Southern PULSE Agronomy

2010 Results Summary

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

State Government Victoria Department of Primary Industries
NSW GOVERNMENT Primary Industries
GRDC Grains Research & Development Corporation
SARDI SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

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INTRODUCTION

The 2010 Southern Pulse Agronomy Program had 40 trials across south-eastern Australia at 15 sites addressing key management issues associated with the 5 pulse crops, lentil, field pea, chickpea, faba bean and lupin. Growing season conditions, including rainfall and temperatures were generally ideal for pulse production in most areas. However record rainfall events throughout harvest meant that in many cases potential grain yields were not met and grain quality downgraded.

Field Days were held at Curyo (southern Mallee) and Vectis (Wimmera) sites, Victoria; Mallala (Lower North), SA and Yenda and Wagga, NSW. At each of the field days, key industry production and marketing issues were highlighted and new varieties released as appropriate from Pulse Breeding Australia. In total, four new varieties were released in 2010 - two lentils, PBA Blitz and PBA Jumbo; and two field peas, PBA Gunyah and PBA Twilight. This program has developed and incorporated all the management related information for these varieties.

About Us

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

<u>Program Objective</u>: 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.

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

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

This project will contribute to the expansion of pulses in the southern region through research and development that delivers:

<u>1. Variety specific agronomy packages (VSAP)</u> - delivering benefits of new varieties to growers. Targeted agronomic research to produce data for new pulse varieties which will be synthesised into management packages for the southern Australian cropping regions in collaboration with PBA and other pulse breeding organisations.

<u>2. Profitable pulses for modern farming systems</u> - matching best genotypes to best farming systems. Strategic genotype x management research that provides: direction to PBA on potential genes/traits that confer advantage in new farming systems; information on how to agronomically maximise the benefits of new traits/genes currently recognised in the breeding program and the impacts of the genotype x management interaction on soil moisture. More specifically research will be focussed on 2 areas:

a. Understanding the agronomic importance of traits linked with weed management, eg. early maturity, herbicide tolerance, competitive plant types including forage types.

b. Identification of traits that are required to maximise production in modern minimum or no-till farming systems.

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

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

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

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

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

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

Acknowledgements

Project Staff

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We are grateful for the support we receive from the numerous commercial agronomists and seed commercialising companies.

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Industry	Grains Research and Development Corporation
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Melton, YP, SA	Neil Harrop
Hart, MN, SA	Matt Dare (c/- Hart Field Site)
Turretfield, MN, SA	Government of South Australia
Minnipa, EP, SA	Government of South Australia
Conmurra, SE, SA	Locky Seears
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RESEARCH HIGHLIGHTS

- LENTILS
  - Significant yield loss from rain at harvest was observed in many trials. For example, at Curyo in the southern Mallee, potential grain yields were in excess of 2.5t/ha for varieties such as PBA Flash. Grain yield losses from extreme rainfall events throughout harvest were between 27% and 65%.
  - Sowing Dates – grain yield was highest or equal highest at the early sowing date, despite the favourable finish to the season.
  - Crop Topping – due to the long season crop topping was generally damaging to yield before the recommended timing (ryegrass milky dough stage). Crop-topping at the recommended time incurred a yield loss only in the very latest maturing varieties, while some of the early maturing varieties showed an increase in yield by crop topping at and 2 weeks after the recommended timing.
  - Yield Stability - the new lentil genotypes, in particular CIPAL0801, continue to show potential in a season considerably different from that which we have had for the last decade, which is promising from a yield stability perspective.
  - Stubble – despite the high rainfall during 2010 stubble retention improved yields across all sowing dates, and up to 15% higher at the latest sowing date at Mallala (SA).

- CHICKPEAS
  - Sowing Dates - early sowing was generally beneficial and maximised yield potential. Avoid extremely early sowing, which can result in increased disease infection and excessive lodging.
  - Row Spacings - wider row spacing (>=30cm; up to 60cm) resulted in higher grain yields for all genotypes in Victoria. Wider row spacings also resulted in less visual symptoms of ascochyta blight. This was particularly notable in the susceptible genotype, Howzat. Wider row sowing of chickpeas in South Australia resulted in reduced grain yields for all genotypes, similarly to 2009.
  - Crop Topping - very damaging to yield when conducted at or before ryegrass milky dough stage (recommended timing), while there was no yield loss applied two weeks after ryegrass milky dough stage.

- FIELD PEAS
  - Sowing Dates - early sowing was generally beneficial even in a year of above average rainfall. At one site, good disease management showed a further yield improvement of 35%. Avoid extremely early sowing which can result in increased disease severity and lodging.
  - Extreme rainfall events throughout harvest resulted in grain yield losses, where measured, between 0% and 55%, the most severe response was in the variety, Sturt, with greatest susceptibility to pod shattering.
  - Crop Topping – generally no yield loss was recorded when applied at optimum timing for ryegrass control (milky dough stage) in NSW and Vic, while only 3 of the later maturing pea lines showed a yield loss at this timing in SA.

- FABA BEANS
  - Sowing Dates - Early sowing was generally optimal for all genotypes, and in all regions except in the Mid North of SA. In some trials, genotypes responded differently to sowing dates. For example, in the Wimmera of Victoria AF05073 was significantly higher yielding than other varieties when sown early, but not different to other varieties with later sowing.
  - Disease Management - Disease levels (ascochyta and chocolate spot) were high across most bean sites, except Victoria. Disease pressure was higher at earlier sowing times, with ascochyta worse at higher densities when sown early.

- LUPINS
  - Sowing Date / Row Space - Jenabillup and WALAN2289 showed a yield penalty at the later sowing date on narrow row spacing which was not evident at the wide row treatment. Mandelup showed yield improvements with each sowing delay at the narrow row spacing, while there was no sowing date response at wide row spacing.
  - Metribuzin applied at point of flower showed no yield penalty in Mandelup, Corromup and Jindalee. Wonga and Jenabillup showed the most sensitivity to Metribuzin.

Southern Pulse Agronomy Trials Sown in 2010

Experiment ID	Page	Rainfall Zone[1] Region (Location), State	Treatments (No. of treatments)	Varieties
LENTIL				
L1	20	LRZ Southern Mallee (Curyo), Victoria	Sowing Date (2) Row Space (2) Stubble (2)	16
L2	23	MRZ Wimmera (Vectis), Victoria	Sowing Date (2) Row Space (2) Stubble (2)	16
L3	25	LRZ Southern Mallee (Curyo), Victoria	Crop-topping/Desiccation (4)	10
L4	27	MRZ Wimmera (Vectis), Victoria	Crop-topping/Desiccation (4)	10
L5	28	MRZ Mid North (Mallala), South Australia	Sowing Date (3) Stubble (3)	8
L6	31	MRZ Yorke Peninsula (Paskeville), South Australia	Sowing Date (3) Disease Management (4)	8
L7	33	MRZ Yorke Peninsula (Melton), South Australia	Crop-topping/Desiccation (4)	16
CHICKPEA				
C1	35	LRZ Southern Mallee (Curyo), Victoria	Sowing Date (2) Row Space (3) Stubble (2)	12
C2	38	MRZ Wimmera (Vectis), Victoria	Sowing Date (2) Row Space (3) Stubble (2)	12
C3	40	MRZ Wimmera (Vectis), Victoria	Fungicide regimes (4) Row Space (2)	8
C4	42	H-MRZ (Wagga Wagga), New South Wales	Sowing Date (4) Plant Population (2)	8
C5	45	LRZ (Yenda), New South Wales	Sowing Date (3) Plant Population (2)	8
C6	47	HRZ (Cowra), New South Wales	Sowing Date (3) Plant Population (2)	6
C7	49	LRZ (Yenda), New South Wales	Plant Population (5)	6
C8	51	LRZ (Yenda), New South Wales	Row Spacing (4) Plant Population (2)	4
C9	53	MRZ Mid North (Mallala), South Australia	Sowing Date (3)	6
C10	54	MRZ Yorke Peninsula (Paskeville), South Australia	Sowing Date (3)	6
C11	56	MRZ Mid North (Mallala), South Australia	Row Space (2)	16
C12	57	MRZ Yorke Peninsula (Melton), South Australia	Crop-topping/Desiccation (4)	6

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

Experiment ID	Page	Rainfall Zone[1] Region (Location), State	Treatments	Varieties
FIELD PEA				
F1	59	LRZ Southern Mallee (Curyo), Victoria	Sowing Date (2) Row Space (3) Stubble (2)	4
F2	61	MRZ Wimmera (Horsham), Victoria	Sowing Date (2)	8
F3	62	LRZ Southern Mallee (Curyo), Victoria	Crop-topping/Desiccation (4)	10
F4	63	MRZ Mid North (Hart), South Australia	Sowing Date (3)	6
F5	65	MRZ Mid North (Hart), South Australia	Fungicide Regime (12)	1
F6	68	LRZ Upper Eyre Peninsula (Minnipa), South Australia	Sowing Date (2)	6
F7	69	LRZ Upper Eyre Peninsula (Minnipa), South Australia	Stubble (2)	6
F8	70	MRZ Mid North (Hart), South Australia	Crop-topping/Desiccation (4)	16
F9	72	LRZ (Yenda), New South Wales	Sowing Date (3) Plant Population (2)	8
F10	74	H-MRZ (Wagga Wagga), New South Wales	Crop-topping/Desiccation (4)	8
F11	77	LRZ (Yenda), New South Wales	Plant Population (5)	8
FABA BEAN				
B1	79	MRZ Wimmera (Vectis), Victoria	Sowing Date (2) Row Space (3) Stubble (2)	8
B2	91	MRZ Wimmera (Vectis), Victoria	Fungicide regimes (4) Row Space (2)	8
B3	82	H-MRZ (Wagga Wagga), New South Wales	Sowing Date (4) Plant Population (2)	6
B4	84	H-MRZ (Wagga Wagga), New South Wales	Row Space (4) Edge Rows (2)	2
B5	85	HRZ Mid North (Tarlee), South Australia	Sowing Date (2) Plant Density (3) Row Spacing (2)	4
B6	87	HRZ South East (Moyall), South Australia	Sowing Date (2) Plant Density (3)	4
B7	89	HRZ South East (Conmurra), South Australia	Sowing Date (2)	5
B8	90	HRZ South East (Conmurra), South Australia	Growth Regulants/Timings (8)	5
LUPIN				
U1	91	HRZ Lower South East (Wanilla), SA	Sowing Date (3) Row Space (2)	4
U2	93	HRZ Lower South East (Wanilla), SA HRZ Lower South East (Tooligie), SA	Herbicide Treatment (5)	5

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

Trial Site Locations for the 2010 Southern Pulse Agronomy Trials

NEW VARIETIES 2010 and VARIETY AGRONOMIC TABLES

The following varieties were released during the 2010 cropping season

- Lentils: PBA Blitz and PBA Jumbo
- Field Peas: PBA Gunyah and PBA Twilight

Variety characteristics are outlined in tables below

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

The tables below outline key disease and agronomic characteristics of varieties/ lines used in the Southern Pulse Agronomy Program, 2010

LENTIL

Name	Ascochyta Blight		Botrytis Grey	Vigour	Lodging	Pod Drop	Shattering	Flowering	Boron	Salt	Maturity	
	Foliage	Seed	Mould		Resistance			Time				Comments
Aldinga	MR	MS	MS	Mod	S	MR	MR	Mid	I	I	Mid	tall, primary branches
Boomer	MR	MS	MR	Good	MS	MR	MS	Early/Mid	I	I	Mid/Late	tall/bulky
Nipper	R	R	R	Poor/Mod	MR	MR	MR	Mid/Late	I	MT	Mid	short/erect
Northfield	R	R	S	Poor/Mod	MS	MR	MR	Mid/Late	I	MI	Mid	short
Nugget	MR	MS/MR	MR*	Mod	MS/MR	MR	MR	Mid	I	I	Mid/Late	semi-erect-branching
Cumra	MS	MS	MS	Mod	R	MS	MS	Early/Mid	I	MI	Early	
PBA Blitz	R	MR	MR	Mod/Good	MR	MR	MR	Early/Mid	I	I	Early	vigorous/early flowering
PBA Bounty	MR	MR	MS	Mod	MS	MR	MR	Mid/Late	I	MI	Mid	prostrate/many branches
PBA Flash	MS	MS	S	Mod	MR	MR	MR	Mid	MI	MI	Early/Mid	erect/high pods/crop topping
PBA Jumbo	R	MR	MS	Mod	MS	MR	MR	Mid	MI	MI	Mid	Aldinga type
CIPAL0501	MR	MR	MR	Mod	MS	MR	MR	Mid	I	I	Mid/Late	Nugget type
CIPAL0607												
CIPAL0611	R	R	MS	Mod	MR	MR	MR	Mid/Late	MI	MT	Mid	
CIPAL0702	R	R	MR	Poor/Mod	MR	MR	MR	Mid/Late	I	MI	Mid/Late	herbicide tolerant
CIPAL0801	R	R	S	Mod	R	MR	MR	Mid	MI	MI	Early/Mid	erect/tall/crop topping
CIPAL0802	R	R	MS	Mod	R	MR	MR	Mid	I	I	Early/Mid	erect/tall/crop topping
CIPAL0803	R	R	MR	Mod	MR	MR	MR	Mid	I	I	Mid	prostrate/bulky/branching
CIPAL0804				Good	MS	MR	MR	Mid			Mid/Late	early maturity for mallee
CIPAL0901	MR	MS	MS	Mod/Good	MR	MR	MR	Early	MI	MI	Early/Mid	
CIPAL0902	MR	MS	MS	Mod	MR	MR	MR	Early	I	I	Early/Mid	
99-088L*02H051				Mod	MR		MS	Mid/Early			Mid	tall

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

CHICKPEA

Name	Ave 100 seed wt (g)	Seed Size (mm)	Vigour	Flowering	Maturity	Botrytis grey mould	Ascochyta blight	Growth Habit
Desi's								
Sonali	18		Good	Early	Early	S	MS	stick-like
Howzat	21		Good	Mid	Mid	MS	S	
Flipper			Average	Late	Late	S	MR/MS	erect
Genesis™ 509	16		Average	Mid	Early/Mid	MS	R	erect
PBA Slasher	18		Average	Mid	Mid	S	R	vase shape
PBA Hattrick	20		Average	Mid	Mid	S	MR	erect
CICA0511	19		Average	Mid	Mid	S	MR	erect
CICA0613	20		Average	Late	Late	S	MS	very high pods
CICA0603	20		Good	Early	Early	S	MR	
CICA0604	18		Good	Early	Early/Mid	S	MR	
CICA0717	22		Average	Mid	Mid			
CICA0721	20		Good	Mid/Late	Mid	S	MR	erect
01-481*03HS010	26		Good	Very Early	Early	S	MR	erect
01-482*03HS009	20		Good	Very Early	Early	S	MR	erect
02-150C*04HS003	18		Average	Early/Mid	Mid	S	MR	
03-028C*04HS004	22		Average	Early/Mid	Mid	S	MR	
99-4447G*02H015	26		Good	Mid/Late	Mid	S	MR	vase shape
01040-1057	25		Good	Late	Late	S	MS	tall, showy
03-024C*04HS003	18		Average	Late	Mid/late	S	R	bunched pods
99226*02HS001	18		Average	Early	Mid/Early	S	MR	short/low pods
Kabuli's								
Genesis™ 090	27	7-8	Good	Mid	Mid/late	S	R	bushy
Almaz	39	9	Average	Late	Late	S	MS	branching
Genesis™ 079	24	6-7	Good	Early	Early	S	R	prostrate
Genesis™ 114	37	8-9	Good	Mid	Mid/Late	S*	MR	erect

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

FIELD PEA

Name	Grain Type	Plant type	Flowering	Maturity	Pod Shattering	Black Spot	Bacterial Blight
Kaspa	Dun	SL	Late	Mid	R	MS	S
Morgan	Dun	SL	Late	Mid-Late	MR	MS	MS
Sturt	White	C	Mid	Mid-Late	S	MS	MS
PBA Gunyah	Dun	SL	Early/Mid	Early	R	MS	S
PBA Twilight	Dun	SL	Early	Early	R	MS	S
Alma	Dun	C	Late	Late	MR	MS	MS
Bundi	White	SL	Early	Early	S	MS	S
Dundale	Dun	C	Early	Mid	MR	MS	MS
Glenroy	Dun	SL	Late	Late	MR	MS	MS
Parafield	Dun	C	Mid/Late	Mid	MR	MS	MS
SW Celine	White	SL	Early	Very Early	S	MS	S
Yarrum	Dun	SL	Late	Mid	MR	MS	MR
Maki	Blue	SL	Early	Mid	S	MS	S
OZP0703	Dun	SL	Early	Early	MR	MS	MS-MR
OZP0804	Dun	SL	Late	Late	R	S	?
OZP0805	Dun	SL	Mid-Late	Mid	R	MS	?
OZP0819	White	SL	Mid	Mid	R	?	
OZP0901	Dun	SL	Early	Mid	R	?	R
OZP0903	Dun	C	Early	Early	MR	?	R
PSL4Early	Dun	SL	Very Early	Very Early	R	?	?

SL = Semi-Leafless, C = Conventional; R = resistant, MR = moderately resistant, MS = moderately susceptible, S = susceptible

FABA BEAN

Name	Maturity	Seed colour	Height	Ascochyta	Chocolate spot	Cercospora	Rust
Nura	Early-Mid	Light brown	Short	MR-R	MS	S	MR
Farah	Early-Mid	Light brown	Medium	MR-R	S	S	S
Fiord	Early	Light Brown	Short	S	S	S	S
PBA Kareema	Late	Light brown	Tall	MR-R	MS-MR	S	MR
AF03063	Early	Light brown	Medium	MR-R	S	S	S
974*(974)/15-1	Mid	Light brown	Medium-tall	R	MS-MR	S	MS-
AF03001	Early	Light brown	Medium	R	S	S	S
AF03029	Early-Mid	Light brown	Medium	MR-R	MS-S	S	S
AF03109	Early-Mid	Light brown	Medium	MR-R	S	S	S
AF05054	Early-Mid	Light brown	Medium	MR-R	S	S	S
AF05073	Mid	Light brown	Medium	MR-R	MS-S	S	S
1269*483/6-1	Mid-Late	Light brown	Medium-tall	MR-R	MS-S	MR	MR

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

LUPIN

Variety	Flower	Height	Early vigour	Lodging	Pod loss/ shatter	Anthrac-nose	Brown leaf spot	Pleio rootrot	CMV on seed	Stem Phomopsis	Pod/Seed Phomopsis	Drought tolerance
Coromup	Early	Tall	Med	MS	R	MR	MR-MS	R	MR	R	R	T
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
WALAN2289	Early	Tall	Med	MS	R	MR	-	-	-	MR	R	T
Wonga	Early	Med	Med	MR	MS	R	MS-MR	S	MR	R	S	MS

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

CLIMATE

Climatic conditions were generally ideal for pulse production in most areas. Rainfall was generally average or above average in most areas and fell at the right time throughout the growing season, although in heavier textured soils and lower lying areas water-logging was an issue during winter and early spring (Rainfall figures below). Record rainfall events throughout harvest meant that in many cases potential grain yields were not met and grain quality downgraded. Harvest in some regions has extended until late February. Temperatures were close to optimum for pulse production, except chickpea which experienced cool conditions during pod set. Few or no frost or major heat events were experienced.

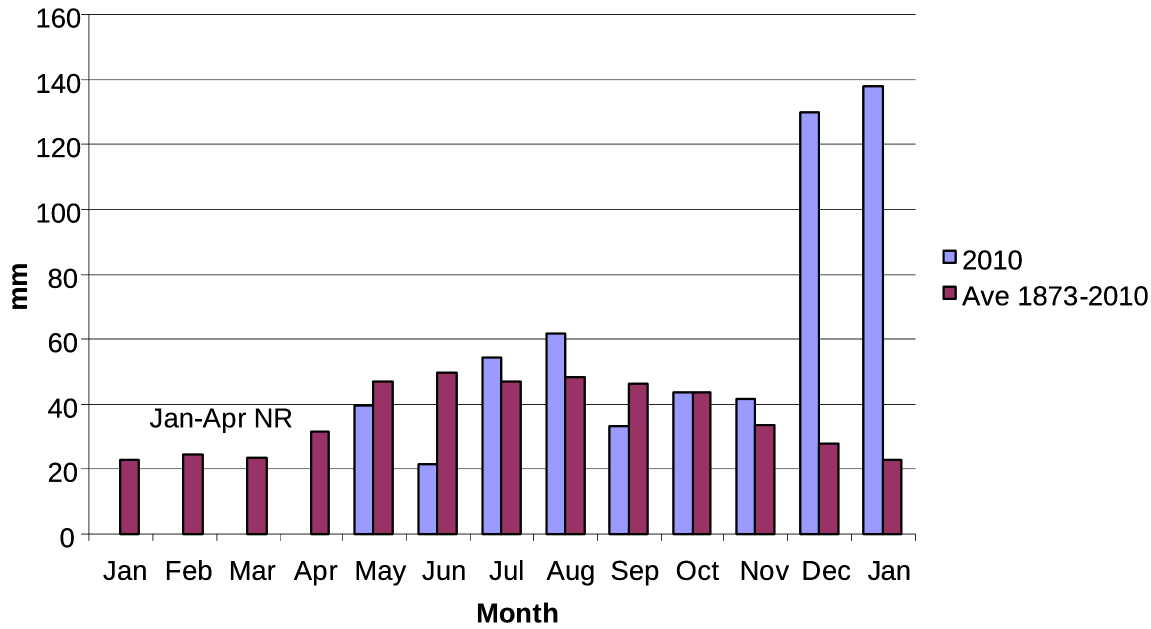

Figure 1. Average monthly rainfall at the Vectis trial site (MRZ) in 2010 compared with the long term average for Horsham.

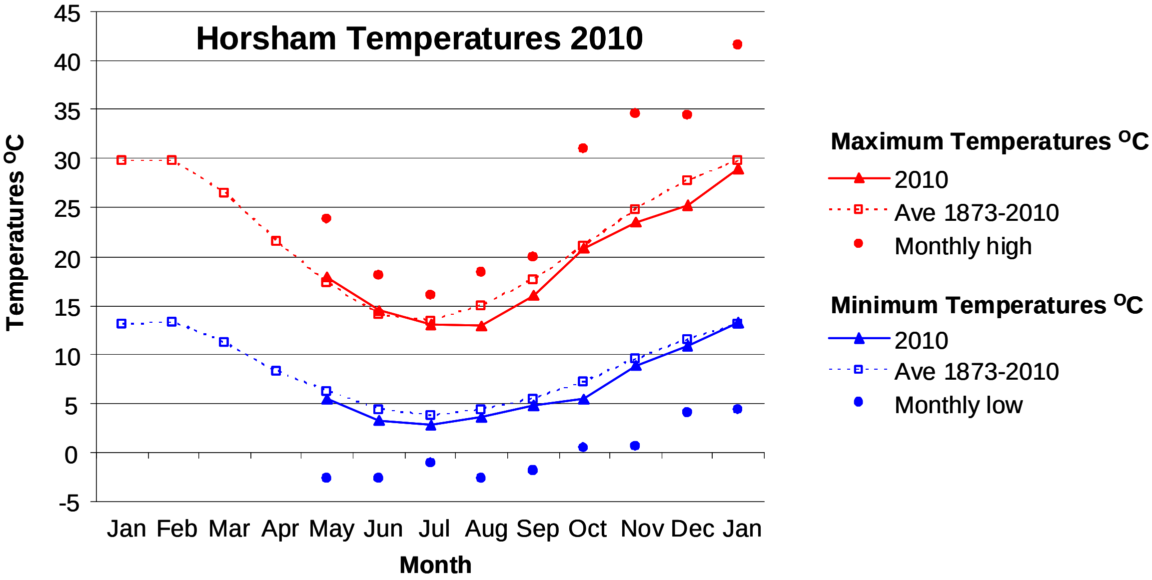

Figure 2. Average monthly maximum and minimum temperatures and absolute maximum or minimum at the Vectis trial site (MRZ) in 2010 compared with the long term average of Horsham.

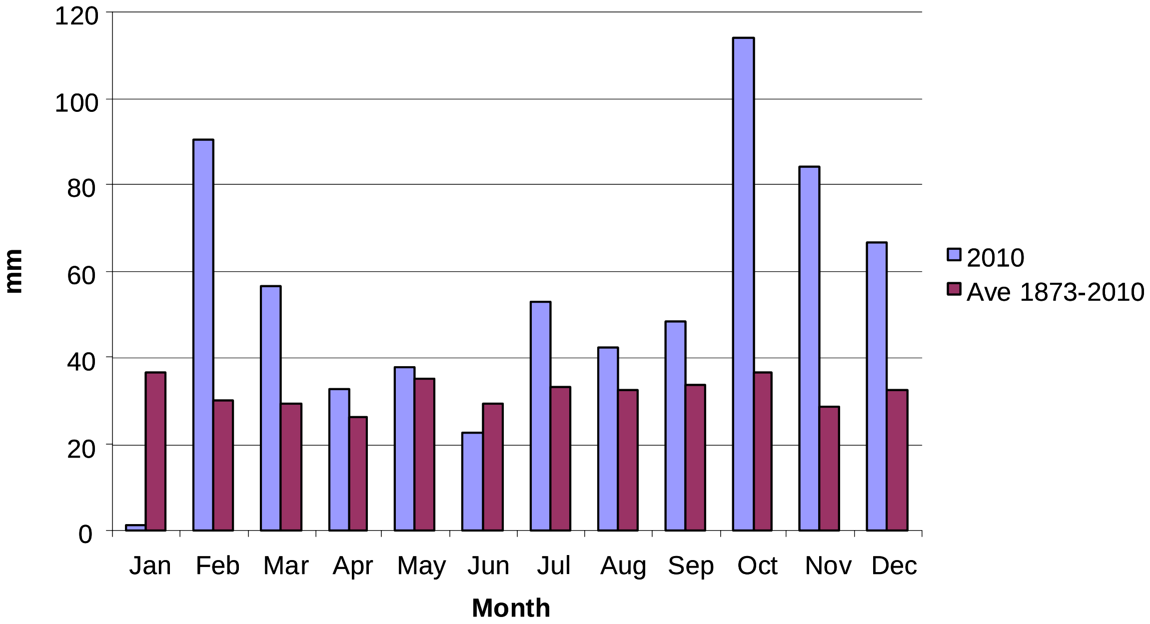

Figure 3. Average monthly rainfall at Yenda (LRZ) in 2010 compared with the long term average.

