi	S*
	PBA Slasher	Mid	MS	Desi	R*
	PBA Striker	Early	MS	Desi	MR*
Field Pea	Kaspa	Mid	Fair-Good	Semi-dwarf dun	MS
	PBA Gunyah	Early	Fair-Good	Semi-dwarf dun	MS
	PBA Oura	Early	Fair-Good	Semi-dwarf dun	MS-MR
	PBA Pearl	Early	Good	Semi-dwarf white	MS
	PBA Percy	Early	Poor	Conventional dun	MS
	Parafield	Mid	Poor	Conventional dun	MS
Lentil	Boomer	Mid-Late	S	Prostrate	MR / MS
	PBA Hurricane XT	Mid	MR	Semi-erect	MR / R
	Nipper	Mid	MR	Erect	MS-MR / MR
	PBA Ace	Mid	MS/MR	Prostrate	R / R
	PBA Blitz	Early	MR	Erect	MR / MR-MS
	PBA Jumbo	Mid	MS	Prostrate	MR-MS / S

*Rating currently under review and relates to foliage only

Treatments: Stubble height was cut to leave: a) Short– 5cm, b) Medium-20cm, and c) Tall–40cm length straw above the ground.
All slashed stubbles were retained in inter-row so that stubble loads were identical between treatments

Other Details

Sowing date: 20th May
Stubble: 3.6t/ha of wheat stubble
Row Spacing: 25cm (10 inches)
Seeding system: Knife point cone seeder
Rolled: Immediately post sowing
Fertiliser: MAP + Zn (2%) @ 90 kg/ha at sowing
Inoculum: Chickpea only Group N
Seed dressing: PPT (+Apron on peas)
Foliar Fungicides: Canopy Closure –Carbendazim @500ml/ha, Chlorothalonil @2L/ha
Mid flowering to Early Podding – Carbendazim @500ml/ha, Chlorothalonil @ 2L/ha

Results and interpretation

- A crop type by stubble height interaction for yield and lodging was not recorded in this trial suggesting that stubble management treatments did not improve grain yields or level of lodging resistance across

the three pulse crops. There was however a significant yield and lodging response observed between the individual crops (data not shown).

- Lentils (1.94t/ha) and field peas (1.92 t/ha) yielding similarly and higher than chickpeas (1.64 t/ha).
- Chickpeas showed a significantly higher lodging resistance level compared with lentils and field peas whose susceptibility to lodging differed between each other with field pea showing reduced lodging resistance over lentils.
- When crops were analysed individually, still no variety by stubble height response for grain yield and lodging resistance was found. A significant variety response was however generated for grain yield for each pulse crop type.
- In chickpeas, PBA Striker was the highest yielding variety followed by PBA Monarch and PBA Slasher which had similar yields, while Genesis™ Kalkee had the lowest yields (Table 2).
- PBA Ace and PBA Blitz were the equal higher yielding lentil varieties with PBA Blitz yielding similar to PBA Hurricane XT. Boomer was the lowest yielding variety.
- A significant variety response for lodging was found for lentils and chickpeas but not for field peas. PBA Ace and PBA Hurricane XT, showed similar and greater lodging resistance compared to Boomer and PBA Blitz which showed similar and lower levels of lodging resistance. Genesis™ Kalkee had significantly higher lodging resistance followed by PBA Monarch with PBA Slasher and PBA Striker showing lower levels of lodging resistance.

Table 2: Grain yield (t/ha) of field pea, lentil and chickpea varieties at Pinery, 2014

Crop	Variety	Yield (t/ha)	LSD (P<0.05)
Chickpea	PBA Striker	1.90 [a]	0.16
	PBA Monarch	1.57 [b]	
	PBA Slasher	1.70 [b]	
	Genesis™ Kalkee	1.41 [c]	
Field Pea	07H031P006	1.85 [a]	0.15
	PBA Oura	2.32 [a]	
	PBA Twilight	1.87 [a]	
	Kaspa	1.63 [b]	
Lentil	PBA Ace	2.18 [a]	0.19
	PBA Blitz	2.05 [ab]	
	PBA Hurricane XT	1.96 [b]	
	Boomer	1.58 c	

Key findings and comments

- Our results show that stubble management (reduction in height from 40cm to 5cm) had no improvement on yield and lodging between crop types and varieties within a crop type under the seasonal conditions in 2014.
- These results are not consistent with those from similar trials conducted in 2013 and 2012 where stubble treatments generated significant responses for grain yield. In 2013, field pea showed significant stubble height response for grain yield compared to chickpeas and lentils which yielded similarly across the stubble treatments. Field pea grain yield improved by 6% by sowing into tall (40 cm) compared to short (5 cm), and medium (20 cm) stubble which yielded similarly. Although those results are not replicated in the current trial, previous results show that stubble management is important for some pulse types such as lentil and field pea.
- When individual crops were analysed in this trial, varieties yielded and lodged similarly across the stubble treatments. This again conflicts with previous similar trials conducted in 2012 which showed that retained standing stubble were important in some lentil varieties such as PBA Blitz which showed the greatest yield response compared to varieties such as Boomer.
- Sowing PBA Blitz into tall stubble (30 and 60 cm) has also been shown to provide protection from wind erosion by benefits from reduced wind speed at the zone of plant growth, (0-40 cm above the soil surface) and improved harvestability as a result of taller and more erect crop compared to seeding into shorter stubble (5 and 15 cm).