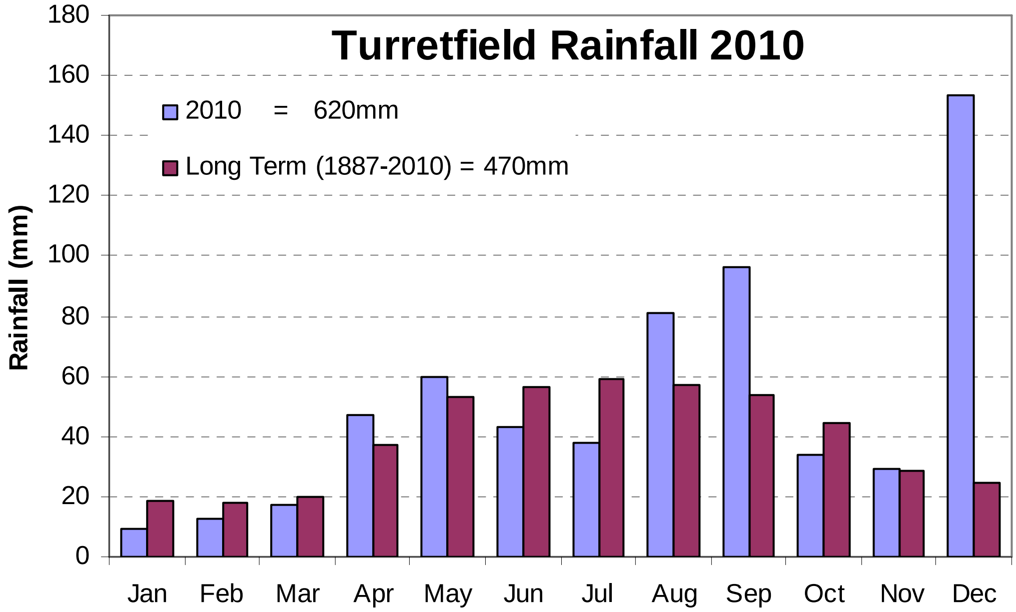

Figure 4. Average monthly rainfall at Turretfield (SA) in 2010 compared with the long term average.

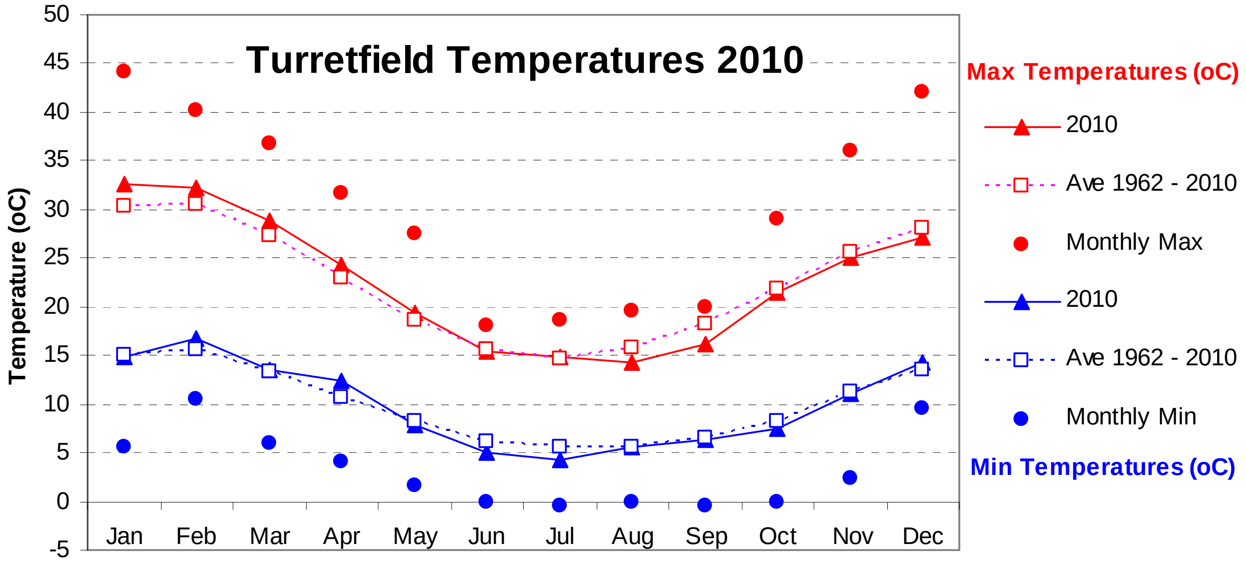

Figure 5. Average monthly maximum and minimum temperatures and absolute maximum or minimum at Turretfield (SA) in 2010 compared with the long term average.

TRIAL SUMMARIES

1. Lentils

L1 Sowing Time x Row Space, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the adaptability of a range of lentil varieties and breeding lines to wider row spacing's sown inter-row in to standing stubble compared with conventional cropping systems (narrow row spacing with slashed stubble). The interaction sowing times is also compared.

Note: Trial is a comparison of systems, not just row space. In the wider row spacing's plots were sown with narrow lucerne points, press wheels and chemicals applied pre-sowing. In the narrow row spacing's plots were sown with narrow lucerne points, harrows and chemicals applied post-sowing, pre-emergent.

Treatments

Varieties:	Aldinga, Boomer, Nipper, Northfield, Nugget, PBA Bounty, PBA Flash, PBA Blitz, PBA Jumbo, CIPAL0501, CIPAL0611, CIPAL0801, CIPAL0802, CIPAL0803, CIPAL0901, 99-088L*02H051.
Sowing dates:	6 May (Early), 7 June (Late).
Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble (ST30), 17.2 cm row spacing, slashed stubble (sl17).

Other Details

Fertiliser:	MAP + Zn @ 40 kg/ha at sowing
Plant Density:	120 plants/m^2

Results and Interpretation

- Key Message: Potential grain yields were in excess of 2.5t/ha for varieties such as PBA Flash Due to extreme rainfall events throughout harvest grain yield losses where between 27% and 65%. The new lentil genotypes continue to show potential in a season considerably different from that which we have had for the last decade, which is promising from a yield stability perspective.

- Plant establishment – Establishment for all lentil genotypes in all treatments was between 100 and 120 plants/m^2. No significant differences between treatments and varieties were noted (data not shown).
- Flowering Dates - See Table L1.1

Table L1.1. Flowering dates of lentil genotypes sown May 6 and June 7 at Curyo in 2010.

Sowing Date	99-088L*02H051	CIPAL0501	CIPAL0611	CIPAL0801	CIPAL0802	CIPAL0803	CIPAL0901	Aldinga
6-May	8-Sep	9-Sep	10-Sep	6-Sep	1-Sep	6-Sep	31-Aug	10-Sep
7-Jun	29-Sep	4-Oct	1-Oct	29-Sep	28-Sep	3-Oct	28-Sep	3-Oct
	Boomer	**Nipper**	**Northfield**	**Nugget**	**PBA Bounty**	**PBA Flash**	**PBA Jumbo**	**PBA Blitz**
6-May	1-Sep	19-Sep	15-Sep	14-Sep	15-Sep	8-Sep	12-Sep	27-Aug
7-Jun	1-Oct	5-Oct	6-Oct	5-Oct	5-Oct	28-Sep	30-Sep	26-Sep

- Crop and Pod Height, and Lodging - There were no effects of sowing date or row spacing on crop and pod height at maturity at Curyo in 2010. However there were significant height differences between lentil genotypes, with CIPAL801 being tallest and Boomer shortest (Table L1.2). Lodging scores showed a significant difference between sowing dates with the May 6 sowing date showing increased lodging compared to the June 7 sowing date (data not shown). Relative differences in lodging between genotypes were similar to that observed with crop and pod heights.

Table L1.2. The main effect of lentil genotype on height of the crop canopy height (crop height; cm) and height to the lowest pod (pod height; cm) at Curyo in 2010.

	99-088L*02H051	CIPAL0501	CIPAL0611	CIPAL0801	CIPAL0802	CIPAL0803	CIPAL0901	Aldinga
Crop Height	28.2	27.1	27.6	30.6	29.9	27.2	27.9	25.1
Pod Height	14.8	12.8	13.7	15.9	14.3	12.9	13.9	12.3
	Boomer	**Nipper**	**Northfield**	**Nugget**	**PBA Bounty**	**PBA Flash**	**PBA Jumbo**	**PBA Blitz**
Crop Height	25.0	27.1	26.1	28.4	25.3	28.6	26.6	27.0
Pod Height	10.4	13.9	13.4	14.1	11.9	14.4	12.8	12.7

lsd(P<0.05)var = 2.1, (Crop height), 1.9 (Pod Height)

- Maturity Biomass – Selected varieties were sampled for biomass and yield component analysis. There was a significant 3 way interaction between sowing date, row spacing and genotype (Table L1.3). Early sown (May 6) treatments produced up to 100% more biomass than later sown (June 7) treatments with Boomer producing more than 10 t/ha in the sl17 treatment. For most genotypes, the sl17 treatment produced slightly more biomass than the ST30. Sampling of these plots occurred just prior to rainfall events that delayed harvest and caused yield loss. Estimated grain yields from these samples enabled prediction of potential grain yield and the grain yield loss indicated in Figure L1.1 and discussed below.
- Grain Yield – Due to extreme rainfall events throughout harvest grain yields were significantly reduced. Potential grain yields were in excess of 2.5t/ha for varieties such as PBA Flash (Fig. L1.1), which was equivalent to yields achieved by growers throughout the region who were able to harvest prior to the rain events. It was predicted that in the May 6 sown treatments grain yield losses where between 34% and 65% and in the June 7 sown treatments losses were between 27% and 56%. For both sowing dates Boomer had the greatest yield loss and Nipper the least. Actual harvested grain yields were generally higher in the 7 June sown treatments, however significant genotype differences were apparent (Table L1.4). For example, the grain yield of CIPAL803 sown early was 32% higher than later sown treatments, while PBA Flash and Nugget were 11% and 13% less, respectively. Variety rankings were similar to what could be expected from long term trials in similar seasonal conditions. Nugget, being a mid season variety was highest yielding in the May 6 treatments, while CIPAL0801 was highest in the June 7 sown treatments. There were no major differences in the average grain yield within a row space treatment for the early sown plots, however in the later sown plots the narrow row spacing averaged yields 25% higher (Table L1.5).

Table L1.3. The effect of the interaction between sowing date, row space and lentil genotype on maturity biomass (t/ha) at Curyo in 2010.

Sowing Date	Row Space (cm)	CIPAL802	CIPAL901	Boomer	Nipper	PBABlitz	PBAFlash
6-May	17	7.99	8.21	10.50	5.84	8.75	8.82
	30	8.43	6.62	8.81	6.59	5.94	7.18
7-Jun	17	4.89	4.81	5.02	4.98	4.65	5.53
	30	4.78	4.77	5.38	4.14	4.32	4.64

lsd(P<0.05)SDxRow SpacexGen = 2.15, except when comparing genotypes within a sowing date or row space = 1.20

Table L1.4. The effect of the interaction between sowing date and lentil genotype on grain yield (t/ha) at Curyo in 2010.

Sowing Date	99-088L*02H051	CIPAL501	CIPAL611	CIPAL801	CIPAL802	CIPAL803	CIPAL901	Aldinga
6-May	1.23	1.14	1.09	1.43	1.03	1.16	1.02	0.84
7-Jun	1.36	1.49	1.40	1.78	1.55	1.70	1.52	0.97
	Boomer	**Nipper**	**Northfield**	**Nugget**	**PBABounty**	**PBAFlash**	**PBAJumbo**	**PBABlitz**
6-May	0.90	1.40	0.87	1.54	1.23	1.31	1.21	0.91
7-Jun	1.10	1.64	0.96	1.36	1.64	1.47	1.36	1.29

lsd(P<0.05)SDxGen = 0.36, except when comparing genotypes within a sowing date = 0.26

Table L1.5. The effect of the interaction between sowing date and row space on grain yield (t/ha) at Curyo in 2010.

Row Space (cm)	6 May	7 June
17	1.12	1.57
30	1.17	1.25

lsd(P<0.05)SDxRowspace = 0.35, except when comparing row space within a sowing date = 0.13

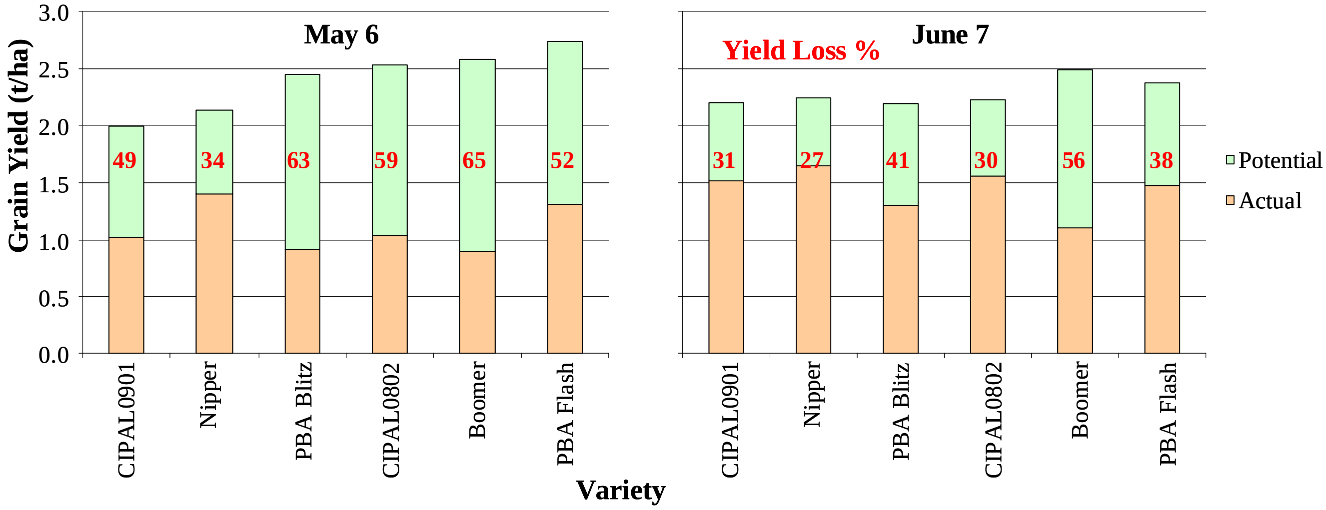

Figure L1.1. Potential versus actual grain yields (t/ha) in May 6 and June 7 sown treatments at Curyo in 2010.

Key Findings and Comments

It is important to interpret the grain yield results with caution as it was demonstrated that yield loss due to extreme rainfall events was between 27% and 65%. Potential grain yields were in excess of 2.5t/ha for varieties such as PBA Flash, however for many genotypes we did not record specific yield loss data. Despite these limitations, the new lentil genotypes continue to show potential in a season considerably different from that which we have had for the last decade, which is promising from a yield stability perspective into the future.

L2 Sowing Time x Row Space, MRZ Wimmera (Vectis), Victoria

Aim

To investigate the adaptability of a range of lentil varieties and breeding lines to wider row spacing's sown inter-row in to standing stubble compared with conventional cropping systems (narrow row spacing with slashed stubble). The interaction sowing times is also compared.

Note: Trial is a comparison of systems, not just row space. In the wider row spacing's plots were sown with narrow lucerne points, press wheels and chemicals applied pre-sowing. In the narrow row spacing's plots were sown with narrow lucerne points, harrows and chemicals applied post-sowing, pre-emergent.

Treatments

Varieties:	Aldinga, Boomer, Nipper, Northfield, Nugget, PBA Bounty, PBA Flash, PBA Blitz, PBA Jumbo, CIPAL0501, CIPAL0611, CIPAL0801, CIPAL0802, CIPAL0803, CIPAL0804, CIPAL0901.
Sowing dates:	12 May (Early), 16 June (Late)
Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble (ST30); 30 cm row spacing, inter-row, slashed stubble (sl, 30); 17.2 cm row spacing, slashed stubble (sl17).

Other Details

Fertiliser:	MAP + Zn @ 60 kg/ha at sowing
Plant Density:	120 plants/m^2

Results and Interpretation

- Key Message: Potential grain yields were likely to be in excess of 3.5t/ha, however due to extreme rainfall events throughout harvest grain yield losses where likely to be greater than 50%. The new lentil genotypes, in particular CIPAL0801 continue to show potential in a season considerably different from that which we have had for the last decade, which is promising from a yield stability perspective.

- Plant establishment – Establishment was variable at the Vectis site in 2010 ranging between 75 and 130 plants/m^2. There were significant issues with stubble dragging and mouse damage (Figure L2.1). Plot damage was more severe in the early sown 30 cm row spacing treatment compared with later sown treatments, however in the 17 cm plot damage was similar across sowing dates. At the early sowing date the 30 cm row space treatment, had much more damage than the 17 cm treatment, however this was reversed at the later sowing date. Plant establishment was highest at both sowing dates in the in the narrow row spacing, slashed stubble treatment (sl17) compared with both wider row treatments (sl30 and ST30; data not shown).

Figure L2.1. Examples of issues with stubble and mice at sowing at Vectis in 2010. L to R: Wobbly stubble rows in Faba Beans; All stubble dragged from a lentil plot and resultant establishment; Mouse damage to one end of slashed stubble lentil plot; Good establishment of lentils sown inter-row into standing stubble.

- Grain Yield – Similarly to Curyo, extreme rainfall events throughout harvest resulted in significantly reduced grain yields. Estimated potential grain yields were in excess of 3.5t/ha, however we were unable to take maturity biomass cuts prior to rainfall, due to the slightly later maturity than Curyo, so specific calculations were unable to be made. It was also expected that early sown treatments were more severely affected than later sown treatments. Given these limitations and the sowing issues previously outlined it is important to interpret actual grain yields with care. Machine harvested grain yields were generally similar in the two sowing date treatments, however there were significant interactions between row spacing and genotype (Table L2.1). For example, Boomer showed higher yield in the ST30 treatment compared with both slashed stubble treatments, while in CIPAL0501 the opposite response was observed. Across all treatments CIPAL0801 was highest yielding and Northfield lowest.

Table L2.1. The effect of the interaction between row space treatment and lentil genotype on grain yield (t/ha) at Vectis in 2010.

Row Space (cm)	CIPAL0501	CIPAL0611	CIPAL0801	CIPAL0802	CIPAL0803	CIPAL0804	CIPAL0901	Aldinga	
sl17	2.07	1.89	2.14	1.82	1.79	1.60	1.96	1.53	
sl30	1.83	2.00	2.27	2.04	1.92	1.52	1.71	1.37	
ST30	1.44	1.91	1.65	1.80	1.69	1.50	1.46	1.26	
Average	*1.78*	*1.93*	*2.02*	*1.89*	*1.80*	*1.54*	*1.71*	*1.39*	
	Boomer	**Nipper**	**Northfield**	**Nugget**	**PBA Bounty**	**PBA Flash**	**PBA Jumbo**	**PBA Blitz**	**Average**
sl17	1.61	2.16	1.55	1.94	1.84	2.06	1.98	1.91	*1.53*
sl30	1.53	1.71	1.31	1.64	1.65	1.84	1.62	1.58	*1.37*
ST30	1.84	1.63	1.11	1.77	1.49	1.63	1.83	1.32	*1.26*
Average	*1.66*	*1.83*	*1.33*	*1.79*	*1.66*	*1.84*	*1.81*	*1.60*	

lsd(P<0.05)Row SpacexGen = 0.37, except when comparing genotypes within a row space = 0.35. lsd(P<0.05)Gen = 0.2. lsd(P<0.05)Row Space = 0.2.

Key Findings and Comments

It is important to interpret the grain yield results with caution as there was likely yield loss due to extreme rainfall events and variable plant establishment. Similar to Curyo, CIPAL801 was the highest yielding variety in 2010. Unlike previous seasons the narrow row space treatment generally resulted in slightly higher grain yields. Reasons for this are unclear, but it may be due to better establishment observed in this treatment. Economic implications of the various systems are being investigated, accounting for the various costs associated with each of the different cropping systems.

L3. Crop Topping, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the suitability of a range of lentil varieties and breeding lines differing in flowering and maturity characteristics for crop-topping/desiccation.

Treatments

Varieties:	Aldinga, Boomer, Nipper, Nugget, PBA Bounty, PBA Flash, PBA Blitz, CIPAL0501, CIPAL0802, CIPAL0803.
Crop Topping:	Nil Early: Applied approximately 10-14 days pre rye grass milky dough stage (25th October) Mid: Applied at rye grass milky dough (9th November) Late: Applied approximately 10-14 days post rye grass milky dough stage (22nd November)

Other Details

Sowing date:	6 May
Row Spacing/Stubble:	30 cm row spacing, inter-row, standing stubble (ST, 0.30);
Fertiliser:	MAP + Zn @ 40 kg/ha at sowing
Plant Density:	120 plants/m^2

Results and Interpretation

- Key Message: results generally showed that earlier maturing lines displayed less yield loss in crop-topping treatments than later maturing types.

- Grain Yield – Due to extreme rainfall events throughout harvest, grain yields were significantly reduced similar to previous trials. This trial was harvested December 16, however without the interruption of rain, the early desiccation treatment could have been harvested mid November. Crop-topping at the recommended time resulted in a 20% yield loss across all varieties, however the only varieties to produce a significant yield loss was Nugget, PBA Bounty, CIPAL0803 and CIPAL0501 (Table L3.1). None of the earlier maturing lines (PBA Blitz, PBA Flash and CIPAL0802) showed a significant yield loss compared to the nil, although there was a trend towards lower yield potential in these varieties due to the longer season in 2010. PBA Blitz showed no significant yield loss in any desiccation treatment, although its yield in the Nil treatment was 50% less than Nugget and in other treatments was equal or less than other varieties.

Table L3.1. The interaction effect of crop topping treatment and lentil genotype on grain yield (t/ha) at Curyo in 2010. Varieties are ranked according to their visual maturity rating, i.e. PBA Blitz was earliest and Nipper latest.

Variety	Nil	- 2 weeks (25 Oct)	Recommended (9 Nov)	+ 2 weeks (22 Nov)
PBA Blitz	0.56	0.38	0.50	0.56
CIPAL0802	0.64	0.36	0.63	0.62
PBA Flash	0.80	0.41	0.64	0.78
Nugget	1.05	0.29	0.79	0.82
PBA Bounty	0.97	0.38	0.72	0.82
Aldinga	0.47	0.25	0.36	0.43
Boomer	0.70	0.50	0.52	0.68
CIPAL0803	0.93	0.48	0.70	0.65
CIPAL0501	0.88	0.31	0.64	0.77
Nipper	0.76	0.26	0.62	0.53
Mean	0.78	0.36	0.61	0.67

lsd(P<0.05)Crop Top x Gen = 0.21, except when comparing genotypes within a crop topping treatment = 0.19.

Key Findings and Comments

Similar to previous experiments it is important to interpret the grain yield results with caution as it was demonstrated that yield loss due to extreme rainfall events was between 27% and 65% (Trial L1). Despite these limitations the general trend in results was that the earlier maturing lines displayed less yield loss in crop-topping treatments than later maturing types.

L4. Crop Topping, MRZ Wimmera (Vectis), Victoria

Aim

To investigate the suitability of a range of lentil varieties and breeding lines differing in flowering and maturity characteristics for crop-topping/desiccation.

Treatments

Varieties:	Aldinga, Boomer, Nipper, Nugget, PBA Bounty, PBA Flash, PBA Blitz, CIPAL0501, CIPAL0802, CIPAL0803.
Crop Topping:	Nil Early: Applied approximately 10-14 days pre rye grass milky dough stage (11th November) Mid: Applied at rye grass milky dough (Not applied) Late: Applied approximately 10-14 days post rye grass milky dough stage (Not Applied)

Other Details

Sowing date:	17 May
Row Spacing/Stubble:	30 cm row spacing, inter-row, standing stubble (ST, 0.30)
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing
Plant Density:	120 plants/m^2

Results and Interpretation

- Grain Yield – Due to extreme rainfall events throughout harvest, grain yields were significantly reduced similar to other trials. In addition, only the early desiccation treatment was able to be applied. The trial was harvested December 22, and showed that crop-topping 2 weeks prior to the recommended time resulted in a 55% yield loss across all varieties. PBA Flash had the lowest yield loss (25%) and Nugget highest (70%) (Table L4.1).

Table L4.1. The effect of the interaction between crop topping treatment and lentil genotype on grain yield (t/ha) at Vectis in 2010. Varieties are ranked according to their visual maturity rating at Curyo, i.e. PBABlitz was earliest and Nipper latest.

Variety	Nil	+ 2 weeks (11 Nov)
PBA Blitz	1.74	1.02
CIPAL0802	1.66	0.97
PBA Flash	1.54	1.18
Nugget	1.93	0.64
PBA Bounty	1.27	0.90
Aldinga	1.56	0.86
Boomer	1.18	0.79
CIPAL0803	1.98	1.09
CIPAL0501	1.97	0.93
Nipper	2.00	0.92
Mean	1.68	0.93

lsd(P<0.05)Crop Top x Gen = NS, lsd(P<0.05)Crop Top = 0.19, lsd(P<0.05)Gen = 0.24

Key Findings and Comments

Due to extreme weather events during harvest it is difficult to determine any significant trends from this data. This trial will be repeated in 2011.

L5. Sowing Time x Stubble Management, MRZ Mid North (Mallala), South Australia

Aim

To maximise yield of new lentil varieties through the identification of optimum sowing dates and stubble management strategies to aid in disease management and harvestability.

Treatments

Varieties:	Boomer, Nipper, Nugget, PBA Blitz, PBA Bounty, PBA Flash, CIPAL0501 and CIPAL0611
Sowing dates:	19 May (Early), 7 June (Mid), 22 June (Late)
Stubble:	2t/ha Barley stubble (30cm high)
Treatments:	Removed (cut at ground height and raked bare just prior to sowing) Slashed (cut at ground height to leave 20-30cm length straw) Standing (30cm high)
Fertiliser:	Map + Zn @ 75kg/ha

Results and Interpretation

Grain yield showed a number of complex, significant interactions between sowing date and stubble treatment, sowing date and variety, and variety plus stubble treatment (see Tables 1 and 2).

Early sown lentils yielded highest or equal highest at this site, averaging 12% better than lentils at the late sowing date. All varieties except PBA Blitz and CIPAL0501 performed better at the early sowing date (Figure L5.1). PBA Blitz showed no difference in yield between early and late sowing dates, and mid and late sowing dates. CIPAL0501 showed no sowing date response. PBA Bounty and PBA Flash were the only varieties that performed better at the mid sowing date than the late sowing date. Nipper showed the biggest penalty from delayed sowing (early sown 18% higher than late sown), while PBA Blitz and CIPAL0501 showed no difference in yield between these sowing dates.

Grain yield was higher in slashed and standing stubble systems at all sowing dates compared to the removed stubble treatment (Table L5.1). There was no difference between yields in standing or slashed stubbles at the early and mid sowing dates. Standing stubble was most effective at the late sowing date, with 15% higher yield than the removed treatment and also 7% higher yield than the slashed stubble treatment. This treatment was able to capture some of the yield loss caused by delayed sowing in this trial.

All varieties except Boomer yielded higher in standing stubbles than where stubbles were removed (Table L5.2). PBA Blitz, PBA Flash, Nipper and Nugget also yielded higher in slashed stubbles than where stubbles were removed. PBA Blitz was the most responsive variety to stubble retention as yield was also greater in standing stubbles than in slashed stubbles in this variety, and standing stubbles performed 22% higher than the removed stubble treatment. Boomer showed no response to either stubble retention treatment.

Lodging reacted significantly to stubble treatment, with lodging worse in standing and slashed stubble treatments compared to the removed stubble treatment (Table L5.3).

Maturity was strongly sowing date responsive, and delayed sowing resulted in a later maturity in all stubble treatments. The various stubble treatments also had a significant affect on maturity scores at the three sowing dates (Table L5.4). At the early sowing date both retained stubble treatments delayed maturity of lentils compared to the removed stubble treatment, and standing stubble showed a later maturity than slashed stubble. At the mid sowing date there was no difference in maturity between the three stubble treatments. Standing stubbles at the late sowing date showed later maturity than both slashed and removed stubble at this sowing date.

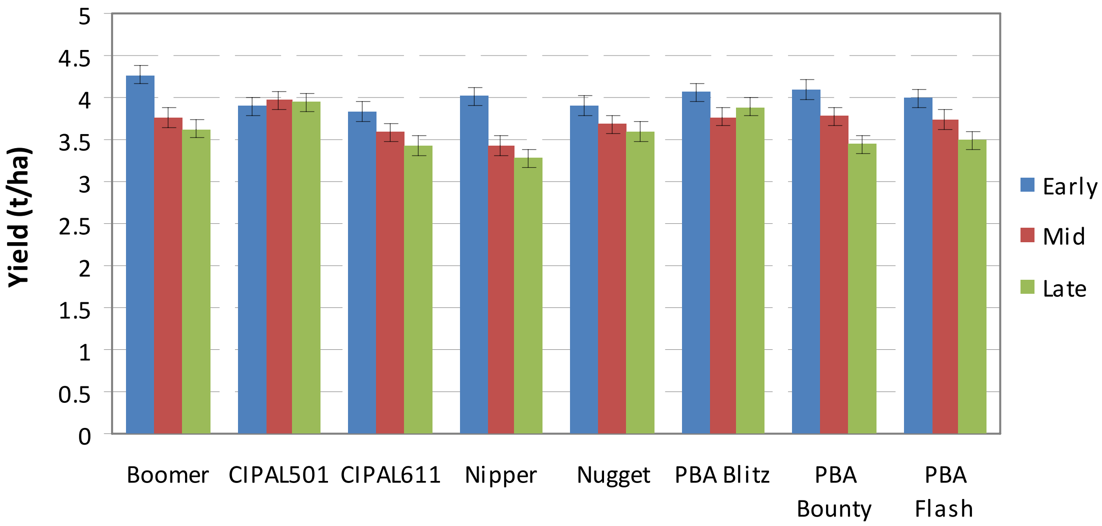

Figure L5.1. Effect of sowing date on grain yield (t/ha) of 8 lentil varieties, Mallala 2010

Table L5.1. Grain yield (t/ha) of lentils at three sowing times and three stubble treatments, Mallala 2010.

Sowing Time	Removed	Retained Slashed	Retained Standing
Early (19 May)	3.91 c	4.04 d	4.07 d
Mid (7 June)	3.47 a b	3.80 c	3.88 c
Late (22 June)	3.33 a	3.59 b	3.84 c
LSD (P<0.05)	**0.17** (0.12 same TOS)		

Table L5.2. Effect of stubble treatment on grain yield (t/ha) of various lentil varieties.

Variety	Removed	Retained Slashed	Retained Standing
Boomer	3.80	3.90	3.96
CIPAL0501	3.83	3.96	4.02
CIPAL0611	3.47	3.64	3.74
Nipper	3.33	3.68	3.72
Nugget	3.52	3.77	3.90
PBA Blitz	3.52	3.92	4.29
PBA Bounty	3.59	3.77	3.96
PBA Flash	3.52	3.84	3.86
LSD (0.05)		0.19	

Table L5.3. Lodging (1-9 score) of lentils at three stubble treatments, Mallala 2010.

Stubble	Removed	Slashed	Standing	LSD (P<0.05)
Lodging Score	6.11	5.69	5.75	0.30

Lodging score: 1 = prostrate, 9 = upright

Table L5.4. Maturity (1-9 score) of lentils at three sowing times and three stubble treatments, Mallala 2010.

Sowing Time	Removed	Retained Slashed	Retained Standing
Early (19 May)	1.8	2.4	2.8
Mid (7 June)	3.2	3.3	3.4
Late (22 June)	4.0	4.0	4.5
LSD (P<0.05)	**0.60** (0.34 same TOS)		

Maturity score: 1 = dead, 9 = healthy

Key Findings and Comments

- Early sown lentils were generally highest yielding, and average 12% higher yield than the late sowing date.
- PBA Blitz and CIPAL0501 showed the least sowing date response in the favourable 2010 growing season.
- Retaining barley stubble at 2t/ha was capable of increasing yield and delaying maturity.
- Stubble retention improved yields at all sowing dates, while standing stubble was most important for grain yield at the later sowing date.
- PBA Blitz was the most responsive variety to stubble retention systems, while Boomer showed no difference in grain yield.
- Lodging was exacerbated in the retained stubble systems.
- Retained stubble delayed maturity, especially at the early sowing date, and may be a result of higher soil moisture in this treatments.
- This trial should be repeated in future seasons in order to compare and validate the 2010 findings across variable growing seasons.

L6. Sowing Time x Disease Management, MRZ Yorke Peninsula (Paskeville), South Australia

Aim

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

Treatments

Varieties: Boomer, Nipper, Nugget, PBA Blitz, PBA Bounty, PBA Flash, CIPAL0501 and CIPAL0611

Sowing dates: 21 May (Early), 11 June (Mid), 2 July (Late)

N.B. Due to herbicide damage the early sowing date was removed from analysis

Treatments: Nil – no fungicide applied

Canopy closure – 500ml/ha Carbendazim at canopy closure

Weather – 500ml/ha Carbendazim at canopy closure, plus before next rain front (>14 days later)

Complete - 500ml/ha Carbendazim at canopy closure, plus 500ml/ha Carbendazim + 2L/ha Chlorothalonil before next rain front (>14days later)

Fertiliser: Map + Zn @ 90kg/ha

Results and Interpretation

A dry spell immediately after the early sowing date meant that metribuzin was applied PSPE on dry and cloddy soil, which was followed by over 25mm of rain just after emergence. This meant that the herbicide was washed into the lentil root zone, and high plant damage and mortality was observed at this sowing date. This sowing date has therefore been removed from analysis.

Due to the favourable season finish and only minimal disease there was no sowing time effect in this trial in 2010. Grain yield results showed that PBA Blitz yielded higher than all other varieties except Nipper (Table L6.1). PBA Bounty was lower yielding than all other varieties except Nugget. All other varieties performed similarly.

Some differences in grain weights were observed in response to sowing date between the varieties (Table L6.2). Boomer showed a reduction in grain weight as sowing was delayed, while Nipper, PBA Bounty and PBA Flash displayed increased grain weight when sowing was delayed. All other varieties showed no difference between the two sowing dates.

Table L6.1. Grain yield of 8 lentil varieties at Paskeville, 2010

Variety	Yield (t/ha)
Boomer	3.91
PBA Bounty	3.63
CIPAL0501	3.86
PBA Blitz	4.20
CIPAL0611	3.98
PBA Flash	3.94
Nipper	4.01
Nugget	3.82
LSD (P<0.05)	0.21

Table L6.2. Effect of sowing date on grain yield of 8 lentil varieties at Paskeville, 2010

Variety	**Grain Weight (g/100)**	
	11 June	**2 July**
Boomer	7.00	6.72
PBA Bounty	4.03	4.21
CIPAL0501	5.48	5.41
PBA Blitz	5.49	5.49
CIPAL0611	4.88	4.92
PBA Flash	4.97	5.17
Nipper	3.40	3.57
Nugget	4.34	4.34
LSD (P<0.05)	0.13 (0.09 same TOS)	

Key Findings and Comments

- Safe application of PSPE herbicides in lentils (metribuzin in this situation) is very reliant on seasonal conditions around the time of sowing. Whilst yield potential is maximised by earlier sowing there is increased risk of crop injury from herbicides.
- Winter and spring seasonal conditions were favourable for lentil production in 2010, and lentil yield averaged 3.9t/ha across all varieties.
- There was no sowing date response for grain yield at this site in 2010. There was only low to moderate levels of disease and so earlier sown lentils were not penalised by disease, and later sown lentils were able to capitalise on the late rain.
- Grain weight was equal or higher at the later sowing date for all varieties except Boomer.

L7. Crop-topping/Desiccation, MRZ Yorke Peninsula (Melton), South Australia

Aim

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

Treatments

Varieties: Boomer, Cumra, Nipper, Nugget, PBA Blitz, PBA Bounty, PBA Flash, CIPAL0501, CIPAL0605, CIPAL0607, CIPAL0611, CIPAL0801, CIPAL0802, CIPAL0804, CIPAL0901, CIPAL0902.

Sowing date: 4 June

Treatments: see tables for dates
- Nil - no desiccant applied
- Early Crop-top - applied 7-14 days pre ryegrass milky dough stage
- Mid Crop-top - applied at ryegrass milky dough stage ("Recommended")
- Late Crop-top - applied 7-14 days post ryegrass milky dough stage

Fertiliser: Map + Zn @ 90kg/ha

Results and Interpretation

Grain yield of all varieties in this study was reduced by crop-topping at 2 weeks prior to the recommended timing (ryegrass milky dough stage) (Table L7.1). Grain yield was also reduced at the recommended timing in the later maturing varieties Boomer, CIPAL0501, CIPAL0607 and Nugget. CIPAL0501 (the latest maturing variety in this trial) suffered the most significant yield penalty at all crop-top timings, and was also the only variety affected at the late crop-top timing.

At the early cop-top timing only Boomer, CIPAL0801, CIPAL0804, Nipper and Nugget did not show a reduction in grain weight (Table L7.1), while CIPAL0804 showed an increase in grain weight at this timing. The same varieties affected at the early crop-top timing also showed reduced grain weight at the mid timing with the exception of PBA Bounty, PBA Flash, CIPAL0802, CIPAL0901 and CIPAL0902. Boomer and Nugget also showed reduced grain weight at this timing, but their early crop-top grain weights were the same as the nil. The late crop-top timing had no effect on grain weight.

Table L7.1. Effect of crop-top timing on grain yield and grain weight of lentils, Melton 2010
Varieties are ranked according to their visual maturity rating from earliest to latest

Treatment	Yield (t/ha)	Yield (% of Nil)			Grain Wt. (g/100)	Grain Weight (% of Nil)		
Variety	Nil	- 2 wks[a] (25/10)	Recommended (11/11)	+ 2 wks[b] (23/11)	Nil	- 2 wks[a] (25/10)	Recommended (11/11)	+ 2 wks[b] (23/11)
PBA Blitz	3.86	25	101	101	5.29	91	92	98
Cumra	2.51	37	113	122	4.23	79	91	100
CIPAL901	3.44	34	115	112	4.84	82	97	102
CIPAL902	3.67	33	110	115	3.87	90	96	102
PBA Flash	3.46	33	98	104	4.79	89	97	100
CIPAL802	4.04	39	93	99	4.37	89	95	98
CIPAL605	4.35	33	97	100	5.08	91	94	99
CIPAL611	3.24	28	105	118	4.79	92	95	96
CIPAL801	3.69	35	101	90	4.29	94	95	97
PBA Bounty	3.51	33	99	98	3.79	83	95	102
Nipper	3.52	38	98	108	3.33	94	92	98
CIPAL804	3.05	31	105	108	5.72	111	96	103
CIPAL607	4.13	27	86	96	3.57	97	93	102
Boomer	3.89	29	86	96	6.87	103	89	98
Nugget	3.78	29	78	90	4.16	98	88	104
CIPAL501	4.01	17	68	86	5.28	94	92	105
Mean	**3.63**	**1.13**	**3.50**	**3.70**	**4.64**	**4.31**	**4.32**	**4.65**

NB: Shading denotes significant difference from the Nil treatment.

[a] = 2 weeks prior to recommended timing

[b] = 2 weeks after recommended timing

Key Findings and Comments

- The wet and late finish to the 2010 season meant that early crop-topping was very detrimental to yield of all lentil varieties
- Later maturing lentil varieties also showed a yield penalty from crop-topping at the recommended timing (ryegrass milky dough stage).
- CIPAL0501 was the most sensitive variety to crop-topping, showing a reduction in yield from crop-topping at all three timings. This variety also has the latest maturity in this trial.
- The early crop topping treatment reduced grain yields of most pulse varieties, while the late crop-top timing had no effect on grain weight.

2. Chickpeas

C1. Sowing Time x Row Space, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the adaptability of a range of chickpea varieties and breeding lines to wider row spacing's sown inter-row in to standing stubble compared with conventional cropping systems (narrow row spacing with slashed stubble). The interaction sowing times is also compared.

Note: Trial is a comparison of systems, not just row space. In the wider row spacing's plots were sown with narrow lucerne points, press wheels and chemicals applied pre-sowing. In the narrow row spacing's plots were sown with narrow lucerne points, harrows and chemicals applied post-sowing, pre-emergent.

Treatments

Varieties:	Genesis 090, Genesis 509, PBA Slasher, Almaz, 01040-1057, 03-024C*04HS003, 99-447G*02H015, CICA0613, CICA0721, Genesis 079, Sonali.
Sowing dates:	6 May (Early), 7 June (Late).
Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble (ST30), 60 cm row spacing, inter-row, standing stubble (ST60), 17.2 cm row spacing, slashed stubble (sl17).

Other Details

Fertiliser:	MAP + Zn @ 40 kg/ha at sowing
Plant Density:	35 plants/m^2

Results and Interpretation

- Key Message: Early sowing maximised yield potential resulting in a gain of 20%-120% dependant on the genotype grown. Wider row spacing (>=30cm) resulted higher grain yields for all genotypes.

- Plant establishment – Establishment for all chickpea genotypes averaged across all treatments was between 20 and 27 plants/m^2. Generally the kabuli types (i.e. Genesis 090, Genesis079 and Almaz had lower establishment (Table C1.1). Plant establishment was generally greater at the second sowing date and in the narrow row spacing (sl17; Table C1.2).
- Flowering Dates - See Table C1.3

Table C1.1. The main effect of genotype space on plant establishment in chickpeas at Curyo in 2010.

Genesis 090	Genesis 509	PBA Slasher	Almaz	01040-1057	03-024C*04HS003
23	28	25	22	27	27
99-447G*02H015	**99226*02HS001**	**CICA0613**	**CICA0721**	**Genesis 079**	**Sonali**
24	25	27	26	20	27

lsd(P<0.05)Var = 2

Table C1.2. The effect of the interaction between sowing date and row space on plant establishment in chickpeas at Curyo in 2010.

Row Space	6 May	7 June
sl17	26	32
ST30	25	25
ST60	20	22

lsd(P<0.05)SDxRS = 2

Table C1.3. Flowering dates of chickpea genotypes sown May 6 and June 7 at Curyo in 2010.

Sowing Date	Genesis 090	Genesis 509	PBA Slasher	Almaz	01040-1057	03-024C*04HS003
6 May	29-Sep	27-Sep	22-Sep	27-Sep	28-Sep	26-Sep
7 June	8-Oct	9-Oct	3-Oct	10-Oct	9-Oct	8-Oct
	99-447G*02H015	**99226*02HS001**	**CICA0613**	**CICA0721**	**Genesis 079**	**Sonali**
6 May	28-Sep	19-Sep	27-Sep	28-Sep	19-Sep	8-Sep
7 June	9-Oct	3-Oct	9-Oct	5-Oct	2-Oct	2-Oct

- Maturity Biomass – Selected varieties were sampled for biomass and yield component analysis. There was a significant main effect of sowing date and genotype, but no interactions (Table C1.4). Early sown (May 6) treatments produced approximately 60% more biomass than later sown (June 7) treatments. Sonali produced approximately 20% less biomass than other genotypes. There were no significant differences in biomass between the row space treatments, however, there appeared to be a trend towards greater biomass in the wider row spacings in standing stubble (ST30 and ST60; Table C1.4).

Table C1.4. The main effect of genotype, row space and sowing date on maturity biomass (t/ha) of chickpea at Curyo in 2010.

Genotype	t/ha	Row Space	t/ha	Sowing Date	t/ha
Genesis090	5.65	sl17	4.84	6 May	6.34
PBASlasher	5.34	ST30	5.34	7 June	4.04
01040-1057	5.39	ST60	5.40		
Sonali	4.39				
lsd(*P*<0.05)	0.83		ns		0.70

- Grain Yield – Similar to lentils, due to extreme rainfall events throughout harvest grain yields were reduced, but significantly less so than observed in lentils. It was estimated that grain yield losses were 15-25% (data not shown). Chickpeas sown May 6 showed grain yields between 18% and 119% more than those sown June 7 (Table C1.5). Almaz was the most responsive to early sowing, followed by Genesis 090 and Genesis 509. PBA Slasher and 99226*02HS001 were the least responsive to delayed sowing. At the May 6 sowing date, Genesis 090 had the highest yields, while at the June 7 sowing date PBA Slasher was highest yielding (Table C1.5). Similar to previous seasons there was a significant grain yield increase in wider row spacings and standing stubble (ST30 and ST60; Table C1.6).

Table C1.5. The effect of the interaction between sowing date and chickpea genotype on grain yield (t/ha) at Curyo in 2010.

Sowing Date	Genesis 090	Genesis 509	PBA Slasher	Almaz	01040-1057	03-024C*04HS003
6 May	1.85	1.49	1.63	1.54	1.29	1.52
7 June	1.05	0.90	1.38	0.70	0.88	1.11
	99-447G*02H015	**99226*02HS001**	**CICA0613**	**CICA0721**	**Genesis 079**	**Sonali**
6 May	1.41	1.56	1.52	1.59	1.54	1.35
7 June	0.98	1.31	1.21	1.08	0.98	1.04

lsd(P<0.05)SDxGen = 0.22, except when comparing genotypes within a sowing date = 0.19

Table C1.6. The main effect of row space treatment on grain yield (t/ha) of chickpeas at Curyo in 2010.

Row Space	t/ha
sl17	1.18
ST30	1.31
ST60	1.37

lsd(P<0.05)RS = 0.12

Key Findings and Comments

Early sowing is essential to maximise grain yield and minimise production risks in the southern mallee. However, if sowing is delayed it is important to carefully select varieties that perform best for each sowing date. For example, in the later sowing date PBA Slasher had the highest yields. In addition, this research has again indicated the benefits of wider row spacings (>=30cm) and standing stubbles for chickpea production.

C2. Sowing Time x Row Space, MRZ Wimmera (Vectis), Victoria

Aim

To investigate the adaptability of a range of chickpea varieties and breeding lines to wider row spacing's sown inter-row in to standing stubble compared with conventional cropping systems (narrow row spacing with slashed stubble). The interaction sowing times is also compared.

Note: Trial is a comparison of systems, not just row space. In the wider row spacing's plots were sown with narrow lucerne points, press wheels and chemicals applied pre-sowing. In the narrow row spacing's plots were sown with narrow lucerne points, harrows and chemicals applied post-sowing, pre-emergent.

Experimental Treatments

Varieties:	Genesis 090, Genesis 509, PBA Slasher, Almaz, 01040-1057, 03-024C*04HS003, 99-447G*02H015, CICA0613, CICA0721, Genesis 079, Sonali.
Sowing dates:	16 May (Early), 21 June (Late).
Row Spacings/Stubble:	17.2 cm row spacing, slashed stubble (sl17), 30 cm row spacing, inter-row, standing stubble (ST30), 30 cm row spacing, inter-row, slashed stubble (sl, 30), 60 cm row spacing, inter-row, standing stubble (ST60).

Other Details

Fertiliser:	MAP + Zn @ 60 kg/ha at sowing.
Plant Density:	35 plants/m^2.

Results and Interpretation

- Key Message: No major agronomic interactions were observed in this trial.

- Plant establishment – Similar to the lentil trials at Vectis, there were significant issues with stubble dragging and mouse damage (Figure L2.1). Plot damage was generally least in the wider roe ST60 treatment. Overall establishment for all chickpea genotypes in all treatments was between 15 and 32 plants/m^2. There were no major effects of genotype or sowing date on plant establishment, however at narrow row spacings (sl17) there was generally higher plant establishment than observed in the wider row spacings (Table C2.1).

Table C2.1. The main effect row space treatment on plant establishment in chickpeas at Vectis in 2010.

Row Space	Plants/m^2
sl17	28
sl30	22
ST30	21
ST60	17

lsd(P<0.05)RS = 1.5

- Grain Yield – In 2010, sowing date had no major effect on the grain yield of different genotypes of chickpeas at Vectis. The responses across the different row space treatments were similar for all genotypes, in that, the sl, 30 treatment produced grain yields significantly less than other treatments (Table C1.3). When comparing across genotypes, Genesis079 was the highest yielding and 99-447G lowest yielding.

Table C1.2. The main effect of chickpea genotype on grain yield (t/ha) at Curyo in 2010.

Genotype	**01040-1057**	**03-024C*04HS003**	**99-447G*02H015**	**99226*02HS001**	**Almaz**	**PBA Slasher**
t/ha	2.15	2.39	1.95	2.37	2.41	2.53
Genotype	**CICA0613**	**CICA0721**	**Genesis 079**	**Genesis 090**	**Genesis 509**	**Sonali**
t/ha	2.49	2.22	2.64	2.38	2.46	2.22

lsd(P<0.05)Var = 0.23

Table C1.3. The main effect of row space treatment on grain yield (t/ha) of chickpeas at Curyo in 2010.

Row Space	t/ha
sl17	2.49
sl30	2.06
ST30	2.33
ST60	2.52

lsd(P<0.05)RS = 0.19

Key Findings and Comments

In terms of grain yield, there were no major agronomic interactions with genotypes in this trial, however overall variety response was interesting. It has often been perceived that Genesis 079 is better adapted to dryer conditions and shorter seasons than other varieties, primarily due to its earlier flowering and maturity, however in 2010 at Vectis, it was the highest yielding variety and at Curyo was similar yield to other genotypes, slightly less than Genesis 090. This is despite seasonal conditions being excellent for growth and yield, with sufficient rainfall. It was possible that Genesis 079 flowered and set pods during an optimal temperature period, ensuring maximal pod set.

C3. Disease Management x Row Space, MRZ Wimmera (Vectis), Victoria

Aim

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

Experimental Treatments

Varieties: Genesis 090, Genesis 079, Genesis 114, CICA0603, CICA0604, PBA Slasher, Almaz and Howzat.

Fungicide Regimes:

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

1. Refers to application rate of the product

Ascochyta Blight inoculant applied 23rd July

Row Spacings/Stubble: 17.2 cm row spacing, slashed stubble (sl17),
60 cm row spacing, inter-row, standing stubble (ST60).

Other Details

Sowing date: 15 May.

Fertiliser: MAP + Zn @ 60 kg/ha at sowing.

Plant Density: 35 plants/m^2.

Results and Interpretation

- Key Message: Wider row spacings resulted in less visual symptoms of ascochyta blight and higher grain yields. This was particularly notable in the susceptible genoptype, Howzat.

- Ascochyta Blight Damage – Ascochyta blight was present at low to moderate levels in this trial in 2010. Ascochyta blight symptoms where generally less in the wider row spacing treatments (ST60) and in the fortnightly fungicide treatment (Table C3.1). This was particularly notable in the susceptible genotype, Howzat, which had a score of 3.0 in the Nil fungicide treatment in wide rows (ST60) compared with 5.3 in the narrow rows (sl17)

Table C3.1. The interaction effect of row space treatment, fungicide regime and genotype on ascochyta blight damage score (1 – no symptoms present, 9 – complete plot death) at Vectis in 2010.

Regime	Howzat	Almaz	CICA0603	Genesis 114	Genesis 079	Genesis 090	CICA0604	PBA Slasher	*Average*
					Row Spacing – sl17				
Fortnightly	2.3	1.0	1.0	1.0	1.5	1.3	1.0	1.0	*1.3*
Strategically	3.5	2.3	1.8	1.3	1.0	1.0	1.5	1.0	*1.7*
Podding	4.8	2.3	1.8	1.5	1.3	1.3	1.3	1.0	*1.9*
Nil	5.3	3.0	2.3	2.3	1.8	1.8	1.0	1.0	*2.3*
Average	*3.9*	*2.1*	*1.7*	*1.5*	*1.4*	*1.3*	*1.2*	*1.0*	*1.8*
					Row Spacing – ST60				
Fortnightly	1.3	1.3	1.0	1.3	1.0	1.0	1.0	1.0	*1.1*
Strategically	3.0	1.3	1.0	1.0	1.0	1.0	1.3	1.0	*1.3*
Podding	2.3	1.5	1.5	1.5	1.3	1.0	1.0	1.0	*1.4*
Nil	3.0	2.0	1.3	1.3	1.0	1.0	1.0	1.0	*1.4*
Average	*2.4*	*1.5*	*1.2*	*1.3*	*1.1*	*1.0*	*1.1*	*1.0*	*1.3*

lsd(P<0.05)RSxregimexgen = 0.7

- Grain Yield – Grain yields showed a similar trend to ascochyta scores. Wider row spacings (ST60) were higher yielding than narrow row spacings (sl17) and the fortnightly fungicide treatment had significantly higher yield than other treatments (Table C3.2). However, there were differences in the way genotypes responded to the treatment. For example, in the susceptible genotype, Howzat, the yield loss in the sl,17 treatment between the 'Fortnightly' and 'Nil' fungicide regimes was 85%, whilst in the ST60 treatment yield loss was 40%. In comparison, the resistant genotype, Genesis 090, the yield loss was 5% and 10%, respectively (Table C3.2, highlighted).

Table C3.2. The interaction effect of row space treatment, fungicide regime and genotype on grain yield (t/ha) at Vectis in 2010.