- Yields of varieties across pulse crops were consistent with those of previous years which demonstrates yield stability for those varieties across the seasons.
- Studies on stubble management especially those evaluating sowing crops into cereal stubble of varying heights have produced varied response to yield across seasons and the type and structure (arrangement/height) of stubble retention required to maximize benefits require further research. The interaction with seasonal conditions also requires further understanding and perhaps the lack of significant rainfall events during spring in 2014 was responsible for the lack of a response seen in 2014. It should also be noted that there was no stubble removed treatment (bare soil) in 2014 and previous work has shown yield benefit in lentil in all seasons between stubble retained and removed stubble treatments regardless of height.

M2. Low Rainfall Pulse Evaluation, Upper Eyre Peninsula (Minnipa), South Australia

Aim

To evaluate pulse options in the upper Eyre Peninsula region following recent increased interest in alternative pulse options to field peas from growers and agronomists.

Table 1: Varieties and sowing densities (plants/m^2) of pulses sown at Minnipa, 2014

Varieties			Plant density
Field Peas	PBA Wharton OBA Oura PBA Twilight	PBA Pearl Kaspa	55 plants/m^2
Lentils	PBA Hurricane XT PBA Bolt PBA Blitz	Nugget PBA Flash	120 plants/m^2
Faba Beans	Fiord AF09167 PBA Samira	Nura Farah	24 plants/m^2
Chickpeas	PBA Slasher PBA striker PBA Monarch	Genesis™ 079 Genesis™ 090	Desi = 50 plants/m^2 kabuli = 35 plants/m^2

Other Details

Sowing date:	5th of May
Fertiliser:	DAP @ 59 kg/ha at sowing
Seed treatment:	P-Pickel T (200 ml/100kg seed)
Inoculant:	Group N (Chickpea only)

Results and interpretation

- Faba beans, averaging a yield of 1.8 t/ha, were the highest yielding pulse in 2014, 6% higher than field peas (1.7 t/ha). Lentils averaged 1.4 t/ha while chickpeas were the lowest yielding crop (27% lower than field peas), with an average yield of 1.3 t/ha.
- Faba beans – Fiord yielded higher than all other varieties, except for AF09167 (Table 1). These two varieties are the earliest maturing faba bean varieties used in this trial. Fiord has a short plant type and early maturity but poor disease resistance and seed quality.
- Field peas – Early maturing PBA Wharton yielded higher than all other varieties except for PBA Oura. Kaspa showed the lowest yields perhaps due to its late maturity.
- Lentils – PBA Hurricane XT and PBA Bolt were the two highest yielding varieties, followed by PBA Blitz. PBA Hurricane XT and PBA Bolt were approximately 75% higher yielding than Nugget. The low yield from PBA Flash is unexpected and unexplained and should be treated with caution. Observations and scores during growing season do not support this yield performance in PBA Flash.
- Chickpeas – Desi chickpeas tended to be higher yielding, due to their earlier maturity and broader adaptation to a range of soil types. PBA striker was the highest yielding variety. PBA Slasher, Genesis™ 079 and PBA Monarch yielded similarly and have similar maturities. Genesis™ 090 is the latest maturing variety and this was the lowest yielding variety.

Table 2. Field pea, lentil, faba bean and chickpea variety performance, Minnipa 2014 (listed in descending order of grain yield).

Field Pea variety	Yield (t/ha)			Lentil variety	Yield (t/ha)	Flower da (Julian)	Maturity rating
PBA Wharton	2.12	221	Early	**PBA Hurricane XT**	1.8	235	Mid
PBA Oura	1.88	218	Early	**PBA Bolt**	1.76	238	Early-mid
PBA Twilight	1.73	216	Early	**PBA Blitz**	1.70	236	Early
PBA Pearl	1.68	223	Early-mid	**Nugget**	1.01#	240	Mid-late
Kaspa	1.52	225	Mid	**PBA Flash**	0.93#	238	Early-mid
Crop mean (t/ha	1.79				1.43		
LSD (0.05)	0.31				0.04		