Regime	Howzat	Almaz	CICA0603	Genesis 114	Genesis 079	Genesis 090	CICA0604	PBA Slasher	*Average*
					Row Spacing – sl17				
Fortnightly	1.34	2.20	2.41	2.28	2.34	2.23	2.37	2.49	*2.21*
Strategically	0.53	1.47	2.00	2.24	1.99	1.93	2.48	2.33	*1.87*
Podding	0.24	1.54	1.89	1.73	1.73	2.14	2.18	2.01	*1.68*
Nil	0.28	1.55	1.83	2.00	1.89	2.09	2.22	1.91	*1.72*
Average	*0.60*	*1.69*	*2.03*	*2.06*	*1.99*	*2.10*	*2.31*	*2.19*	*1.87*
					Row Spacing – ST60				
Fortnightly	1.59	2.70	2.72	2.20	2.56	3.09	2.48	2.50	*2.48*
Strategically	1.04	1.73	2.35	2.38	1.96	2.71	2.33	2.30	*2.10*
Podding	1.11	1.56	2.38	2.15	1.95	2.20	2.48	2.49	*2.04*
Nil	0.93	1.78	2.17	2.39	2.44	2.67	2.63	2.45	*2.18*
Average	*1.17*	*1.94*	*2.41*	*2.28*	*2.23*	*2.67*	*2.48*	*2.43*	*2.20*

lsd(P<0.1)RSxregimexgen = 0.5

Key Findings and Comments

Wider row spacings resulted in less visual symptoms of ascochyta blight and higher grain yields. This was particularly notable in the susceptible genoptype, Howzat. It is likely that in this treatment there was slower spread of ascochyta blight from rain splash due to the distance between rows and the standing stubbles. Further work will occur in 2011 to confirm these findings.

C4. Sowing Time x Variety x Plant population, M-HRZ (Wagga Wagga), New South Wales

Aim

To test the yield response of eight chickpea varieties across 4 different sowing times and two targeted plant populations in southern NSW. The information from this trial will be used to improve current grower sowing time recommendations, variety selections and targeted plant population at each sowing time.

Treatments

Varieties:	Kabuli – Genesis 079, Genesis 090, Genesis 114
	Desi – Genesis 509, PBA Slasher, Genesis 509, CICA0511, CICA0603
Sowing dates:	6th April (early), 29th April, 28th May, 16th June (late)
Plant populations:	Targeted 25 & 40 plants/m^2
Row Spacing/Stubble:	30 cm into standing light stubble
Fertiliser:	Legume Starter @ 115 kg/ha at sowing

Results and Interpretation

- Grain Yield - Variety, time of sowing, and plant population were statistically significant (*P<0.005*). The only significant interaction for grain yield was variety x time of sowing. Targeted plant populations of 40 plants/m^2 yielded on average 9% higher yielding than 25 plants/m^2 (*P<0.005*) (data not shown). PBA Slasher, PBA Hattrick, Genesis 509, CICA0511 and CICA0603 generally yielded similarly and equal highest at all sowing dates (Figure C4.1). There was little sowing date response between varieties at the earliest sowing date. Genesis 090 yielded higher than all varieties except Genesis 509 and PBA Slasher, while Genesis 114 yielded lower than these three varieties. There was no sowing date response between the last three sowing dates for any of the varieties in this trial except Genesis 114 and Genesis079, which were also the lowest yielding varieties at the two latest sowing dates. This is a reflection of the favourable seasonal conditions and the wet spring experienced in 2010. However, later sowings can be risky in drier years with short springs. Sowing earlier than late April predisposes the crop to disease, particularly ascochyta, and results in excessive vegetative growth (as occurred this season) resulting in poor pod set and lodging. Our investigations over a range of different seasons (2008 to 2010) show that late April - early May has been the optimal time to sow chickpea in this region. The kabuli lines Genesis 079 and Genesis 114 yielded significantly lower than all other varieties and showed a far greater yield decline with delayed sowing. The only other kabuli line, Genesis 090 was more consistent across sowing dates and generally yielded similar to the desi lines. Severe wet conditions at planting and follow up rain did have greater impact on establishment of kabuli lines, and this may have contributed to their reduced grain yields.

- Grain Weight - Variety and time of sowing effects and their interaction were significantly different (*P<0.005*). Seeds of kabuli lines were bigger, especially Genesis 114. Desi lines varied between 19-20 g/100 seeds, however Genesis 509 had the smallest seeds (16g /100 seeds). Sowing time effects were small, some varieties (particularly kabuli) had smaller seeds at the last sowing date (16 June).

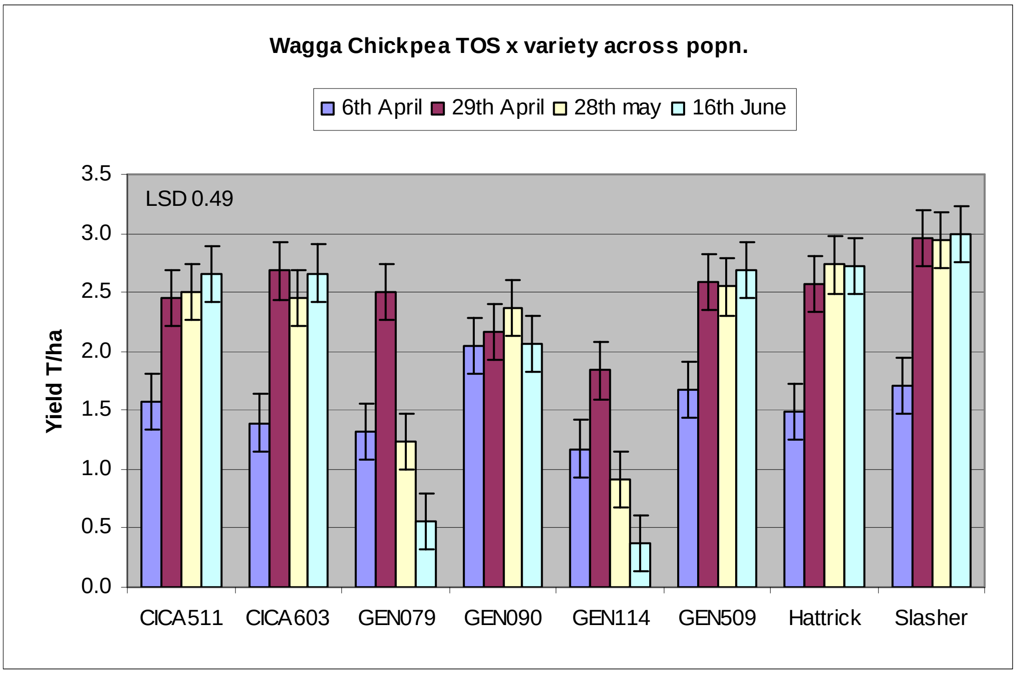

Figure C4.1. The interaction effect of sowing date and genotype on grain yield (t/ha) at Wagga in 2010.

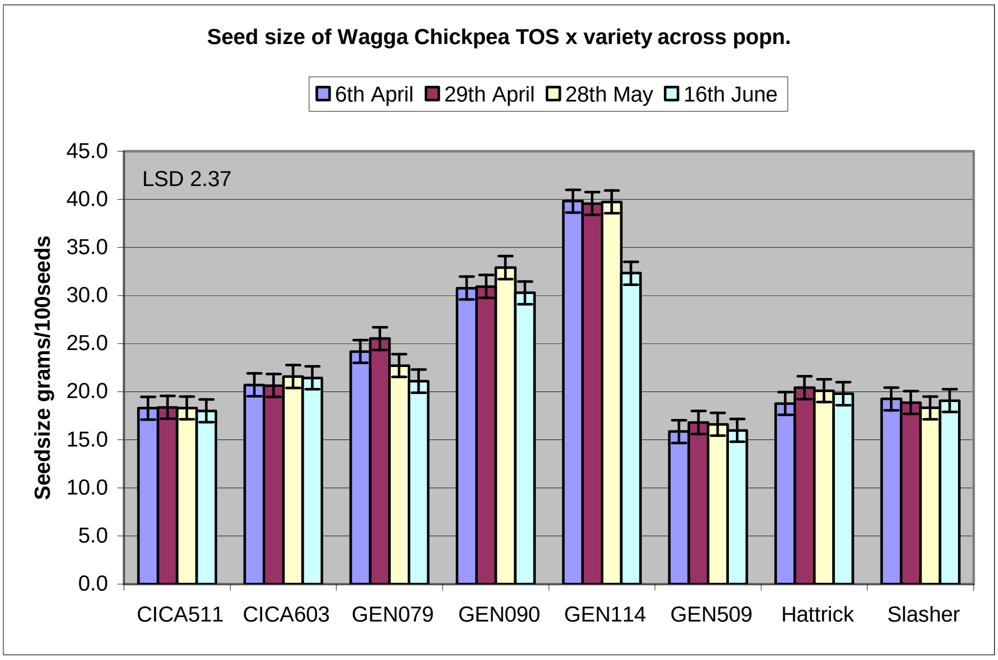

Figure C4.2. The interaction effect of sowing date and genotype on grain weight (g/100seed) at Wagga in 2010.

Key Findings and Comments

- Late April - early May has proven to be the optimal time to plant chickpeas in southern NSW. This finding has been consistent over a range of seasons (2008 to 2010). Sowing any earlier runs the risk of producing excessive dry matter, increases disease risk, increases flower abortion and consequently lowers pod set. Sowing later increases drought risk and reduces yield potential. The kabuli lines Genesis 079 and Genesis 114 were particularly sensitive to sowing delays.
- PBA Slasher, PBA Hattrick, Genesis 509, CICA0511 and CICA0603 generally yielded similarly and equal highest at all sowing dates.
- Kabuli varieties, particularly Genesis 079 and Genesis 114, yielded well below the desi varieties.

- Seed size largely reflected varietal differences, tended to fall in some varieties (particularly the kabuli types) at the last sowing date (16 June) and was unaffected by plant population.
- The lower plant populations (25 plants/m^2) did limit yield by about 9%.

C5. Sowing Time x Variety x Plant population, LRZ (Yenda), New South Wales

Aim

To test the yield response of eight chickpea varieties across 3 different sowing times and two targeted plant populations in southern NSW. The information from this trial will be used to improve current grower sowing time recommendations, variety selections and targeted plant population at each sowing time.

Treatments

Varieties:	Kabuli – Genesis 079, Genesis 090. Desi – Genesis 509, PBA Slasher, Genesis 509, CICA0511, CICA0603, Flipper.
Sowing dates:	20th April (Early), 15th May, 18th June (late).
Plant populations:	Targeted 25 & 40 plants/m^2.
Row Spacing/Stubble:	30 cm into standing light stubble.
Fertiliser:	Legume Starter @ 115 kg/ha at sowing.

Results and Interpretation

- Grain yield - The effects of variety and time of sowing as single factors were significant ($P<0.05$). The interaction of variety x time of sowing and plant population x time of sowing was also significant ($P<0.05$). All other interactions were not significant. PBA Slasher and Genesis509 were the highest or equal highest yielding varieties at all sowing dates. CICA0603 performed similarly to these at the mid and late sowing dates, but yielded lower when sown early, potentially due to its lower ascochyta blight resistance. Yield was generally maximised at the 15 May sowing produced the highest or equal highest yields, although CICA0603 showed increased yield at the latest sowing date (18 June). CICA0603, Genesis079 and Genesis090 showed the largest yield penalty from early sowing at this site (54-63%). Excellent finishing conditions assisted flowering and grain fill at the last sowing, but during a more normal season in this low rainfall zone, greater stresses and lower yield would be expected. At the earliest (20 April) sowing, yields were halved compared to the mid sowing (15 May). Early sowing (in this favourable season) increased plant dry matter production, height and lodging particularly in the varieties Genesis 079, Flipper, Genesis 090 & CICA0603. Increasing plant density increased this effect. Lodging lead to excessive shading, poorer flower set and increased pod abortion, ultimately lowering grain yield. Lodging was less severe in PBA Slasher and Genesis 509. Disease pressure was highest for early sown plots.

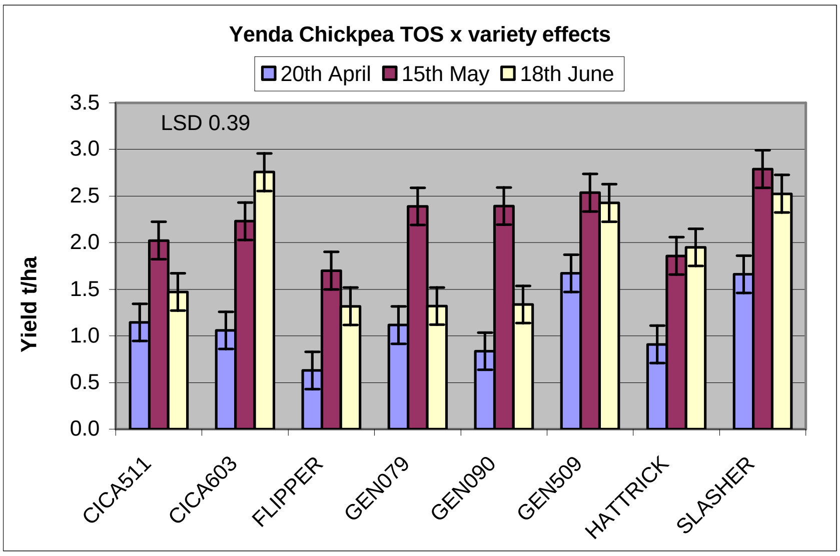

Figure C5.1. The interaction effect of sowing date and genotype on grain yield (t/ha) at Yenda in 2010.

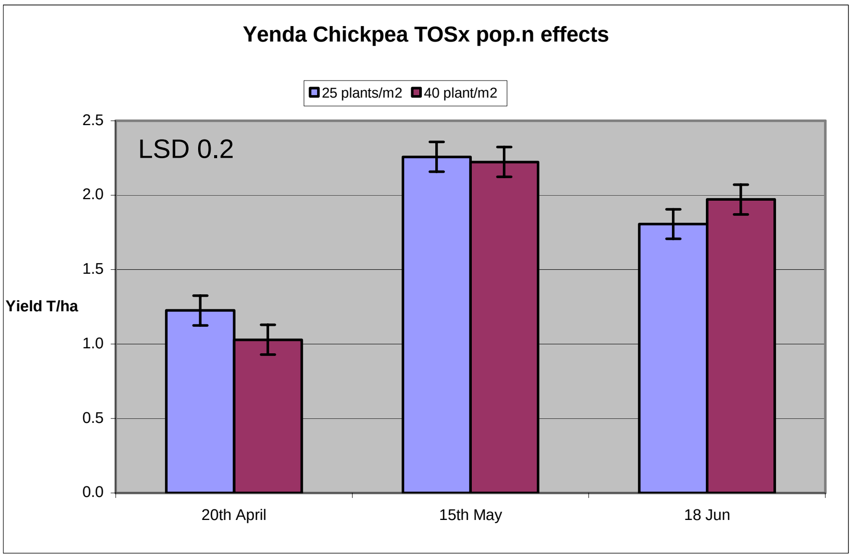

Figure C5.2. The interaction effect of sowing date and plant density on grain yield (t/ha) at Yenda in 2010.

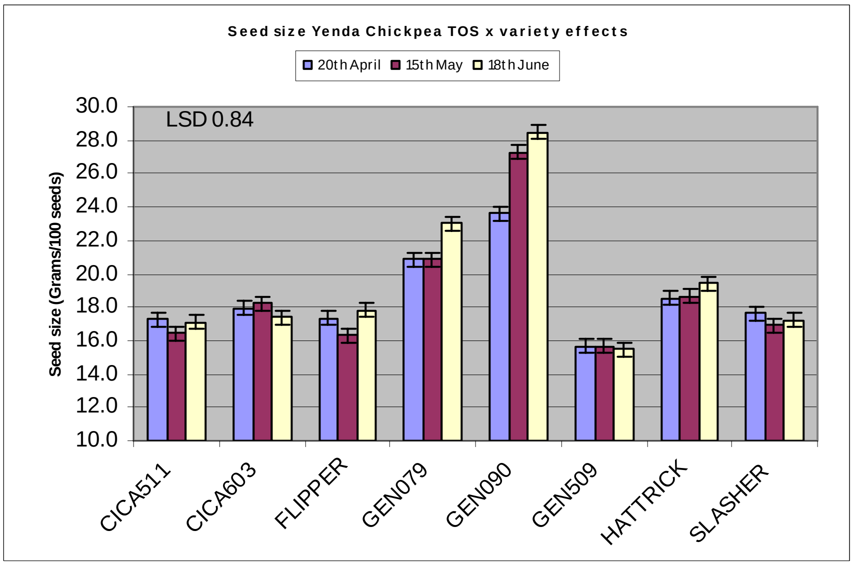

Figure C5.3. The interaction effect of sowing date and plant density on grain weight (g/100seed) at Yenda in 2010.

- Grain weight - Grain weight largely reflected varietal differences. Grain weight of kabuli types was higher than desi types. Genesis 090 showed considerably higher grain weight then Genesis 079. As sowings were delayed, seeds of kabuli's increased in size, whereas sowing time had little or no effect on grain weight in desis chickpeas. There was a significant interaction between sowing time and variety for grain weight ($P<0.05$).

Key Findings and Comments

- Early to late May was optimum for planting chickpeas at Yenda in 2010. This season was one of the most favourable experienced for many years. However, during a normal season in this lower rain zone, greater moisture and heat stresses will occur, later sowings will be more exposed to climate stress and yields will be lower. These findings support conclusions from the Wagga Time of Sowing trial reported above - late April to early May is the optimal window to plant chickpeas in southern NSW. In the drier Yenda environment (compared to Wagga), sowings should be targeted more towards the first half of this window.
- PBA Slasher, CICA0603 and Genesis 509 (all desi types) were the best varieties especially when sown in May and June. Genesis 090 and Genesis 079 (kabuli) performed well at the May planting only.
- Plant population had little or no affect on yield or seed size

C6. Sowing Time x Variety x Plant population, HRZ (Cowra), New South Wales

Aim

To test the yield response of six chickpea varieties across 3 different sowing times and two targeted plant populations in southern NSW. The information from this trial will be used to improve current grower sowing time recommendations, variety selections and targeted plant population at each sowing time.

Treatments

Varieties:	Kabuli – Genesis 079, Genesis 114.
	Desi – Genesis 509, PBA Slasher, Genesis 509, CICA0511
Sowing dates:	15th April (Early), 6th May, 27th May (late).
Plant populations:	Targeted 25 & 40 plants/m^2.
Row Spacing/Stubble:	30cm into standing light stubble.
Fertiliser:	Legume Starter @ 115kg/ha at sowing.

Results and Interpretation

- Grain Yield - Sowing time and variety were only significant as primary factors in this trial (P<0.05). Grain yield was increased by delaying sowing into May, while there was no significant difference in yield between the two May sowing dates (Figure C6.1). A similar trend was observed at the Wagga and Yenda sites, which is a reflection of the very favourable season and ideal growing conditions for late plantings. Under these conditions, early sowing produces tall vegetative plants more susceptible to lodging and disease. PBA Slasher and Genesis 509 (both desi types) were the best yielding varieties at Cowra (Figure C6.2), again a trend seen at both the Wagga and Yenda sites this season. Genesis 090 was the highest yielding of the kabuli types, but other trials showed its sowing window to be much narrower in comparison to desi types.

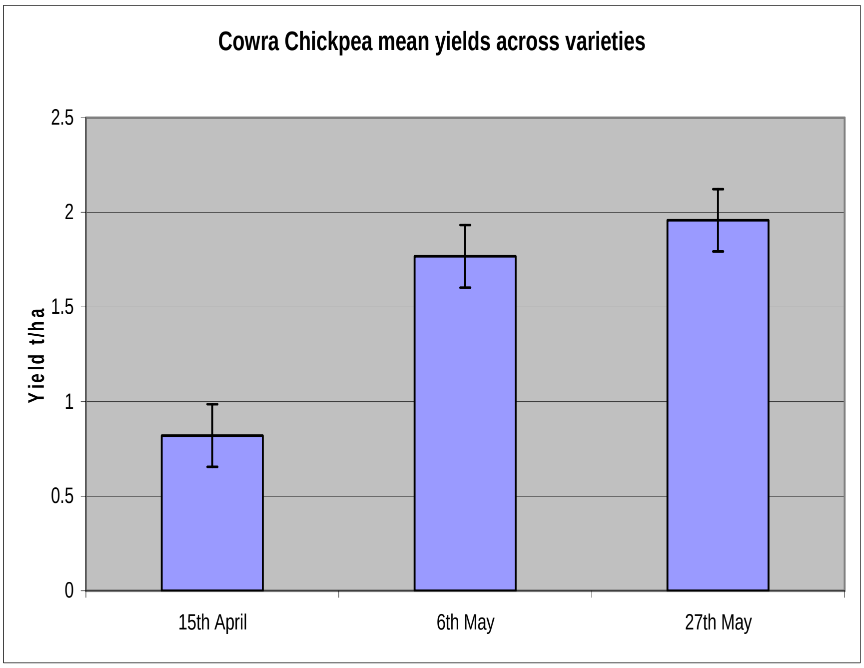

Figure C6.1. The main effect of sowing date on grain yield (t/ha) of chickpeas at Cowra in 2010.

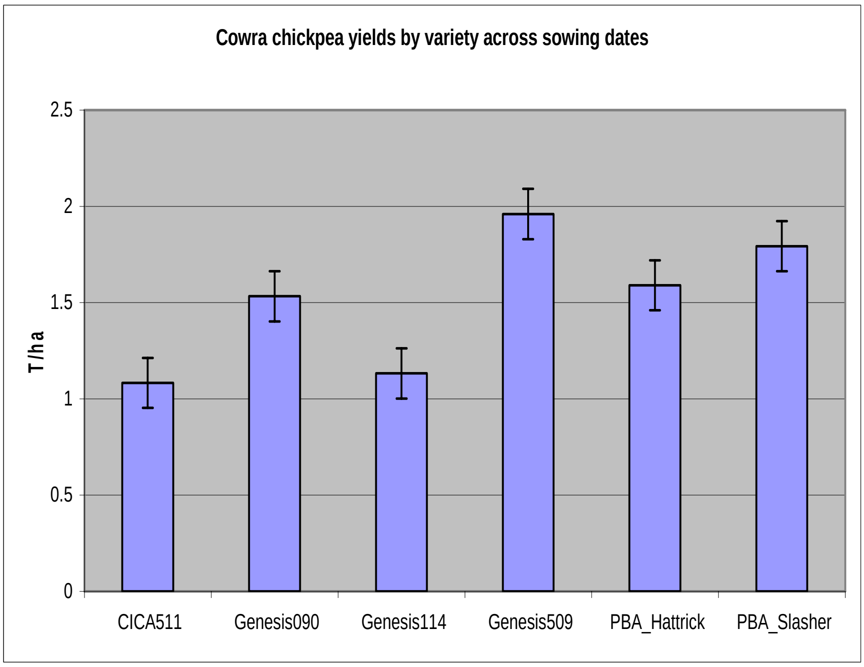

Figure C6.2. The main effect of genotype on grain yield (t/ha) of chickpeas at Cowra in 2010.

Key Findings and Comments

- Later sowings (May) produced maximum yields this season.
- PBA Slasher and Genesis 509 were the best yielding varieties.

C7. Chickpea Plant Population x Variety, LRZ Yenda, New South Wales

Aim

To test the yield response of new varieties and advanced lines of chickpeas to changes in plant populations in south western NSW. The information from this trial plus others is used to validate and improve grower recommendations.

Treatments

Varieties:	Desi - PBA Slasher, PBA Hattrick, CICA0511, Genesis509, CICA0603. Kabuli – Genesis 090.
Plant populations:	Targeted 10, 25, 40, 55 & 70 plants/m^2.
Sowing dates:	16th May
Row Spacing/Stubble:	30 cm into standing light stubble.
Fertiliser:	Legume Starter @ 115 kg/ha at sowing.

Results and Interpretation

Grain Yield - Variety, plant population and their interaction were found to be significant in this trial ($P<0.05$). Yield showed a general decline as seeding rate was increased for all varieties except CICA0511 and Genesis 090 (Figure C7.1).Given the optimum growing conditions of 2010, lower plant populations were able to compensate with regard to yield while higher populations suffered more from lodging and shading issues. Genesis 509 was the highest yielding variety and Hattrick the lowest. Genesis 090 and CICA0511 were exceptions to above trend. With respect to Genesis 090, establishment across all treatments was poor and targeted plant densities were not achieved, if fact did not exceed 30 established plants/m^2 in the field. Therefore, comparison of its responses to other varieties is not valid. With respect to CICA0511, excellent lodging resistance allowed it to maintain a positive response to yield with increasing plant density. All other varieties, particularly Genesis 509, PBA Hattrick and PBA Slasher showed optimum yield response at 20-30 plants/m^2.

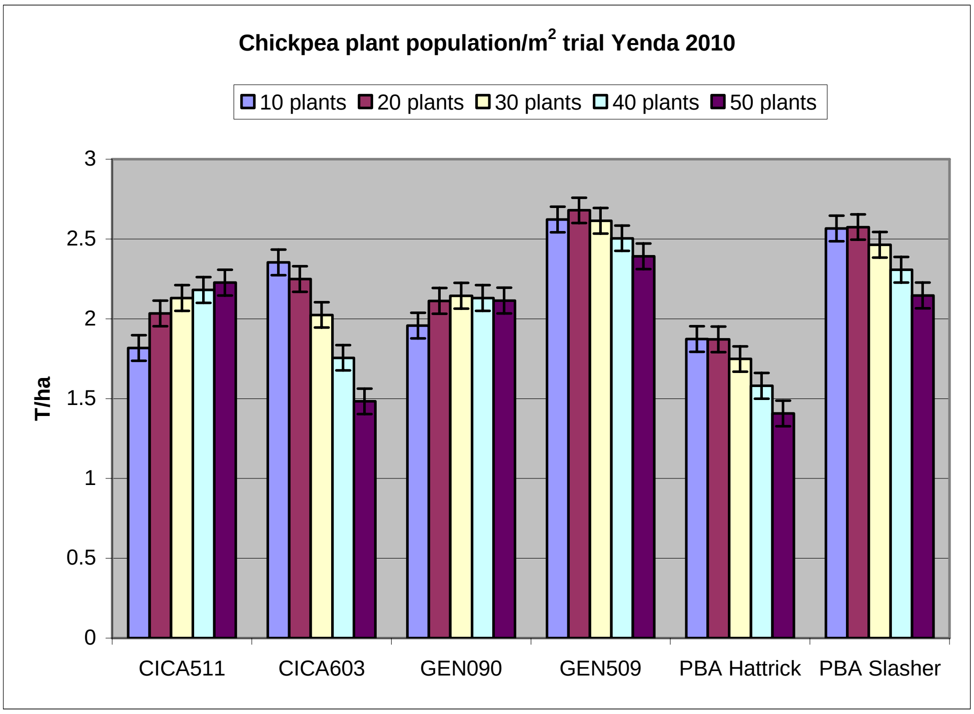

Figure C7.1. The main effect of genotype on grain yield (t/ha) of chickpeas at Yenda in 2010.

Key Findings and Comments

- Given the optimum growing conditions of 2010, lower plant populations more than compensated while higher populations suffered from lodging and shading issues
- Optimum plant densities were at the lower range - 20-30 plants/m^2.
- Yield declined sequentially as seeding rate and lodging increased
- CICA0511 showed excellent lodging resistance, allowing it to maintain a positive response to yield as plant density increased.
- Genesis 509 was the highest yielding variety

<u>**C8. Row Spacing, LRZ (Yenda), New South Wales**</u>

Aim

To investigate the effects of row spacing and plant populations across a range of advanced varieties on yields of chickpea at Yenda in south western NSW.

Treatments

4 Chickpea varieties x 2 targeted plant populations x 4 rows spacing configurations

Varieties:	Kabuli – Genesis 090.
	Desi – Genesis 509, PBA Slasher, PBA Hatrick.
Sowing dates:	19th May.
Plant populations:	Targeted 25 & 40 plants/m^2.
Row Spacing/Stubble:	20 cm, 30 cm, 40 cm & 50 cm.
Fertiliser:	Legume Starter @ 115 kg/ha at sowing banded with seed.

Results and Interpretation

- Grain Yield - Yields at the widest row spacing (50cm) were significantly less than the yields at 20, 30 and 40 cm row spacings (which did not differ from each other). These means are averaged over varieties and plant populations. Similar results have been observed in previous years. PBA Slasher and Genesis 509 were significantly higher yielding, while PBA Hatrick and Genesis 090 significantly lower. Chickpea yield peaked at around 30 plants/m^2, similar to the adjoining chickpea plant density trial. At both lower and higher plant populations, grain yields declined.

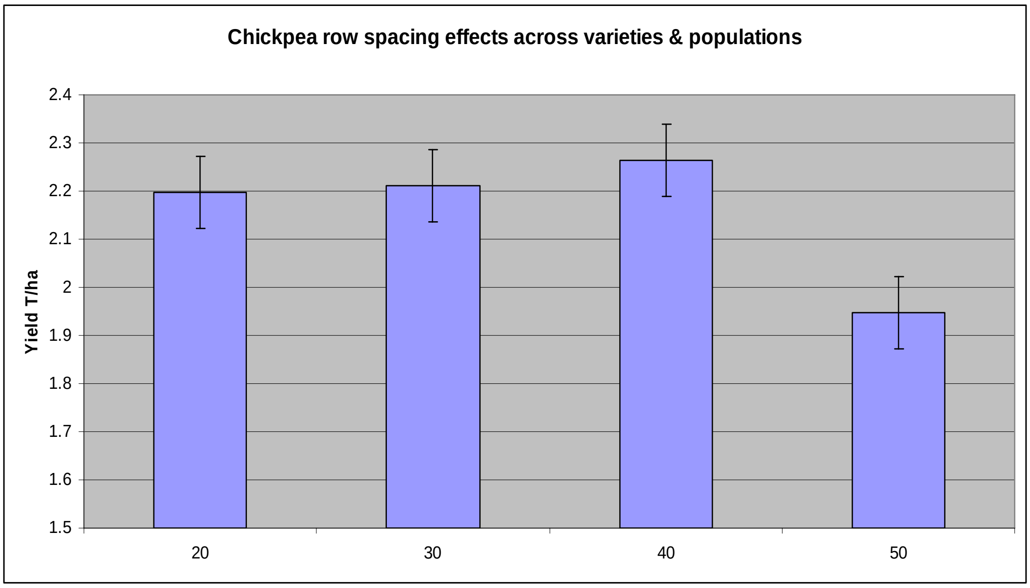

Figure C8.1. The main effect of row spacing on grain yield (t/ha) of chickpeas at Yenda in 2010.

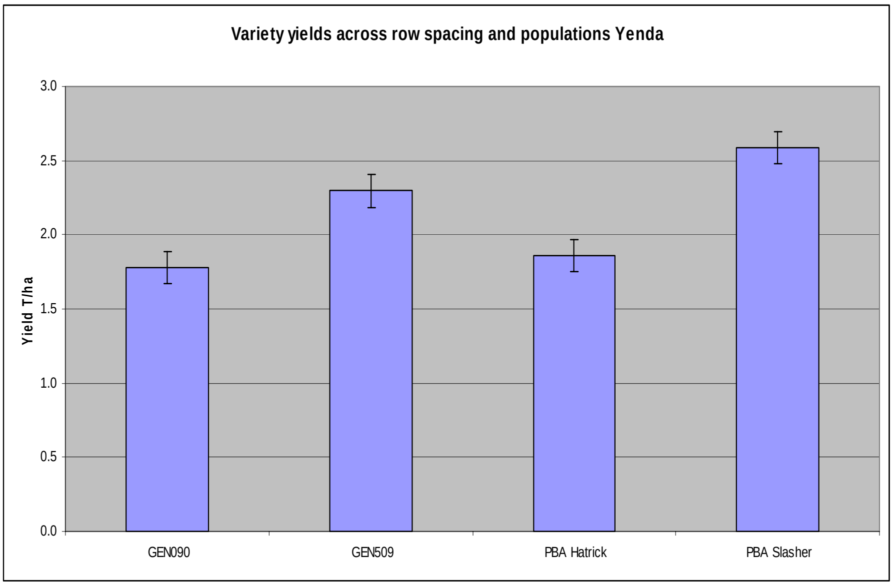

Figure C8.2. The main effect of genotype on grain yield (t/ha) of chickpeas at Yenda in 2010.

- Grain Weight - The main effect of variety and the interaction of variety and row spacing were found to be significant ($P<0.05$). All other treatments and interactions were not significant. Row spacing had the major effect on grain weight of Genesis090 with 15% higher grain weight at 40cm row spacing than at 20cm row spacing. Other varieties (desi) showed little variation with the exception of Genesis509 having significantly larger seed size at 30cm than at other row spacings. The significance of seed size response is of higher importance with Kabuli varieties as a premium is paid for larger seed size. Further work with other Kabuli varieties is important to determine optimum plant population and row spacing to maximise seed size and grain yields.

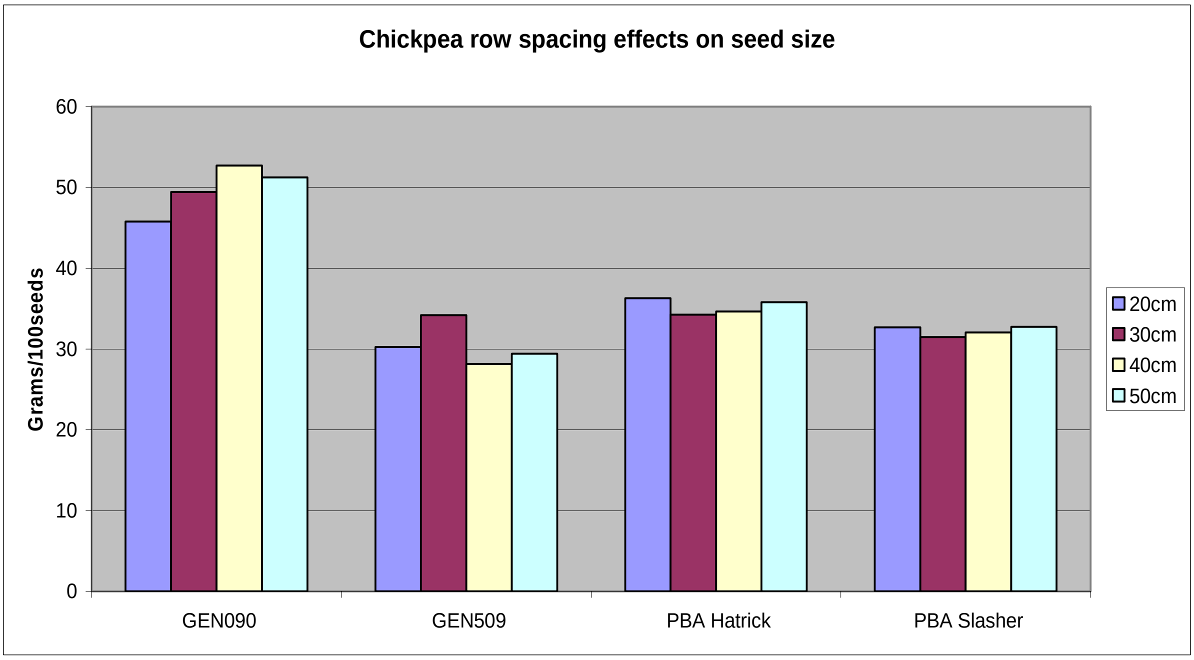

Figure C8.3. The interaction effect between genotype and row spacing on grain yield (t/ha) of chickpeas at Yenda in 2010.

Key Findings

- Yields at the widest row spacing (50cm) were significantly less
- Seed size in desi varieties showed reasonable stability across row spacing
- Seed size in Genesis 090 (kabuli) increased with row spacing

C9. Sowing Date, MRZ Mid North (Mallala), South Australia

Aim

To maximise yield of new chickpea varieties through the identification of optimum sowing dates.

Treatments

Varieties: Kabuli: Genesis 079, Genesis 090 and Genesis 114,
Desi: PBA Slasher, CICA0603 and CICA0604
Sowing dates: 19 May (Early), 7 June (Mid), 22 June (Late)
Fertiliser: Map + Zn @ 75kg/ha

Results and Interpretation

The wet season finish in 2010 favoured chickpea production, and yields were significantly higher than in previous years, averaging 2.5t/ha in this trial.

Grain yield was highest at the early sowing date and lowest at the late sowing date in all varieties (Figure C9.1). PBA Slasher and CICA0603 performed similarly, and were both the highest or equal highest yielding varieties at each sowing date. Genesis 090 and Genesis 114 performed similarly, and were both the lowest or equal lowest yielding varieties at each sowing date.

Lodging was the highest at the early sowing date for all varieties except Genesis 090 and PBA Slasher (Table C9.1). Genesis 090 showed no difference in lodging between the three sowing dates, while PBA Slasher showed no difference in lodging between the early and mid sowing dates. CICA0603 was the most prone to lodging at the early sowing date, while CICA0603, CICA0604 and Genesis 079 showed more lodging than Genesis 090, Genesis 114 and PBA Slasher at the mid and late sowing dates.

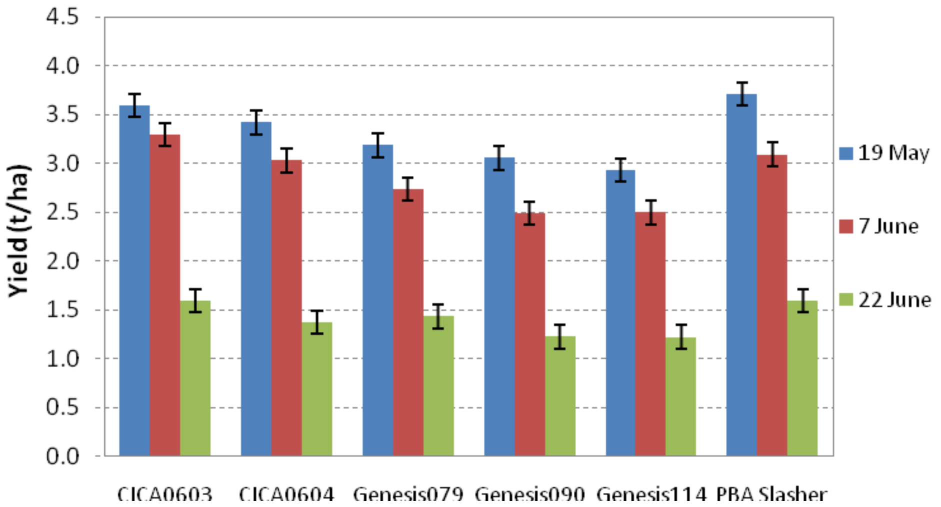

Figure C9.1. Effect of sowing date on grain yield (t/ha) of 6 chickpea varieties, Mallala 2010.

Table C9.1. Effect of sowing date on lodging (1-9 score) of 6 chickpeas varieties, Mallala 2010.

TOS	CICA0603	CICA0604	Genesis 079	Genesis 090	Genesis 114	PBA Slasher
May 19	2.3	3.7	4.3	8.0	7.7	6.7
June 7	5.7	6.0	5.7	8.3	8.7	7.3
June 22	6.0	6.0	5.7	8.7	8.7	8.0
LSD (P<0.05)	0.93 (0.90 same TOS)					

Key Findings and Comments

- All varieties yielded highest sown at the early sowing date.
- PBA Slasher and CICA0603 were the highest yielding at each sowing date.
- Lodging was generally worse at the early sowing date.
- CICA0603 and CICA0604 show high yield potential, but are also more prone to lodging, especially sown early.

C10. Sowing Date, MRZ Yorke Peninsula (Paskeville), South Australia

Aim

To maximise yield of new chickpea varieties through the identification of optimum sowing dates.

Treatments

Varieties: Kabuli: Genesis 079, Genesis 090 and Genesis 114,
Desi: PBA Slasher, CICA0603 and CICA0604
Sowing dates: 21 May (Early), 11 June (Mid), 2 July (Late)
Fertiliser: Map + Zn @ 90kg/ha

Results and Interpretation

The wet season finish in 2010 favoured chickpea production, and yields were significantly higher than in previous years, averaging 2.8t/ha in this trial. The favourable season also meant that conditions were conducive for disease, and moderate to high ascochyta blight levels were observed at this site. This created a complex sowing date response, where yield of susceptible varieties was penalised at the early sowing date.

The variety response to sowing dates was variable (Figure C10.1). All varieties except CICA0603 and CICA0604 performed better at the early sowing date than the late sowing date. CICA0603 showed no sowing date response, while CICA0604 yielded highest at the mid sowing date. Yield of Genesis 079 and Genesis 114 was maximised at the early and mid sowing dates. Genesis 090 performed best at the early sowing date, while the mid and late sowing dates performed the same. PBA Slasher performed similarly at early and mid dates, and mid and late dates, but yielded higher at the early sowing date than the late sowing date.

Genesis 079 showed a significant yield loss from delayed sowing. Genesis 114 was generally the lowest yielding variety, while Genesis 090 and Genesis 114 performed lower than the desi varieties at the respective mid and late sowing dates.

Moderate to high ascochyta blight levels were observed at this site in 2010 (Table C10.1). Infection of all varieties was greater at the early sowing date, and lowest at the late sowing date in all varieties except Genesis 079, Genesis 090 and PBA Slasher. CICA0603 had the highest level of infection at the early sowing date, followed by CICA0604 and then Genesis 079. CICA0603 and CICA0604 had the highest infection at the mid sowing date, and CICA0604 had the highest level of infection at the late sowing date.

Lodging was the highest at the early sowing date for all varieties (Table C10.2). CICA0603 showed the worst lodging at the early sowing date, followed by CICA0604 and then Genesis 079. These same varieties also had the worst ascochyta blight infection at this sowing date. CICA0603, Genesis 079 and Genesis 114 had the lowest lodging at the later sowing dates, while the other varieties showed no difference between lodging at mid and late sowing dates.

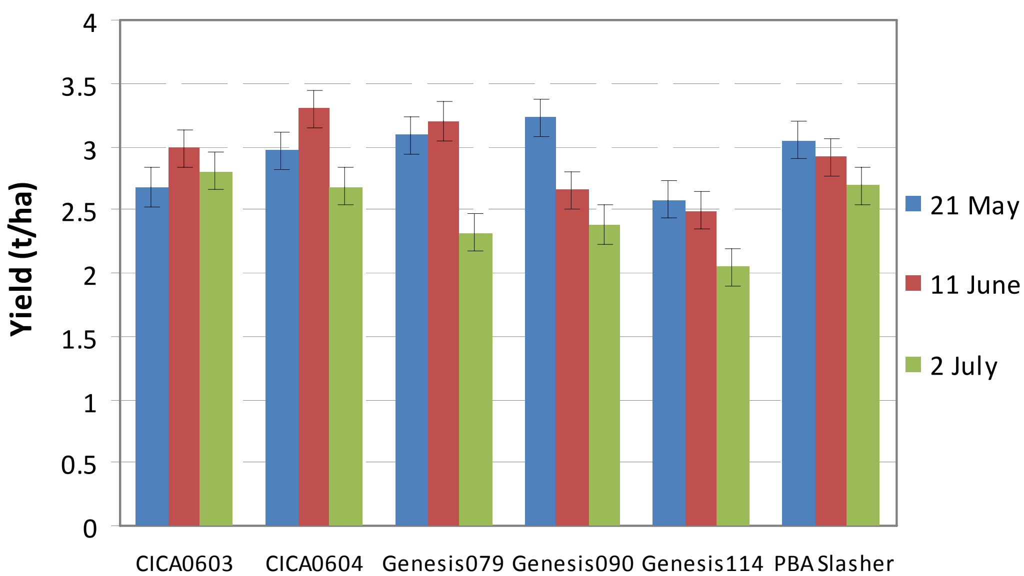

Figure C10.1. Effect of sowing date on grain yield (t/ha) of 6 chickpeas varieties, Paskeville 2010.

Table C10.1. Effect of sowing date on ascochyta blight infection (% plot infected) of 6 chickpeas varieties, Paskeville 2010.

Variety	CICA0603	CICA0604	Genesis 079	Genesis 090	Genesis 114	PBA Slasher
May 21	77	67	57	43	37	47
June 11	40	43	20	23	23	20
July 2	13	27	17	17	13	13
LSD (P<0.05)	8.6 (9.2 same TOS)					

Table C10.2. Effect of sowing date on lodging (1-9 score) of 6 chickpeas varieties, Paskeville 2010

Variety	CICA0603	CICA0604	Genesis 079	Genesis 090	Genesis 114	PBA Slasher
May 21	1.7	2.7	4.3	7.3	8.0	6.3
June 11	5.7	6.0	6.3	8.3	9.0	8.0
July 2	6.7	6.7	7.3	9.0	8.0	8.3
LSD (P<0.05)	0.88 (0.87 same TOS)					

Lodging score: 1 = prostrate, 9 = upright

Key Findings and Comments

- The favourable season meant that yields were high, but conditions were also conducive for ascochyta blight development.
- Early sown plots were highest or equal highest yielding for all varieties except CICA0604.
- Yields at the early sowing date were compromised by the moderate to high ascochyta blight infection. CICA603, CICA604 and Genesis079 were the most severely penalised by this disease.
- Genesis079 showed the largest yield penalty from delayed sowing. This may be because its early maturity would not allow it to capitalise on the rains at the end of the season.
- Genesis114 was the lowest or equal lowest yielding variety, however price premiums are paid for its superior grain size.
- CICA603 and CICA604 had the most severe ascochyta blight infection, followed by Genesis079.
- The varieties with the most severe ascochyta blight infection also showed the most lodging.
- Lodging was most severe at the early sowing date in all varieties.
- CICA603 and CICA604 show high yield potential, but are also more prone to ascochyta blight and lodging, especially when sown early.

C11. Row Spacing, MRZ Mid North (Mallala), South Australia

Aim

To maximise production advantages of new kabuli and desi chickpea varieties through the identification of optimum row spacings.

Treatments

Varieties: Kabuli: Genesis 079, Genesis 090 and Genesis 114
Desi: PBA Slasher, CICA0603 and CICA0604
Sowing date: 19 May
Row Spacing's: 22.5cm (9") and 45cm (18")
Fertiliser: MAP + Zn @ 75kg/ha at sowing

Results and Interpretation

All varieties showed a significant yield penalty associated with wider row spacing (Figure C11.1). CICA0603 showed the highest yield penalty at wider rows (39%), followed by CICA0604 (27%). PBA Slasher showed the lowest yield loss from wider row spacing (13%).
A low to moderate ascochyta blight infection was measured, but this had no significant relationship with row spacing.
There was no significant row spacing effect on lodging at this site in 2010.

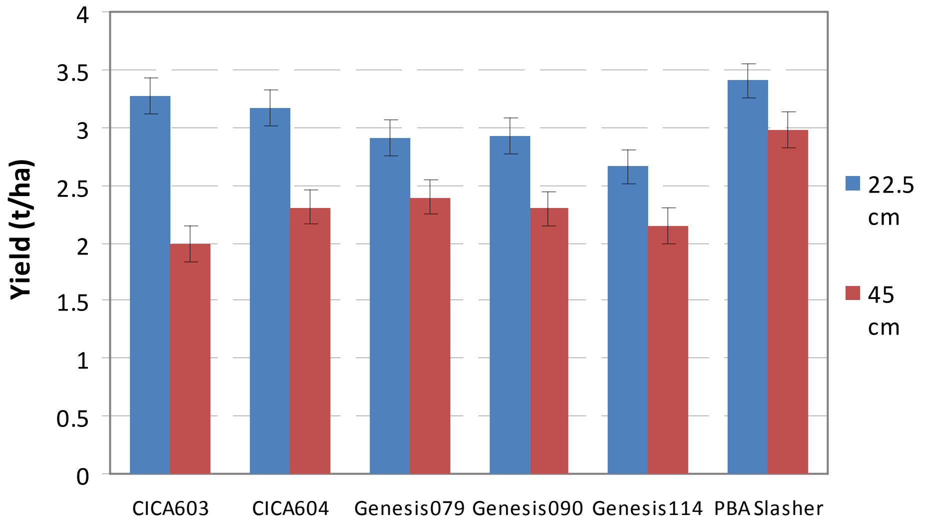

Figure C11.1. Effect of row spacing on grain yield (t/ha) of 6 chickpeas varieties, Mallala 2010

Key Findings and Comments

- The wet season finish in 2010 favoured chickpea production, and yields were significantly higher than in previous years, averaging 2.7 t/ha in this trial.
- All varieties showed reduced yield at wider row spacings.
- The two potential new releases CICA0603 and CICA0604 showed the largest reduction in yield at the wide row spacing, while PBA Slasher showed the least.
- Row spacing had no significant effect on ascochyta blight infection or lodging in this trial in 2010.

C12. Crop-topping/Desiccation, MRZ Yorke Peninsula (Melton), South Australia

Aim

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

Treatments

Varieties: see Table 1
Sowing date: 4 June
Treatments: see tables for dates
Nil - no desiccant applied
Early Crop-top - applied 7-14 days pre ryegrass milky dough stage
Mid Crop-top - applied at ryegrass milky dough stage ("Recommended")
Late Crop-top - applied 7-14 days post ryegrass milky dough stage
Fertiliser: Map + Zn @ 90kg/ha

Results and Interpretation

Due to the long and favourable season finish, yield losses from crop-topping were high in 2010, averaging 61% performed two weeks prior to the recommended timing, and 29% at the recommended timing across all varieties. Yield of all varieties was reduced by crop-topping at and prior to the recommended timing (Table C12.2). At 2 weeks after ryegrass milky dough stage PBA Hattrick was the only variety to show a significant yield loss, while CICA0604 and the early maturing line 01-482*03HS009 showed a yield improvement from this treatment.
Grain weight of all varieties was reduced by crop-topping at the recommended timing (Table C12.2). At two weeks prior to the recommended timing 7 of the 16 lines in this trial showed a reduction in grain weight. These included Almaz, Genesis079, Genesis114, PBA Hattrick, and the breeders lines 01-481*03HS010, 01-482*03HS009 and 03-028C*04HS004. Of these varieties only Genesis114 showed reduced grain weight from crop-topping at the late timing, which is likely resulting from its later maturity.

Table C12.2. Effect of crop-top timing on grain yield and grain weight of chickpeas, Melton 2010
Varieties are ranked according to their visual maturity rating from earliest to latest

	Yield (t/ha)	Yield (% of Nil)			Grain Wt. (g/100)	Grain Weight (% of Nil)		
Variety	Nil	- 2 wks[a] (25/10)	Recommended (11/11)	+ 2 wks[b] (23/11)	Nil	- 2 wks[a] (25/10)	Recom. (11/11)	+ 2 wks[b] (23/11)
01-481*03HS010	4.28	30	64	90	29.6	86	74	98
01-482*03HS009	3.2	41	83	110	22.4	78	84	97
Genesis079	3.96	42	71	99	25.9	88	86	99
CICA0603	4.1	43	70	90	23.7	93	83	98
CICA0604	3.36	39	81	110	20.4	91	80	97
Genesis509	3.79	40	71	91	17.5	91	79	97
PBA Hattrick	3.64	29	56	73	22.2	90	79	98
PBA Slasher	4.03	38	65	94	20.3	92	78	94
CICA0717	3.38	52	78	97	25.6	98	80	97
Genesis090	3.99	34	64	90	33.1	96	85	97
02-150C*04HS003	3.52	40	77	102	21.9	93	78	98
03-028C*04HS004	3.65	35	63	96	23.7	85	71	95
Genesis114	2.99	40	78	98	37.5	87	93	90
Almaz	2.99	43	75	98	38.8	91	91	99
Mean	**3.63**	**1.41**	**2.56**	**3.46**	**25.9**	**23.3**	**21.3**	**25.0**

NB: Shading denotes significant difference from the Nil treatment.
[a] = 2 weeks prior to recommended timing
[b] = 2 weeks after recommended timing

Key Findings and Comments

- The wet season finish in 2010 favoured chickpea production, however this made timely weed control through crop-topping very destructive.
- There was little varietal response from crop-topping in 2010.
- All varieties showed reduced yield when crop-topped at or before the recommended timing for optimum ryegrass control (milky dough stage).
- Crop-topping 2 weeks after the recommended timing was the only timing considered “safe” for chickpeas in 2010, with only one variety showing reduced grain yield and one variety having reduced grain weight.
- These results emphasise the difficulty in employing this weed control method in chickpea.

3. Field Peas

F1. Sowing Time x Row Space, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the adaptability of a range of field pea varieties and breeding lines to wider row spacing's sown inter-row in to standing stubble compared with conventional cropping systems (narrow row spacing with slashed stubble). The interaction sowing times is also compared.

Note: Trial is a comparison of systems, not just row space. In the wider row spacing's plots were sown with narrow lucerne points, press wheels and chemicals applied pre-sowing. In the narrow row spacing's plots were sown with narrow lucerne points, harrows and chemicals applied post-sowing, pre-emergent.

Treatments

Varieties:	Kaspa, Morgan, OZP0703, OZP0804, OZP0805, PBA Gunyah, PBA Twilight, Sturt.
Sowing dates:	6 May (Early), 7 June (Late)
Row Spacings/Stubble:	30 cm row spacing, inter-row, standing stubble (ST30), 60 cm row spacing, inter-row, standing stubble (ST60), 17.2 cm row spacing, slashed stubble (sl17).