Faba bean variety	Yield (t/ha)	Flower day (Julian)	Maturity rating	Chickpea variety	Yield (t/ha)	Flower day (Julian)	Maturity rating
Fiord	2.13	208	Early	**PBA Striker**	1.52	233	Early
AF09167	1.92	210	Early	**PBA Slasher**	1.35	236	Mid
PBA Samira	1.84	223	Early-mid	**Genesis079**	1.34	235	Early
Nura	1.80	225	Early-mid	**PBA Monarch**	1.23	233	Early
Farah	1.79	210	Early-mid	**Genesis090**	1.09	237	Mid
Crop mean (t/ha)	1.89				1.30		
LSD (0.05)	0.22				0.16		

 # lower yields of these varieties are unexplained, treat with caution

Key findings and comments

- Grain yields of all pulses evaluated in 2014 were very much higher than their long term averages and also than those achieved in 1999, the last time these four pulse types were compared at Minnipa.
- The higher yields achieved last year are largely a result of the more favourable season that occurred in 2014 compared with 1999. Growing season rainfall was 85 mm higher in 2014 and annual rainfall 144 mm higher. Another major factor was the earlier sowing date in 2014 (May 5) compared with May 28 in 1999.
- Previous studies on the Upper Eyre Peninsula have shown that field pea yield is reduced by between 0.1 – 0.2 t/ha for every week sowing is delayed. The other critical seasonal difference in 2014 was the absence of hot days during the flowering and grain fill period. In 1999 a severe hot day in early September (33^0C) drove crops rapidly towards premature maturity, the absence of these type of events in 2014 allowed crops to finish last year despite the lack of significant rainfall after July.
- Under favourable conditions there was little separation in grain yield between the pulse types in 2014. Field pea yields are likely to have been reduced by the high disease infection that occurred last year while the later maturing chickpeas were lower yielding than all other crops. Generally earlier maturing varieties yielded higher than those maturing later across all crops and this reflected the dry finish to the season.
- Apart from in faba beans recent early maturing variety releases (PBA Wharton & PBA Oura field peas, PBA Blitz, PBA Bolt & PBA Hurricane lentils and PBA Striker and PBA Monarch chickpea) were all higher yielding than the older standard later maturing varieties (Kaspa field peas, Nugget lentils and Genesis 090 chickpeas). This reflects recent good progress being made by the relevant PBA breeding programs particularly when considering that a number of these varieties also contain agronomic improvements such as boron tolerance, disease resistance, harvestability and in the case of PBA Hurricane XT, herbicide tolerance. The PBA faba bean program is targeting medium to higher rainfall production areas with a large emphasis on improving disease resistance and seed quality and recent releases have not been aimed at low rainfall environments.
- In previous years PBA Wharton has generally performed similar to PBA Twilight and Kaspa at Minnipa however it was the highest yielding variety last year. It also was high yielding at many other sites in SA in 2014 most likely due to it being well suited to 'favourable' short season environments due to its early maturity and slightly lower biomass production than Kaspa. Its

suitability to years with lower winter rainfall levels is still questionable and requires further evaluation on the Upper Eyre Peninsula. Its combination of early maturity, boron tolerance and virus resistance makes it well suited to the lower rainfall regions and it has performed well in the Victorian mallee over a number of years.

- Clearly the results in table 1 show that successful and potentially profitable pulse crops can be grown in some regions of the low rainfall zone given favourable season conditions. Despite only similar yields to other crops in 2014 field pea remain the best adapted pulse to these regions, particularly in lower rainfall seasons due to their higher levels of winter biomass production and broader soil type adaptation.
- Pulses are not suited to all soil types in the low rainfall regions and should be targeted at the better loamy soil types free of herbicide residues, sticks and stones. Early sowing dates are also critical to maximise success but as seen in 2014 consideration with black spot risk is required with field peas particularly in the more reliable production areas and where sown in close proximity to the previous years pea stubble. Frost risk also needs careful consideration. Faba beans are the least susceptible to frost but still occur yield loss and the other three options are all susceptible. Delayed sowing does not guarantee frost avoidance and areas prone to regular frost events should be avoided.

Dual purpose field peas, forage peas or vetch all provide alternative options to the straight grain crops for these areas. Lentil, faba bean and chickpea despite varietal improvements and a similar performance to field pea at Minnipa in 2014 remain suited to the better soil types and more reliable production areas of the upper Eyre Peninsula. Outside of this they are at best opportunistic options in years with early season breaks and favourable seasonal out looks. Where they are grown, correct varietal choice will be critical to success. Earlier maturing varieties with improvements in disease, boron and in particular improved height and lodging resistance to aid harvestability will all help to increase the chances of success and should be used where available. Timely insect control and harvest is critical to maximise yield and reduce seed quality down grading. Growers also need to be aware of the specific market requirements for pulses including limitations with market access, often on farm storage will be required until the appropriate market is secured.