Other Details

Fertiliser:	MAP + Zn @ 40 kg/ha at sowing
Plant Density:	35 plants/m^2

Results and Interpretation

- Key Message: Early sowing was beneficial at this site even in a year of above average rainfall. Extreme rainfall events throughout harvest resulted in grain yield losses between 0% and 55%, the most severe response was in the variety, Sturt, with greatest susceptibility to pod shattering. Several of the new genotypes continue to show potential indicating yield stability across a range of seasonal conditions.

- Plant establishment – Establishment range between 13 and 33 plants/m^2 for field peas at Curyo in 2010 (Table F1.1). Sturt had the lowest establishment and Morgan highest. There was little difference between sowing dates for all genotypes except Sturt (Table F1.1). Plant establishment was higher in the narrow row spacing treatments (Table F1.2)

Table F1.1. The effect of the interaction between sowing date and field pea genotype on establishment (plants/m^2) at Curyo in 2010.

Sowing Date	Kaspa	Morgan	OZP0703	OZP0804	OZP0805	PBA Gunyah	PBA Twilight	Sturt
6 May	30	34	23	27	27	26	28	20
7 June	33	34	26	30	28	30	31	13

lsd(P<0.05)SDxGen = 3.7, except when comparing genotypes within a sowing date = 3.6

Table F1.2. The effect of row space on field pea establishment at Curyo in 2010.

Row Space	Plants/m2
sl17	31
ST30	28
ST60	23

lsd(P<0.05)Row Space = 1.5

- Maturity Biomass – Selected varieties were sampled for biomass and yield component analysis. Generally Biomass was higher in the early sown (May 6) treatments compared with later sown (June 7) treatments (Table F1.4). There was a significant interaction between row spacing and genotype (Table F1.3). Overall all genotypes across the two sowing dates, the sl17 treatment produced more biomass than ST30, which was greater than ST60. However there was variation in this response, with PBA Twilight and Morgan producing more biomass in the ST30 compared with sl17 treatments.

- Grain Yield – Due to extreme rainfall events throughout harvest some grain yields were significantly reduced. Potential grain yields were in excess of 3.5t/ha for varieties such as Morgan and Sturt. It was predicted that in the May 6 sown treatments grain yield losses where between 20% and 30% and in the June 7 sown treatments losses were between 0% and 55% (Table F1.5). Sturt had the greatest or equal greatest yield loss at both sowing dates. Based on the actual grain yields all genotypes had a significant yield loss through delayed sowing, similar to biomass estimates, however some varieties were more responsive than others. Sturt showed a yield loss of 57% through delayed sowing, while OZP0805 had only a 12% loss (Table F1.5). Responses to row spacing's were similar to that observed for biomass. Generally, grain yields were highest in the sl17 treatment and lowest in the ST60 treatment (Table F1.6). However, several varieties, including Morgan, OZP0703 and PBA Gunyah showed little or no response to increasing row spacing from sl17 to ST30.

Table F1.3. The effect of row space and stubble on maturity biomass (t/ha) of selected field pea genotypes at Curyo in 2010.

Row Space	Kaspa	Morgan	PBA Twilight	Sturt	*Average*
sl17	7.89	7.46	6.57	7.52	7.36
ST30	5.11	8.45	7.03	6.44	6.76
ST60	5.15	6.20	5.38	6.33	5.76
Average	6.05	7.37	6.32	6.76	

lsd(P<0.05)Row SpacexGen = 1.81, except when comparing genotypes within a row space = 1.57

Table F1.4. The effect of sowing date on field pea maturity biomass (t/ha) at Curyo in 2010.

Sowing Date	t/ha
6 May	7.79
7 June	5.46

lsd(P<0.05)SD = 0.44

Table F1.5. The effect of the interaction between sowing date and field pea genotype on grain yield (t/ha) at Curyo in 2010 (Number in brackets indicates predicted yield loss due to rain fall events based on biomass and harvest index calculations taken from the yield component sampling completed before rainfall events).

Sowing Date	Kaspa	Morgan	OZP0703	OZP0804	OZP0805	PBA Gunyah	PBA Twilight	Sturt	*Average*
6 May	2.62 (18%)	2.51 (31%)	2.63	2.89	2.34	2.85	2.53 (23%)	2.69 (30%)	*2.63*
7 June	1.88 (6%)	2.12 (0%)	1.68	2.05	2.04	2.01	2.04 (21%)	1.15 (54%)	*1.87*

lsd(P<0.05)SDxGen = 0.47, except when comparing genotype within a sowing date = 0.30. lsd(P<0.05)SD = 0.50

Table F1.6. The effect of the interaction between row space and field pea genotype on grain yield (t/ha) at Curyo in 2010.

Row Space	Kaspa	Morgan	OZP0703	OZP0804	OZP0805	PBA Gunyah	PBA Twilight	Sturt	*Average*
sl17	2.63	2.51	2.29	2.86	2.58	2.62	2.55	2.18	*2.53*
ST30	2.23	2.48	2.54	2.39	2.13	2.58	2.31	1.70	*2.29*
ST60	1.88	1.95	1.63	2.17	1.86	2.09	2.01	1.88	*1.93*
Average	*2.25*	*2.31*	*2.15*	*2.47*	*2.19*	*2.43*	*2.29*	*1.92*	

lsd(P<0.05)Row SpacexGen = 0.41, except when comparing genotypes within a row space = 0.36. lsd(P<0.05)Gen = 0.21, lsd(P<0.05)RS = 0.25.

Key Findings and Comments

Similar to lentils it is important to interpret the grain yield results with caution as it was demonstrated that yield loss due to extreme rainfall events was between 0% and 55%. The importance of pod shatter resistance has been highlighted through these results as, both Kaspa and PBA Twilight have the pod shatter resistance trait and generally show the least yield loss due to the rainfall events. Despite these limitations, grain yields for peas, particularly sown early were excellent and several of the new genotypes continue to show potential in a season considerably different from that which we have had for the last decade, which is promising from a yield stability perspective into the future.

F2. Sowing Time, MRZ Wimmera (Vectis), Victoria

Aim

To investigate the adaptability of a range of field pea varieties and breeding lines to differing sowing dates.

Treatments

Varieties:	Kaspa, Morgan, OZP0703, OZP0804, OZP0805, PBA Gunyah, PBA Twilight, Sturt.
Sowing dates:	16 May (Early), 21 June (Late).

Other Details

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

Results and Interpretation

➢ Key Message: OZP0703 which has bacterial blight resistance was one of the higher yielding genotypes sown early and the highest yielding genotype sown later.

- Plant establishment – Establishment range between 20 and 30 plants/m^2 for field peas at Vectis in 2010 (Data not shown). No significant varietal or treatment differences were observed.

- Grain Yield – Yields ranged between 2.0 and 3.3 t/ha and a significant interaction between sowing date and genotype was observed. The late flowering varieties, Kaspa, Morgan and OZP0805 showed the most significant increase grain yield with delayed sowing of 38-52% (Table F2.1). This is possibly due to their ability to more effectively utilise late season rainfall that we observed. Alternatively, the early sown treatments of the genotypes were more severely affected by the rain as grain was not as mature as the early to mid flowering genotypes. It is important to not that these observations are not generally consistent with trials in previous seasons and at Curyo this year, where we have generally observed increased yield with early sowing and this is often more pronounced in the later flowering genotypes. OZP0703, which has improved bacterial blight resistance, was one of the higher yielding genotypes sown early and the highest yielding genotype sown later, with a relatively small difference between sowing dates. This line has previously demonstrated good general adaptation to a range of environments, as well as its bacterial blight resistance, and shows a lot of potential for the field pea industry.

Table F2.1. The effect of the interaction between sowing date and field pea genotype on grain yield (t/ha) at Vectis in 2010 (Number in brackets indicates percentage yield loss or gain relative to the early sown treatment).

Sowing Time	Kaspa	Morgan	OZP0804	OZP0805	OZP0703	Sturt	PBA Gunyah	PBA Twilight	*Average*
16 May	2.00	2.29	2.25	3.03	2.87	2.65	3.28	2.27	*2.58*
21 June	3.05 (+52%)	3.21 (+40%)	3.10 (+38%)	2.58 (-15%)	3.34 (+16%)	2.84 (+7%)	2.69 (-18%)	2.63 (+16%)	*2.93*
Average	2.52	2.75	2.67	2.80	3.11	2.75	2.98	2.45	

lsd(P<0.05)SDxGen = 0.77, except when comparing genotype within a sowing date = 0.70.

Key Findings and Comments

OZP0703, which has improved bacterial blight resistance was one of the higher yielding genotypes sown early and the highest yielding genotype sown later. The relatively small difference between sowing dates at this site indicates good yield stability, combined with high yields under difficult seasonal conditions.

F3. Crop Topping, LRZ Southern Mallee (Curyo), Victoria

Aim

To investigate the suitability of a range of lentil varieties and breeding lines differing in flowering and maturity characteristics for crop-topping/desiccation.

Treatments

Varieties:	Kaspa, Morgan, PBA Twilight, PBA Gunyah, OZP0703, OZP0804, OZP0805, OZP0901, PSL4Early, Sturt.
Crop Topping:	Nil.
	Early: Applied approximately 10-14 days pre rye grass milky dough stage (25th October).
	Mid: Applied at rye grass milky dough (9th November).
	Late: Applied approximately 10-14 days post rye grass milky dough stage (22nd November).

Other Details

Sowing date:	6 May
Row Spacing/Stubble:	30 cm row spacing, inter-row, standing stubble
Fertiliser:	MAP + Zn @ 60 kg/ha at sowing
Plant Density:	35 plants/m^2

Results and Interpretation

- Key Message: Crop topping at the recommended time of application (ryegrass milky dough) resulted in no yield loss for any genotype.

- Grain Yield – Crop-topping at the recommended time and 2 week post resulted in no yield loss across all varieties, while the early croptopping treatment resulted in a yield loss of about 12%. No major differences between varieties were noted.

Table F3.1. The interaction effect of crop topping treatment and field pea genotype on grain yield (t/ha) at Curyo in 2010. Varieties are ranked according to their visual maturity rating, i.e. PSL4Early was earliest and OZP0804 latest.

Variety	**Flowering Date**	**Nil**	**- 2 weeks (25 Oct)**	**Recommended (9 Nov)**	**+ 2 weeks (22 Nov)**
PSL4Early	Aug 8	2.62	2.38	2.63	2.40
PBA Twilight	Aug 21	2.80	2.83	3.00	2.97
PBA Gunyah	Aug 23	3.25	2.81	3.04	3.23
OZP0703	Aug 30	2.88	2.46	2.78	2.83
OZP0805	Sep 7	2.62	2.45	2.73	2.59
Kaspa	Sep 9	3.29	2.87	3.01	3.10
OZP0901	Aug 15	3.17	2.82	3.26	2.93
Sturt	Aug 30	3.04	2.74	3.28	2.92
Morgan	Sep 11	3.20	2.33	3.09	3.03
OZP0804	Sep 10	3.24	2.81	3.17	3.19
Mean		*3.01*	*2.65*	*3.00*	*2.92*

lsd(P<0.05)Crop Top x Gen = NS. lsd(P<0.05)Crop Top = 0.18

Key Findings and Comments

Crop topping at the recommended time of application (ryegrass milky dough) resulted in no yield loss for any genotype.

F4. Sowing Date, MRZ Mid North (Hart), South Australia

Aim

To maximise yield of new field pea varieties through the identification of optimum sowing dates.

Treatments

Varieties: Kaspa, Alma, PBA Gunyah, PBA Twilight, OZP0703, OZP0903
Sowing dates: 30 April (Early), 21 May (Mid), 11 June (Late)
Fertiliser: Map + Zn @ 75kg/ha

Results and Interpretation

Yield of field peas averaged 2.5 t/ha at Hart in 2010, the same as in 2009. Grain yield showed no response to sowing time. This was likely due to the moderate blackspot, which penalised yield of early sown Kaspa by 35% (as evidenced by the fungicide trial), and the favourable season finish (which favoured later sown peas).

Varietal differences in grain yield were observed (Figure F4.1). Alma, a tall, trailing conventional type pea, yielded lowest (17% lower than Kaspa). Yield of Alma may have been compromised by the large biomass and severe lodging. Kaspa performed similarly to the site mean.
PBA Gunyah and PBA Twilight performed similarly, and slightly lower than the site mean. PBA Twilight performed similarly to Kaspa, while PBA Gunyah yielded slightly (8%) lower than Kaspa, but still 11% higher than Alma. Both recent releases outperformed Alma and were only slightly lower yielding than Kaspa in a wet season which generally favoured later maturing lines. This data demonstrates their reliability across seasons. Over the last three seasons PBA Gunyah has performed between 7% below (2010) and 15% above (2008) Kaspa at Hart across all sowing dates, averaging 4% greater than Kaspa. PBA Twilight has been included in Hart trials in both the favourable seasons of 2009 and 2010, but has still averaged just 2% below Kaspa over those seasons.
Prospective releases OZP0703 and OZP0903 both yielded similarly and greater than the site mean. OZP0703 is a high yielding early flowering dun variety with greater tolerance to bacterial blight than current pea varieties. OZP0903 is a high yielding, early flowering and erect growing dun pea variety with pod shatter resistance and high field resistance to bacterial blight and the new strain of downy mildew present in SA. OZP0903 yielded 10% higher than Kaspa and 33% higher than Alma and OZP0703 yielded similar to Kaspa.

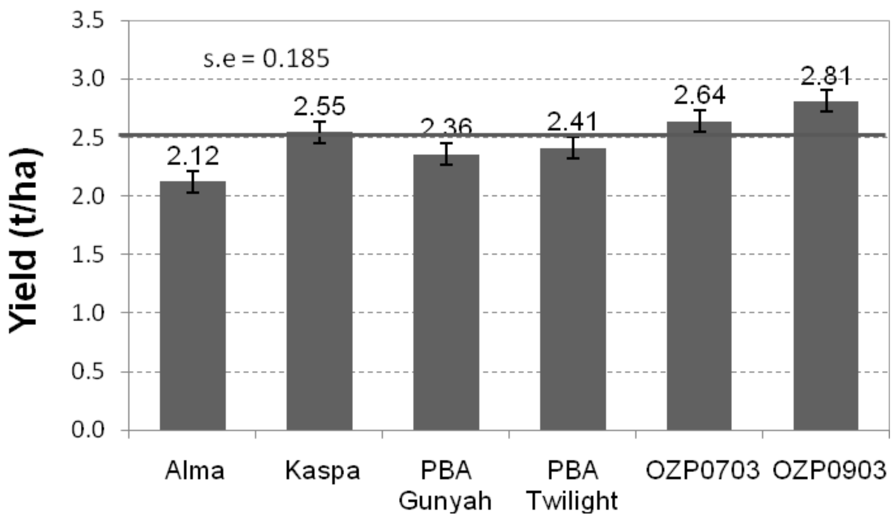

Figure F4.1. Grain yield of field pea cultivars at Hart, 2010.

Key Findings and Comments

- Grain yield of field peas sown at Hart in 2010 averaged 2.5t/ha across all varieties, similar to 2009.
- No sowing time response was observed in 2010 due to disease in early sown plots and the favourable season finish that promoted yield in later sown plots.
- Early sown plots with uncontrolled blackspot showed a 35% yield loss compared to the optimum control (fortnightly chlorothalonil), which yielded 3.6t/ha.
- Recently released early maturing varieties PBA Gunyah and PBA Twilight performed slightly below the site mean yield in a year which favoured later maturing types like Kaspa.
- Prospective releases OZP0703 and OZP0903 show a lot of promise, with OZP0703 performing similarly to Kaspa and OZP0903 yielding 10% greater.

F5. Disease Management, MRZ Mid North (Hart), South Australia

Aim

To compare current and potential fungicide options for the control of blackspot in field pea.

Treatments

Variety: Kaspa
Sowing date: 30 April (Early)
Fungicide tmts: Nil, Mancozeb (2kg/ha), Chlorothalonil (2L/ha), Amistar® (700ml/ha), Amistar® Xtra (850ml/ha), Amistar® Opti (3L/ha), Amistar® + Tilt (700ml/ha + 500ml/ha), Filan® (200g/ha), Cabrio® (200ml/ha), Filan® + Carbio® (200g/ha + 200ml/ha), Syngenta Product (identity withheld)
Timing: 9 node + early flower
Fertiliser: Map + Zn @ 75kg/ha

Results and Interpretation

Conditions were favourable for plant growth, foliar disease and grain yield in 2010. However blackspot infection was less than the early predictions based on 2009 stubble spore counts. This was most likely due to a combination of high summer and early autumn rainfall, prompting spore releases prior to sowing, and the dry start to May, which generally delayed sowing and reduced blackspot risk. Blackspot was recorded at moderate levels throughout the season despite the favourable growing season.

Blackspot infected pea stubble was collected from each time of sowing (early, mid and late) in the field pea disease management trial at Hart in November 2009. The disease level on the stubble varied for these sowing dates *viz.* 18, 12 and 8 nodes infected, respectively. Nylon pouches containing the stubble were incubated on the soil surface at Hart through 2010 and each fortnight one pouch per sowing date was sent by Peter Hooper (Alan Mayfield Consulting) to the Department of Agriculture and Food, WA (DAFWA) to count the spore release in their wind tunnel. Spore release patterns (Figure 2) show that the peak release was late April and by the time most field pea crops in South Australia were emerging in late May, very few blackspot spores remained. This data validated the prediction of early spore release by 'Blackspot Manager' and blackspot disease was of lesser severity in South Australia in 2010 compared to previous years with late release of spores, except in crops that were sown very early on the break of the season. The results in Figure 2 show that many more spores were released from the medium severity stubble (mid sown) than either the high or low severity (early or late sown). It was expected that the high severity stubble would produce most spores as had occurred in similar experiments in 2008 and 2009. Nevertheless the number of spores was much lower than in previous years, irrespective of severity of disease on the stubble.

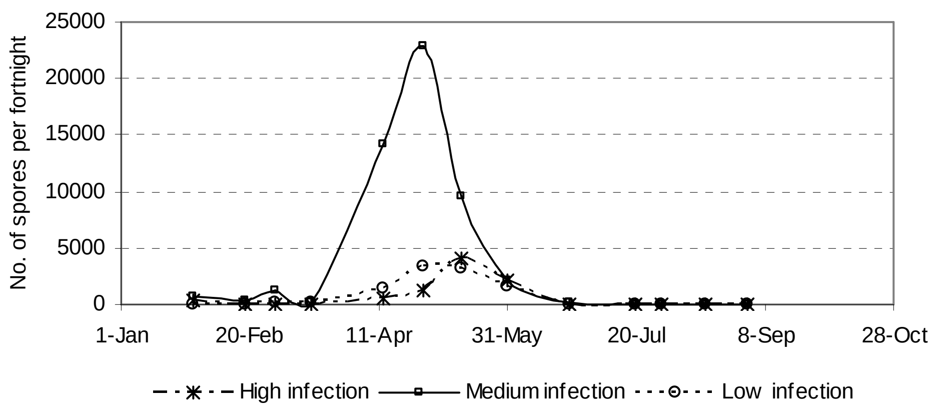

Figure F5.1. Blackspot spores trapped from pea stubble per fortnight from Hart incubation in 2010

A range of fungicides (unregistered for this purpose) were tested for blackspot control on early sown (30th April) Kaspa field pea at Hart in 2010, as the current options either provide inadequate or uneconomical control. These treatments included azoxystrobin (Amistar®), a range of azoxystrobin mixes, pyraclostrobin (Cabrio®)and boscalid (Filan®), and were compared to the registered products, chlorothalonil and mancozeb, as well as fortnightly sprays of chlorothalonil. Blackspot was assessed six times during the season and results are expressed as Area Under the Disease Progress Curve (AUDPC). Disease was less and yield was increased over the untreated in plots with chlorothalonil, pyraclostrobin and azoxystrobin plus chlorothalonil (Figures F5.2 and F5.3). However there is still room for improvement over these treatments as the response from fortnightly sprays was even greater (54% yield increase compared to unsprayed plots). This work will be validated in the coming season but any move toward registration will need to be conducted by chemical companies. In the meantime the recommended strategy in field pea crops with a yield potential of at least 2 t ha^{-1} is to apply P-Pickel T seed dressing followed by foliar applications of either mancozeb or chlorothalonil at 9 node growth stage and again at early flowering. This strategy should remain economic for grain prices above $200 tonne, but may not be economic in crops that yield less than 2 t ha^{-1}.

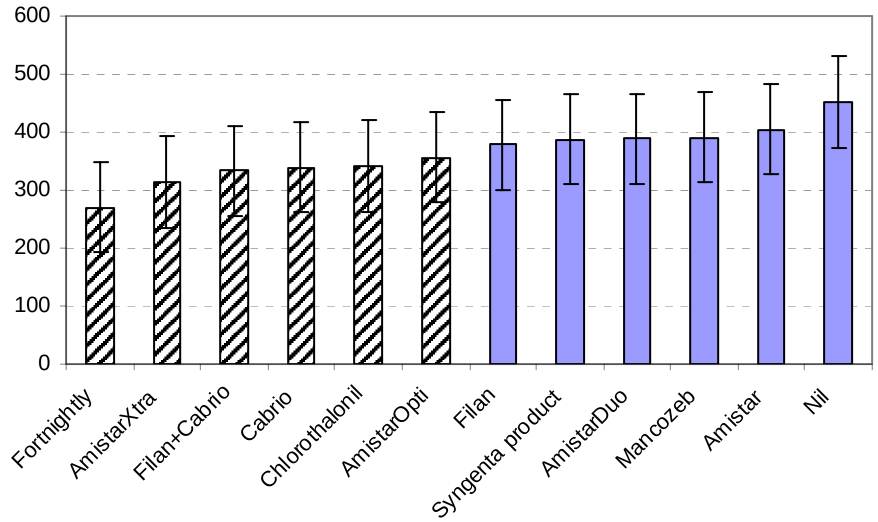

Figure F5.2. Blackspot assessed as Area Under Disease Progress Curve in fungicide treated plots of Kaspa at Hart 2010. Striped bars have significantly less disease than the untreated. L.S.D. = 78.2

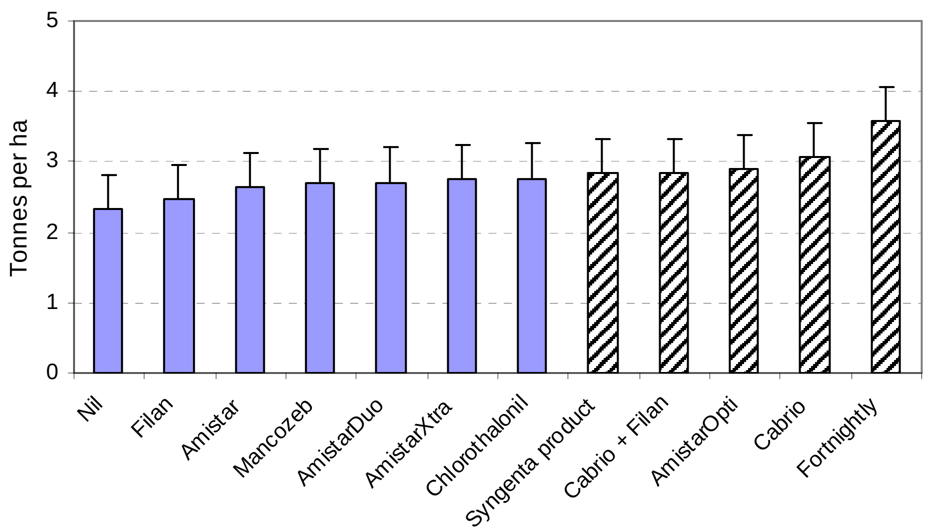

Figure F5.3: Yield in fungicide treated plots of Kaspa at Hart 2010. Striped bars have significantly more yield than the untreated. L.S.D. = 0.49

Key Findings and Comments

Chlorothalonil (Bravo®), pyraclostrobin (Cabrio®) and azoxystrobin plus chlorothalonil (Amistar® Opti) showed increased yield compared to the nil treatment, however further improvement is possible as the response from fortnightly chlorothalonil sprays was even greater.

F6. Sowing Date, LRZ Upper Eyre Peninsula (Minnipa), South Australia

Aim

To maximise yield of new field pea varieties through the identification of optimum sowing dates.

Treatments

Varieties: Kaspa, Alma, PBA Gunyah, PBA Twilight, OZP0703, OZP0903
Sowing dates: 27 May (Early), 11 June (Late)
Fertiliser: Map + Zn @ 75kg/ha

Results and Interpretation

Yield of early sown peas was not affected by disease in 2010, and the soft finish to the season did not penalise yield of later sown peas. Consequently, there was no yield difference between sowing dates in this trial. This is a very different result to that found from previous experiments at Minnipa where a yield penalty of 26/kg/day occurred as sowing was delayed. Significant variety differences were apparent (Table F6.1). OZP0903 yielded higher than all other varieties (3.3 t/ha), and 13% higher than Kaspa. OZP0903, Kaspa and OZP0703 all yielded higher than Parafield. 2010 releases PBA Gunyah and PBA Twilight performed similarly to Kaspa, along with the bacterial blight resistant OZP0703, an anticipated 2011 release.

Table F6.1. Grain yields of six varieties in a sowing date trial at Minnipa, 2010.

Line	Kaspa	Parafield	PBA Gunyah	PBA Twilight	OZP0703	OZP0903	LSD (P>0.05)
Yield t/ha	2.90	2.61	2.78	2.75	2.88	3.29	0.25

Key Findings and Comments

Since soil moisture was not limiting, and a soft finish to the season was observed, sowing date trials at Minnipa in 2010 showed no differences in yield between early and late sowing dates under these conditions. However, early sowing is still generally recommended in low rainfall regions provided that optimal management of blackspot, frost and weed risks are considered.

F7. Stubble Management, LRZ Upper Eyre Peninsula (Minnipa), South Australia

Aim

To maximise yield of new field pea varieties through the identification of optimum sowing dates.

Treatments

Varieties: Kaspa, Alma, PBA Gunyah, PBA Twilight, OZP0703, OZP0903
Stubbles: Slashed (wheat)
Standing (30cm, wheat)
Fertiliser: Map + Zn @ 75kg/ha

Results and Interpretation

As for the sowing date trial, there was no significant treatment interaction with stubble management. This is likely because the long and wet season favoured vegetative growth and biomass was high, and consequently any improvements in crop standability, ease of harvest or disease which might have been observed in a drier season were not apparent in 2010. However there were differences in yield between varieties (Table F7.1). OZP0819, a tall, white field pea, yielded highest (3.3 t/ha), averaging 17% higher yielding than Kaspa, a result not found in the PBA breeding trial. As for the sowing date trial, PBA Gunyah, PBA Twilight and OZP0703 all performed similarly to Kaspa (2.8 t/ha). Parafield yielded lower than all lines except PBA Twilight.

Table F7.1. Grain yields of six varieties in sowing date and stubble management trials at Minnipa, 2010.

Line	Kaspa	Parafield	PBA Gunyah	PBA Twilight	OZP0703	OZP0819	LSD (P>0.05)
Yield t/ha	2.78	2.46	2.84	2.69	2.78	3.27	0.25

Key Findings and Comments

Since soil moisture was not limiting, and a soft finish to the season was observed, sowing date trials at Minnipa in 2010 showed no differences in yield between stubble treatments under these conditions. This trial will be repeated in the same environment to validate across seasons.

F8. Crop-topping/Desiccation, Mid North (Balaklava), South Australia

Aim

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

Treatments

Varieties: Alma, Bundi, Dundale, Glenroy, Kaspa, Morgan, Parafield, PBA Gunyah, PBA Twilight, Sturt, SWCeline, Yarrum, PSL-RESEL, OZP0703, OZP0804, OZP0805.

Sowing date: 4 June

Treatments: see tables for dates

Nil - no desiccant applied

Early Crop-top - applied 7-14 days pre ryegrass milky dough stage

Mid Crop-top - applied at ryegrass milky dough stage ("Recommended")

Late Crop-top - applied 7-14 days post ryegrass milky dough stage

Fertiliser: Map + Zn @ 90kg/ha

Results and Interpretation

Crop-topping treatments had a significant effect on both grain yield and grain weight in 2010. The early crop-top timing significantly reduced yield and grain weight of all varieties, while the late timing had no significant effect on either yield or grain weight (Table F8.1). Yarrum and Parafield had reduced yield and grain weights from crop-topping at the recommended timing, while Glenroy also had reduced yields and OZP0804 showed reduced grain weight.

Table F8.1. Effect of crop-top timing on grain yield and grain weight of field peas, Balaklava 2010. Varieties are ranked according to their visual maturity rating from earliest to latest

Treatment	Yield (t/ha)	Yield (% of Nil)			Grain Wt. (g/100)	Grain Weight (% of Nil)		
Variety	Nil	- 2 wks[a] (20/10)	Recommended (5/11)	+ 2 wks[b] (19/11)	Nil	- 2 wks[a] (20/10)	Recommended (5/11)	+ 2 wks[b] (19/11)
PSL-RESEL	1.45	54	94	93	16.2	73	95	96
SWCeline	2.22	61	86	93	19.2	68	103	93
PBA Twilight	1.73	53	91	95	16.4	74	99	99
PBA Gunyah	1.79	55	92	101	17	81	106	102
Bundi	1.69	43	94	99	16.8	78	101	104
OZP0703	2.03	54	89	99	17.6	72	101	99
OZP0805	2.29	48	93	100	17.2	69	97	102
Dundale	1.85	50	92	86	17.1	79	97	91
OZP0804	2.24	49	98	110	15.9	62	89	99
Yarrum	3.07	32	72	98	19.4	52	91	96
Kaspa	1.99	45	100	94	15.9	73	99	99
Sturt	2.38	49	89	100	15.4	78	97	101
Parafield	1.96	40	70	85	14.3	69	89	95
Alma	1.57	45	93	96	15.4	75	100	102
Glenroy	2.03	38	74	85	14.2	79	95	101
Morgan	2.03	31	84	105	13.7	69	93	97
Mean	**2.02**	**0.93**	**1.76**	**1.95**	**16.4**	**11.7**	**15.9**	**16.1**

NB: Shading denotes significant difference from the Nil treatment.

[a] = 2 weeks prior to recommended timing

[b] = 2 weeks after recommended timing

Key Findings and Comments

- The wet season end in 2010 meant that all varieties showed reduced yield and grain weight from the early crop-top timing, regardless of maturity.
- At the recommended crop-top timing yield of the later maturing lines Parafield, Yarrum and Glenroy was significantly affected, while some later maturing lines were not. This may have

been a result of a moderate powdery mildew infection at this site, which sped up maturity of sensitive lines. Yarrum, which has mid maturity and is powdery mildew resistant, would not otherwise have been expected to show this yield penalty at this timing as shown by 2009 results.

- Further work is required to validate these results.

F9. Sowing Time x Variety x Seeding Rate, LRZ (Yenda), New South Wales

Aim

To maximise performance of a range of new field pea varieties across a range of sowing dates. The information from this trial will be used to improve current grower sowing time recommendations and variety selections.

Treatments

Varieties:	Kaspa, Yarrum, Sturt, OZP0703, PBA Twilight, PBA Gunyah, OZP0805, OZP0901
Sowing dates:	20 April (Early); 15 May (Mid); 21 June (Late)
Plant populations:	Targeted 30 & 50 plants/m^2
Row Spacing/Stubble:	30cm, direct drilled into wheat stubble
Fertiliser:	Legume Starter @ 115kg/ha at sowing

Results and Interpretation

- Grain yields - Grain yield was significantly highest at the second (15 May) and third (21 June) sowing dates for all varieties (P<0.001). The lower yields at the earliest sowing were not surprising given the excellent season. These plots grew luxuriously tall and bulky during the very mild and wet autumn and looked spectacular during July and August. However, given the continuing good season, the early sowings grew too vigorous and lodged badly during pod fill. Consequently, smothering and lack of light resulted in excessive smothering, disease and pod abortion and restricted seed fill, all combining to significantly reduce yield. This is the “classic” self-destruct syndrome characteristic of early sown field pea during average to excellent growing conditions. Variety yields were also highly significantly different, as was the interaction with sowing time (P<0.001). Yarrum was the outstanding variety at all sowings, only OZP0805 coming close to its performance. Yarrum has regularly preformed well in southern NSW and this has been attributed to its superior seed set, PM and PSbMV resistance. Plant populations had no affect on yield.

- Seed Size - Yarrum and OZP0805 had the largest seed size (P<0.001) while the Sturt and the Kaspa types (Kaspa, OZP0601 & OZP0602) the smallest. Seeding rate and sowing time did not significantly affect seed size, with the notable exception of OZP0805 where seed size increased as sowing was delayed (P<0.001 for Var X Sowing Date).

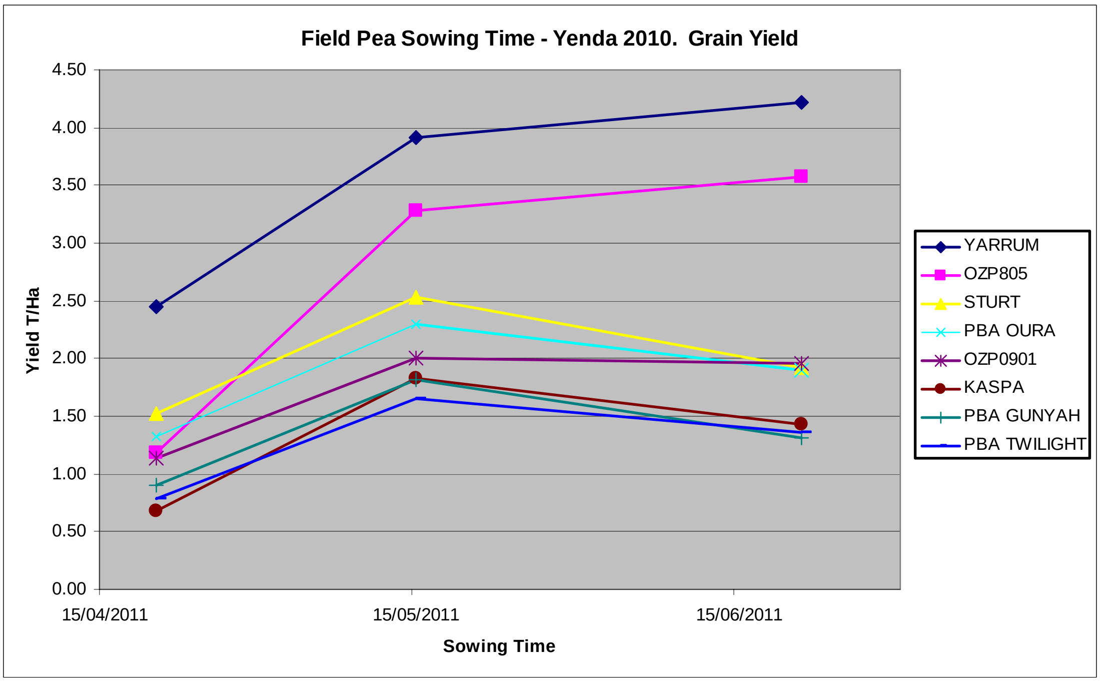

Figure F9.1. The main effect of sowing date on grain yield (t/ha) of field peas at Yenda in 2010.

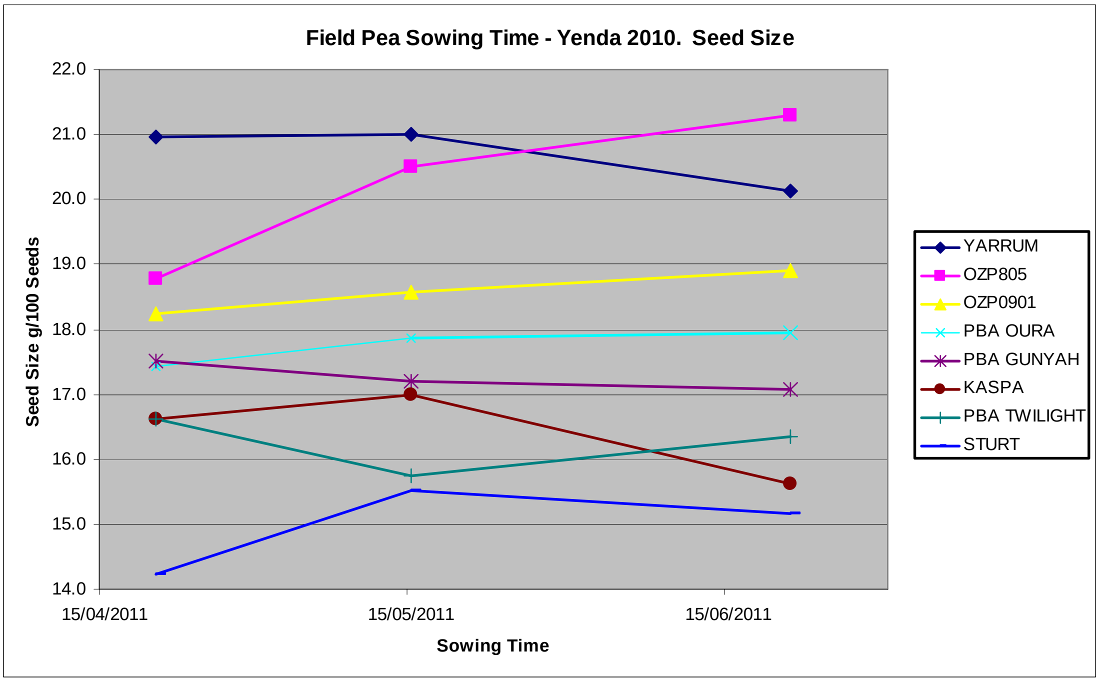

Figure F9.2. The main effect of sowing date on grain weight (g/100seed) of field peas at Yenda in 2010.

Key Findings and Comments

- Yield of all varieties peaked when sown between mid May and late June during the highly favourable season of 2010.
- Performance at the later sowings was unusually good, again due to the favourable finish.
- Early sowings suffered from excessive dry matter production, disease and the classic "self-destruct syndrome" of peas that are too well grown.
- Yarrum was the best variety, followed by OZP0805.
- Seed size varied mainly with variety and was generally not affected by sowing date or seeding rate.

F10. crop topping trial, H-MRZ (Wagga Wagga), New South Wales

Aim

To test the adaptability and yield potential of current and new field peas varieties to crop topping over a range of timings in southern NSW to provide an additional weed control method for problem weeds ie ARG.

Treatments

Varieties:	Kaspa, Yarrum, Sturt, Maki, PBA Twilight, PBA Gunyah, OZP0703 OZP0901,
Sowing dates:	26 June 2010
Plant populations:	Targeted 50 plants/m^2
Row Spacing/Stubble:	30cm, direct drilled into wheat stubble
Fertiliser:	Legume Starter @ 115kg/ha at sowing
Crop topping:	Gramoxome® 800ml/ha @ 100L water/ha (4th,16th & 26th November)

Results and Interpretation

Grain yields - There was significant effects detected from variety and crop topping timings *($P<0.005$)*. There was not interaction of variety and crop topping timing detected. Yield was severely penalised when crop topping occurred too early (earliest treatment). All varieties (even early maturing types) were too physiologically immature and suffered up to 50% yield loss. The timing of this spray is depicted in the photos below, clearly illustrating that even the fastest maturing types were yet to show signs of turning. (yellowing).

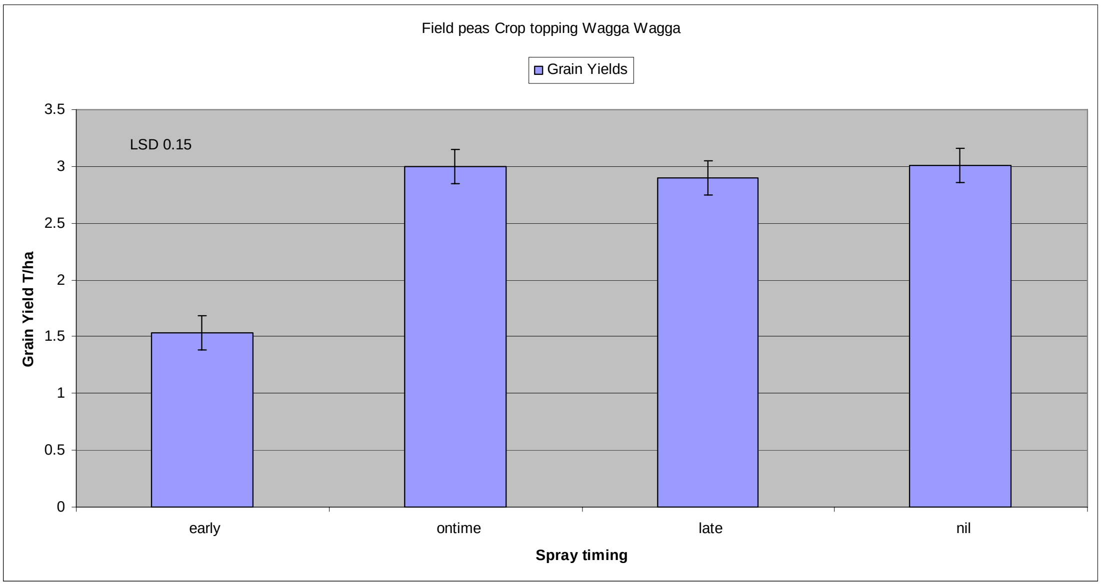

Figure F10.1. The main effect of crop topping treatment on grain yield (t/ha) of field peas at Wagga in 2010.

Further to this, the “ontime”, “late” and “nil” sprays maintain maximum yields without any yield penalties. The “ontime” was only 14 days later on the 16th November then the early spray. (see photos below).

The stage of the crop varied at this timing as the fastest maturing types (PBA Oura, Twlight, Gunya, Yarrum) had well and truly begun to turn, whilst late types (ie Kaspa) had only just begun. Whilst no interaction was detected between timing and variety at the 95% level, there were significant differences at the 90% level. This emphasises considerable thought and understanding be given to define crop maturity, variety and timing of crop topping. Obviously faster maturing varieties provide a wider window of opportunity to synchronise yield maximization with correct development stage (earlier enough) of the escapee or resistant weed to achieve maximum control.

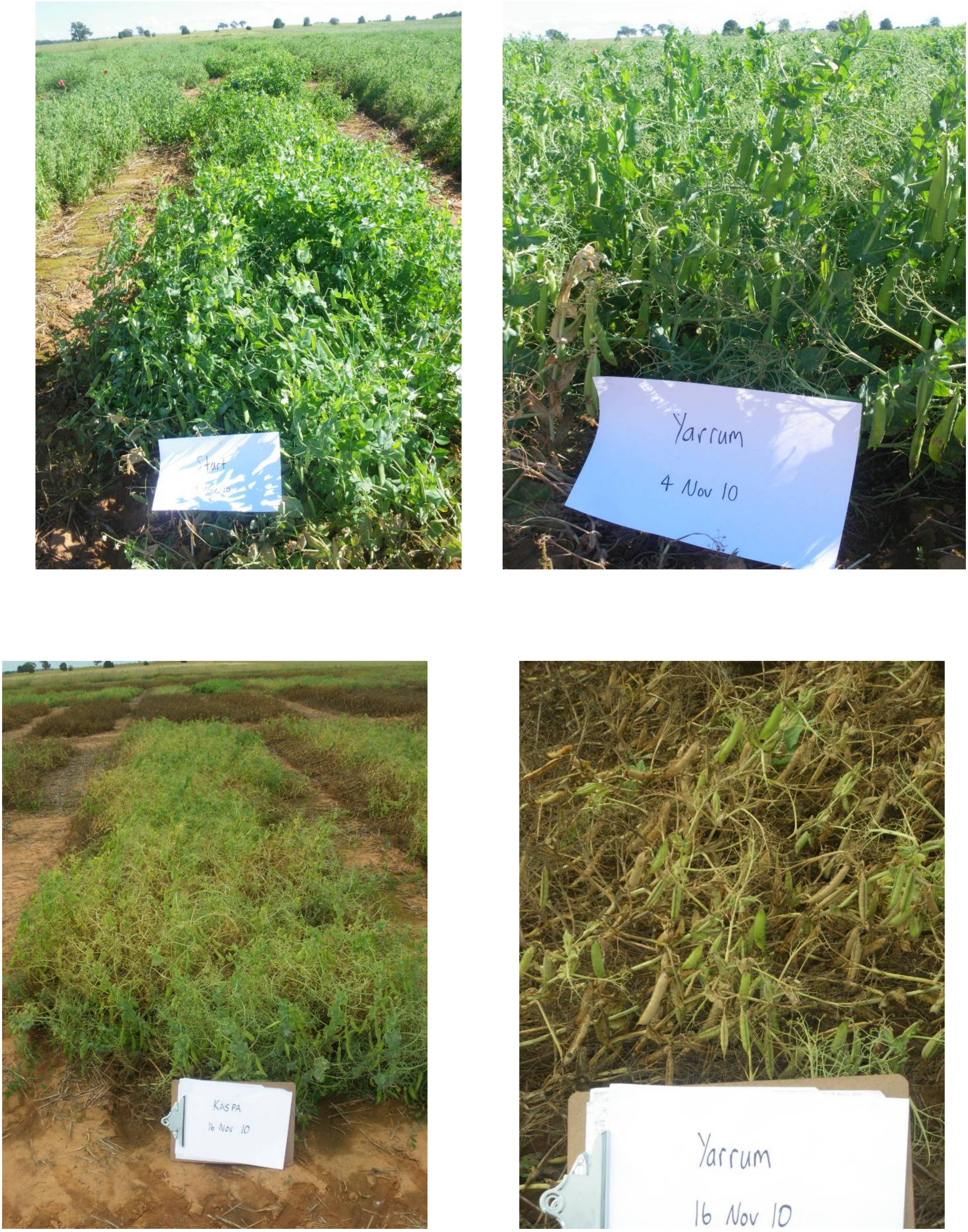

Figure F10.2. Photographs illustrating the maturity of Yarram at the early (top) and 'on time' (bottom) crop topping treatment applications.

- From the photos it can be seen that the “on-time” spray application was made when full seed development had completed (for early maturing types such as Yarrum) and the chlorophyll loss was highly noticeable. Maturity of later maturing types such as Kaspa was not as advanced at this timing but still at a stage that limited yield loss. Ideally this treatment would have been delayed slightly for later maturing types (ie late timing).

- Weed Control - Whilst the aim of this trial was to test the potential yields and the suitability of each variety to crop-topping, it was noted that any Annual Rye Grasses (ARG) present in the field were fully controlled by the each spray treatment. Some of these grasses escaped selective “Group A” in-crop herbicide applications. The early and on time coincided with ARG flowering, whilst the late spray was applied during seed development of ARG.

Key Findings and Comments

- Crop topping provides an excellent strategy to control escapee or resistant weeds in field pea crops.
- Yield can be severely penalised if crop topping occurs too early.
- Correct variety choice and careful timing of crop topping is essential
- Varieties should be selected to achieve maximum yield simultaneously with maximum weed control.
- Ontime spraying achieved excellent weed control as annual ryegrass and wild oats were at the flowering stage.

F11. Variety x Seeding Rate, LRZ (Yenda), New South Wales

Aim

To maximise performance of a range of new field pea varieties across a range of plant densities. The information from this trial will be used to improve current grower sowing time recommendations and variety selections.

Treatments

Varieties: Kaspa, Sturt, PBA Twilight, PBA Gunyah, OZP0703, OZP0901,

Plant populations: Targeted 16, 32, 48, 64 & 80 plants/m^2
Sowing date: 16 May
Row Spacing/Stubble: 30cm, direct drilled into wheat stubble
Fertiliser: Legume Starter @ 115kg/ha at sowing

Results and Interpretation

Grain yields - Seeding rate and established plant population had no significant affect on grain yield during 2010. Plots with as little at 12-14 plants per square metre had similar yields to plots varying in densities across the entire range up to 80 plants per square metre. This result is quite extraordinary considering how much plasticity was required in the lowest density plots to compensate. This is a reflection of how good the season was and of the extent of branching, podding and or seed set in these low density plots.

Varieties varied significantly ($P<0.001$). Sturt was the highest yielder, followed by OZP0901 and OZP0703.

Seed Size - Seed size varied significantly between varieties and increased significantly as density increased. OZP0901 had a significantly larger seed size and Sturt a significantly smaller seed size ($P<0.001$).

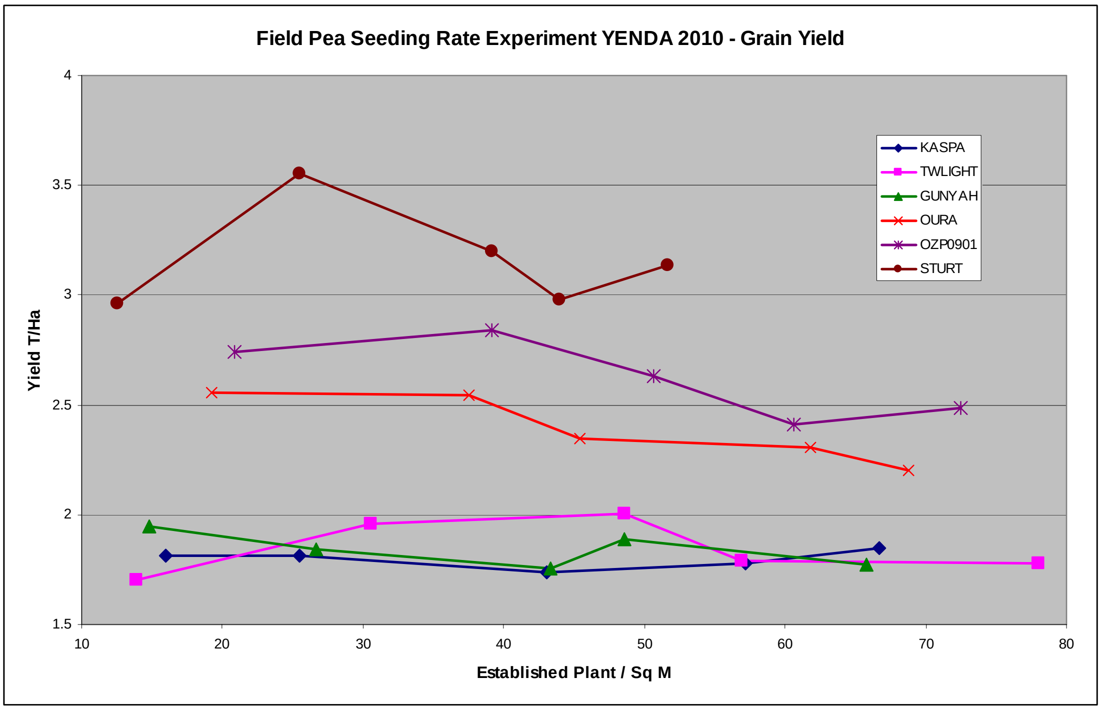

Figure F11.1. The interaction effect of genotype and seeding rate on grain yield (t/ha) of field peas at Yenda in 2010.

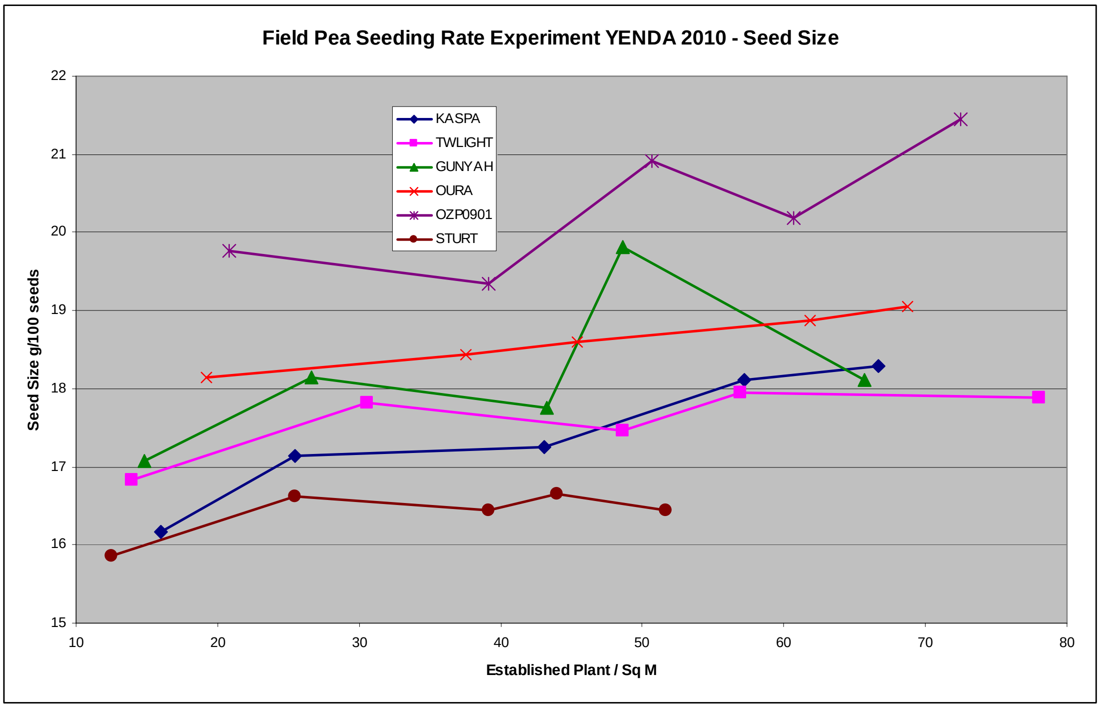

Figure F11.2. The interaction effect of genotype and seeding rate on grain weight (g/100seed) of field peas at Yenda in 2010.

Key Findings and Comments

- Yield of all varieties were largely unaffected across the range of plant density (12 to 80 plants/sqm) during the highly favourable season of 2010.
- As densities increased, seed size increased.
- Varieties differed significantly in grain yield and seed size. Sturt was the highest yielder, followed by OZP0901 and OZP0703.

4. Faba Beans

B1. Sowing Time x Row Space, MRZ Wimmera (Vectis), Victoria

Aim

To investigate the adaptability of a range of faba bean varieties and breeding lines to wider row spacing's sown inter-row in to standing stubble compared with conventional cropping systems (narrow row spacing with slashed stubble). The interaction sowing times is also compared.

Note: Trial is a comparison of systems, not just row space. In the wider row spacing's plots were sown with narrow lucerne points, press wheels and chemicals applied pre-sowing. In the narrow row spacing's plots were sown with narrow lucerne points, harrows and chemicals applied post-sowing, pre-emergent.

Treatments

Varieties:	Nura, Farah, AF03063, AF03109, AF05054, AF05073, 1269*483/6-1, 974*(611*974)/15-1.
Sowing dates:	16 May (Early), 21 June (Late).
Row Spacings/Stubble:	17.2 cm row spacing, slashed stubble (sl17), 30 cm row spacing, inter-row, standing stubble (ST30), 30 cm row spacing, inter-row, slashed stubble (sl30), 60 cm row spacing, inter-row, standing stubble (ST60).

Other Details

Fertiliser:	MAP + Zn @ 60 kg/ha at sowing.
Plant Density:	20 plants/m^2.

Results and Interpretation

➢ Key Message: Genotypes compared in this trial responded differently to sowing dates. Early sowing was optimal for all genotypes, particularly for AF05073, which was the highest yield genotype when sown early.

- Plant establishment – Similar to the lentil and chickpea trials at Vectis, there were significant issues with stubble dragging and mouse damage (Figure L2.1). Overall establishment for all faba bean genotypes in all treatments was between 13 and 31 plants/m^2. There were no major effects of genotype or sowing date on plant establishment, however at narrow row spacings (sl17) there was generally higher plant establishment than observed in the wider row spacings (Table B1.1).

Table B1.1. The main effect row space treatment on plant establishment in faba beans at Vectis in 2010.

Row Space	Plants/m^2
sl17	25
sl30	19
ST30	18
ST60	17

lsd(P<0.05)RS = 1.6

- Grain Yield – There was an interaction between sowing date and genotype. At the May 16 sowing date AF05073 yielded significantly more than all other genotypes, what at the June 21 sowing date the was no difference among the genotypes (Table B1.2). Row spacing had no effect on grain yield.

Table B1.2. The effect of the interaction between sowing date and faba bean genotype on grain yield (t/ha) at Vectis in 2010.

	1269*483/6-1	974*(611*974)/15-1	AF03063	AF03109	AF05054	AF05073	Farah	Nura	*Average*
16 May	3.26	3.10	3.54	3.14	3.41	3.97	3.40	3.26	*3.38*
21 June	2.62	2.67	2.47	2.70	2.57	2.40	2.60	2.37	*2.55*
Average	*2.94*	*2.89*	*3.00*	*2.92*	*2.99*	*3.19*	*3.00*	*2.82*	

lsd(P<0.05)SDxGen = 0.43, except when comparing genotypes within a sowing date = 0.36

Key Findings and Comments

Genotypes compared in this trial responded differently to sowing dates. Early sowing was optimal for all genotypes, particularly for AF05073, which was the highest yield genotype when sown early.

B2. Disease Management x Row Space, Wimmera (Vectis), Victoria

Aim

To investigate if optimum disease management strategies change in different row spacings across a range of faba bean genotypes, differing in ascochyta blight and chocolate spot susceptibility.

Treatments

Varieties: Nura, Farah, AF03063, AF03109, AF05054, AF05073, 1269*483/6-1, 974*(611*974)/15-1.

Fungicide Regimes:

Regime	Chemical & Application Rate[1]	Timing
Complete	chlorothalonil 720 @ 2L/ha carbendazim 500 @ 500ml/ha	Fortnightly starting 6 weeks after emergence.
Double Choc (Cx2)	carbendazim 500 @ 500ml/ha	early and late flower
Triple Choc (Cx3)	carbendazim 500 @ 500ml/ha	early, mid and late flower
Nil	Nil	Nil

1. Refers to application rate of the product

Row Spacings/Stubble: 17.2 cm row spacing, slashed stubble (sl17),
60 cm row spacing, inter-row, standing stubble (ST60).

Other Details

Sowing date: 15 May.
Fertiliser: MAP + Zn @ 60 kg/ha at sowing.
Plant Density: 20 plants/m^2.

Results and Interpretation

- Key Message: Disease pressure was low in the trials and no major effects of agronomic treatment were noted.

- Disease Presence – Disease levels (both Chocolate spot and Ascochyta Blight) were only present at very low levels in these trials in 2010. This was a surprise as many growers experienced difficulty in managing the disease. The reason for low disease pressure was unclear.

- Grain Yield – Grain yields showed a similar trend to that observed in the sowing time x row space trial described above. AF5073 was significantly higher yielding than all other genotypes. (Table C3.2, highlighted).

Table B2.1. The main effect of genotype on grain yield (t/ha) at Vectis in 2010.

Genotype	1269*483/6-1	974*(611*974)/15-1	AF03063	AF03109	AF05054	AF05073	Farah	Nura
Grain Yield (t/ha)	4.00	4.08	4.16	4.11	4.08	4.78	4.26	4.26

lsd($P<0.05$) = 0.27

Key Findings and Comments

Disease pressure was low in the trials and no major effects of agronomic treatment were noted.

B3 Sowing Time x Variety x Plant population, H-MRZ (Wagga Wagga), New South Wales

Aim

To test the yield response of six faba bean varieties across 4 different sowing times and two targeted plant populations in southern NSW. The information from this trial will be used to improve current grower sowing time recommendations, variety selections and targeted plant population at each sowing time.

Treatments

Varieties:	Farah, Nura, AFO3063, AFO3001, AFO3029, 974*(611*974)/15.
Sowing dates:	6th April (Early), 29th April, 28th May, 16th June (late).
Plant populations:	Targeted 20 & 35 plants/m^2.
Row Spacing/Stubble:	30cm into standing light stubble.
Fertiliser:	Legume Starter @ 115kg/ha at sowing.

Results and Interpretation

- Grain yields - The effects of variety, time of sowing, and plant population as single factors were found to be significant (*P<0.005*). There also was a significant interaction of variety x time of sowing, and sowing time x plant population detected All other interactions were found not significant.

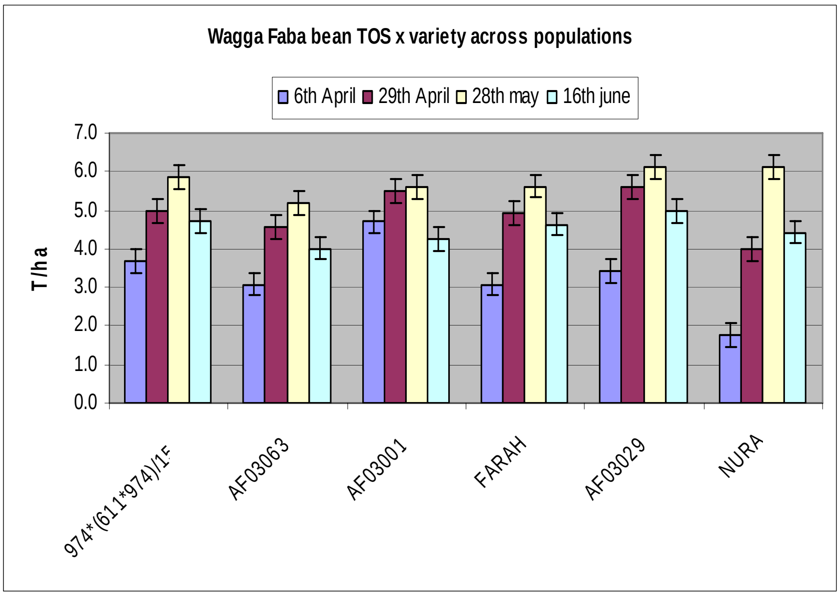

Figure B3.1. The interaction effect of genotype and sowing date on grain yield (t/ha) of faba beans at Wagga in 2010.

- As can be seen from above, there was a significant yield penalty across all treatments from early sowing (6th April). This yield penalty is associated with increased disease pressure (despite regular fungicide applications), large plant biomass and early plant lodging. Some treatments began lodging as early as 9th September in the 6th April planting. This early lodging also increased the disease pressure as spray fungicides were unable to fully penetrate the plant canopy. Sowing date 28th May was optimum in terms of yield and lodging at this site in 2010 . The first 2 sowing dates suffered severe lodging and caused massive yield loses. However, the 29th April sowing date was able to return higher yields than the 6th April sowing date because there was less disease and lodging occurred much later.

Figure B3.2. The interaction effect of genotype and sowing date on lodging of faba beans at Wagga in 2010.

From this data, it is clear that a late April to late May is the optimum planting time for faba beans in a season like 2010. Sowing early increases the instance of disease and early crop lodging.

- Grain Weight - The effects of variety and time of sowing as single factors were found to be significant (P<0.005). There also was a significant interaction of variety x time of sowing detected All other interactions were found not significant. The grain weight result is very similar to the grain yield result. This is of no surprise as seed size is a major driving to grain yield (within a variety). Early lodging and increased disease pressure (induced by early lodging) reduced seed size significantly across all treatments. Generally 2nd & 3rd sowing dates did not differ and the mid June was significantly lower (as were grain yields).

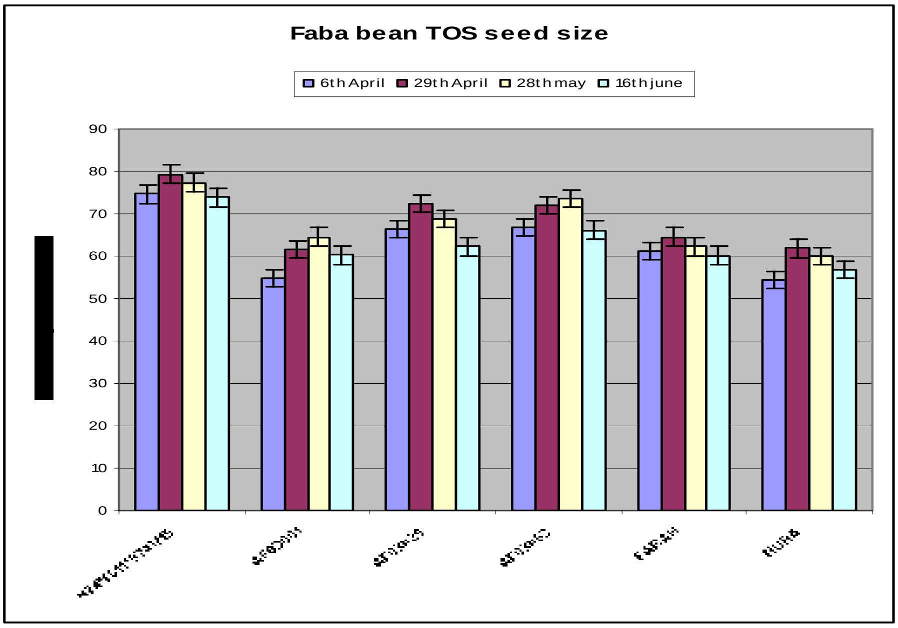

Figure B3.3. The interaction effect of genotype and sowing date on grain weight of faba beans at Wagga in 2010.

B4. Row spacing x edge row effect, H-MRZ (Wagga Wagga), New South Wales

Aim

To investigate the effects of row spacing and effect row across a range of advanced varieties on yields of Faba bean at Yenda in south western NSW.

Treatments

2 Faba bean varieties x +/- edge rows x 4 rows spacing configurations

Varieties:	Farah, AFO3063
Sowing dates:	19th May
Edge row:	retained or removed at plant maturity
Row Spacing/Stubble:	20cm, 30cm, 40 & 50cm
Fertiliser:	Legume Starter @ 115kg/ha at sowing banded with seed

Results and Interpretation

- Grain yields - The effects of variety, row spacing and edge row effects as single factors were found not to be significant ($P<0.005$). There was also no significant interaction of any of the combination of treatments detected. No differences were detected across row spacing's and varieties. Whilst this is a non significant result, this does tell us that no yield penalties are incurred by widening row spacing out to 50cm. This results suggests that faba bean maybe a good crop choice in large stubble retention farming systems and where wider planting rows are need to sow the crop through the stubble (without the need to burn or cultivate).

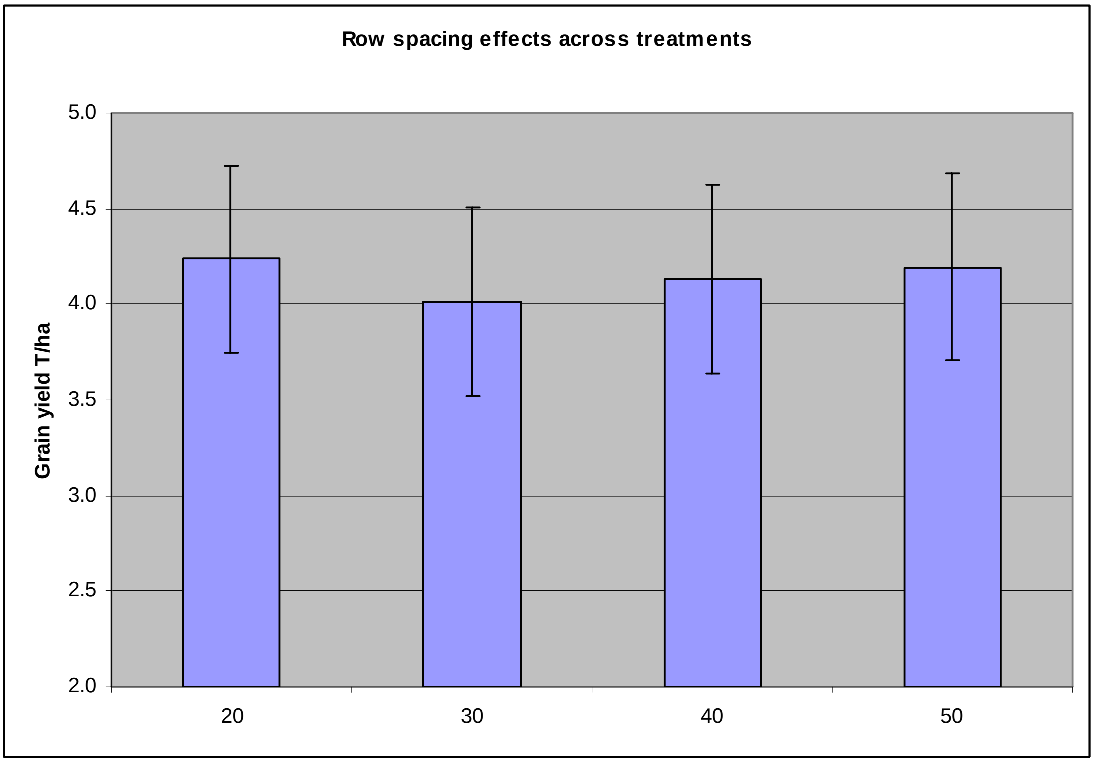

Figure B4.1. The main effect of row spacing on grain yield (t/ha) of faba beans at Wagga in 2010.

B5. Sowing Date x Plant Density x Row Spacing, HRZ Mid North (Tarlee), South Australia

Aim

To determine optimum sowing dates, sowing densities and row spacings for maximising yield of new faba bean varieties.

Treatments

Varieties:	Nura, Farah, Fiord, 974*(611*974)/15-1 (abbreviated in text to 974*)
Sowing dates:	3 May (Early), 27 May (Mid)
Densities:	16, 24 and 32 plants/m^2
Row Spacing:	Narrow = 22.5cm (9 inch), Wide = 45cm (18 inch)
Fertiliser:	Map + Zn @ 90kg/ha at sowing

Results and Interpretation

Sowing date and row spacing had significant effects on grain yield of the four faba bean varieties (see Table B5.1). Farah and Fiord showed no difference in yield between sowing dates, while 974* and Nura showed yield improvements of 14% and 78% from delayed sowing. This is in contrast to previous seasons results, and is due to a combination of the favourable season and the onset of disease.

Narrow row spacing (22.5cm) was consistently higher yielding than at double width (45cm). The taller and bulkier variety 974* displayed the highest yield loss (22%) from wider row sowing, compared to 14-17% in the other varieties.

Ascochyta blight (AB) infection was rated at only low to moderate severity in 2010, compared to high severity in 2009, due to the drier start to the season. Sowing date plus variety, and sowing date plus plant density interactions for ascochyta severity were observed (Tables B5.2 and B5.3). Ascochyta blight infection was similar at both sowing dates for Farah and 974*, while Fiord and Nura showed increased severity at the early sowing date (Table B5.2). Fiord had the highest level of infection at both sowing dates. 974* had the least AB infection at the early sowing date, but only similar to Farah and Nura at the late sowing date. Ascochyta blight infection was increased by sowing early at the highest density (Table B5.3), while all other treatments were similar.

Lodging of faba beans at this site was influenced by plant density and a sowing date x row spacing interaction in 2010 (see Tables B5.4 and B5.5). Lodging was increased at the two higher plant densities (24 and 32 plants/m2) (Table B5.4). Lodging was greater for early sown beans, particularly at the wider row spacing in the taller varieties, Farah and 974* (Table B5.5). Nura was the only variety that showed a row spacing effect on lodging when sown late, which was higher at the wider row spacing.

Table B5.1. Effect of sowing date and row spacing on grain yield (t/ha) of four faba bean varieties, Tarlee 2010.

Variety	Sowing Date		Row Spacing	
	3 May	27 May	22.5cm	45cm
Farah	3.8	4.1	4.3	3.6
Fiord	3.3	3.7	3.7	3.2
Nura	2.3	4.1	3.5	2.9
974*(611*974)/15-1	3.7	4.2	4.5	3.5
LSD (P<0.05)	0.46 (0.21 same TOS)		0.25 (0.21 same spacing)	

Table B5.2. Effect of sowing date on ascochyta infection (% plant infected) of four faba bean varieties, Tarlee 2010.

Variety	3 May	27 May
Farah	3.5	1.9
Fiord	13.7	8.3
Nura	4.4	2.2
974*(611*974)/15-1	1.6	0.9
LSD (P<0.05)	1.6 (1.7 same TOS)	

Table B5.3. Effect of sowing date and plant density on ascochyta infection (% plant infected) of faba bean, Tarlee 2010

Plant Density (#/m2)	**Ascochyta Blight (% infected)**	
	3 May	**27 May**
16	4.2	3.4
24	5.0	3.3
32	8.2	3.3
LSD (P<0.05)	1.9 (2.3 same TOS)	

Table B5.4. Effect of plant density on lodging (1-9 score) of faba bean, Tarlee 2010.

Plant Density (#/m2)	**Lodging (1-9 score)**
16	5.7
24	5.1
32	4.3
LSD (P<0.05)	0.46

Table **B5.5.** Effect of sowing date and row spacing on lodging (1-9 score) of four faba bean varieties, Tarlee 2010.

Sowing Date:	**3 May**		**27 May**	
Row Spacing:	**22.5cm**	**45cm**	**22.5cm**	**45cm**
Farah	4.6	3	4.8	4.1
Fiord	4.3	4.2	6	5.9
Nura	4.1	4.7	7.1	5.0
974*	4.9	3.6	7.7	6.9
LSD (P<0.05)	1.11 (1.09 same TOS)			

Key Findings and Comments

- Winter and spring seasonal conditions favoured faba bean production in 2010, and as a consequence plants were able to maximise pod fill so that the highest sowing density yielded highest.
- Yield was generally maximised at the later sowing date except Farah and Fiord, which showed no difference in yield at either sowing date.
- Increasing plant density increased ascochyta blight infection, likely resulting from increased canopy humidity.
- Fiord and Nura showed increased ascochyta blight infection when sown early, consistent with other recent findings.
- Lodging was worse for thicker sown and earlier sown beans, particularly at wider row spacings in 974* and Farah due to their bulkier canopies.

B6. Sowing Date x Plant Density, HRZ South East (Moyhall), South Australia

Aim

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

Treatments

Varieties:	Nura, Farah, Fiord, 974*(611*974)/15-1 (abbreviated in text to 974*)
Sowing dates:	14 May (Early), 3 June (Late)
Densities:	16, 24 and 32 plants/m^2
Fertiliser:	Map + Zn @ 100kg/ha at sowing

Results and Interpretation

Plant density had a significant effect on grain yield and plant height for all varieties at Moyhall in 2010 (see Table B6.1). Compared to a recommended sowing density of 24 plants/m^2, a 10% yield gain was observed by increasing sowing density to 32 plants/m^2, while reducing plant density to 16 plants/m2 brought about a 9% yield penalty. This is a result of the favourable winter and spring conditions in 2010, so that plants were able to fill all grain and pods set even at the higher density.

Sowing date had a significant effect on yield, lodging and plant height for all bean varieties (see Table B6.2). All varieties except Farah showed a yield penalty from delayed sowing, with Fiord showing the largest yield reduction at 42%. This is likely due to its early maturity, so that it was unable capitalise on the late spring and early summer rains.

All varieties displayed increased lodging when sown early. Farah was the most susceptible to lodging sown early, and Fiord the least. At the later sowing date Farah scored no differently to 974*, while Fiord and Nura scored similarly, and highest.

Table B6.1. effect of plant density on grain yield (t/ha), plant height and bottom pod height (cm) of faba bean, Moyhall 2010.

Plant Density	Yield (t/ha)	Plant Height (cm)
16 plants/m^2	4.43	106.5
24	4.87	110.6
32	5.36	111.7
LSD (P<0.05)	**0.20**	**4.2**

Table B6.2. effect of sowing date on grain yield (t/ha), lodging (1-9 score) and plant height (cm) of four faba bean varieties, Moyhall 2010.

TOS	Yield (t/ha)		Lodging (1-9 score)		Plant Height (cm)	
	Early	Late	Early	Late	Early	Late
974*(611*974)/15-1	5.60	4.98	7.11	8.00	137.8	110.0
Farah	5.08	4.71	4.78	7.33	142.2	101.1
Fiord	5.31	3.06	8.11	8.67	112.2	72.2
Nura	5.58	4.78	6.67	8.78	117.8	83.3
LSD (P<0.05)	**0.53 (0.33 same TOS)**		**0.67 (0.76 same TOS)**		**6.1 (6.8 same TOS)**	

Key Findings and Comments

- Winter and spring seasonal conditions favoured faba bean production in 2010, and as a consequence plants were able to maximise pod fill so that the highest sowing density yielded highest.
- Yield was maximised at the early sowing date by all varieties except Farah, whose later maturity meant it could capitalise on the rains in late spring and into summer.
- Fiord showed a relatively high yield penalty from delayed sowing in a favourable season, most likely due to its early maturity so that it could not make the most of the favourable season finish.
- Lodging was worse for earlier sown beans, particularly Farah, as observed at Conmurra this year.

- Farah showed the largest reduction in plant height by delayed sowing, which may be linked to its similar yields at both sowing dates.

B7. Sowing Date, HRZ South East (Conmurra), South Australia

Aim

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

Treatments

Varieties: Nura, Farah, Aquadulce, Aquadulce_Gilb (grower selection), 974*(611*974)/15-1 (abbreviated in text to 974*), PBA Kareema

Sowing dates: 19 May (Early), 15 June (Late)

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

Results and Interpretation

Early sowing was important for maximising faba bean yield at Conmurra in 2010, showing up to 14 percent yield loss by delayed sowing in the most sensitive varieties (Aquadulce, Aquadulce_Gilb, see Table B7.1). Nura and PBA Kareema showed no yield loss from delayed sowing. Aquadulce yielded 27% higher than PBA Kareema, while all other varieties performed similarly.

Lodging of faba beans was exacerbated by early sowing (Table B7.1). Nura and Farah were the worst affected, whilst Aquadulce_Gilb and 974* were least affected.

Disease infection at Conmurra in 2010 was not as severe as in previous years, with Ascochyta ranking only low-moderate severity. Ascochyta infection of early sown beans was more than three times higher than late sown beans, while there was no difference between varieties.

Table B7.1. Effect of sowing date on grain yield (t/ha) and lodging (1-9 score) of six faba bean varieties, Conmurra 2010.

TOS	Yield (t/ha)		Lodging (1-9 score)	
	Early	**Late**	**Early**	**Late**
974*(611*974)/15-1	6.43	5.90	8.5	9.0
Aquadulce	7.18	6.19	7.7	8.8
Aquadulce_Gilb	6.62	5.83	8.5	8.7
Farah	6.95	6.51	5.3	8.3
Nura	6.64	6.84	4.8	8.3
PBA Kareema	5.65	5.66	7.8	8.7
LSD (P<0.05)	**1.40 (0.55 same TOS)**		**0.83 (0.90 same TOS)**	

Table B7.2. Effect of sowing date on ascochyta severity (% infected) of faba beans, Conmurra 2010.

TOS	Early	Late	LSD (P<0.05)
Asco Severity (% infected)	5.7	1.6	0.98

Key Findings and Comments

- Winter and spring seasonal conditions favoured faba bean production in 2010.
- Yield was generally maximised at the early sowing date.
- Lodging was worse for earlier sown beans, particularly Farah and Nura.
- While early sown beans had higher ascochyta blight infection than late sown beans, there was no difference in severity between bean varieties.
- Chocolate spot severity was low at this site in 2010, and there was no difference between varieties or sowing dates.

B8. Growth Regulant trial, South East (Conmurra), South Australia

Aim

To determine growth regulants can be used to modify canopy architecture of bean.

Treatments

Varieties:	Nura, Farah, Aquadulce, Aquadulce_Gilb (grower selection), 974*(611*974)/15-1 (abbreviated in text to 974*)
Chemicals:	Cycocel (2L/ha) Glyphosate (100ml/ha) Tebuconazole (500ml/ha)
Timings:	Single – at 25cm crop height Double – at 25cm crop height, plus 14 days later Triple - 25cm crop height, plus 14 and 28 days later (Cycocel only)
Sowing Date:	15th June
Fertiliser:	Map + Zn @ 100kg/ha at sowing

Results and Interpretation

Grain yield were high and plant canopies were large in 2010, however none of the three chemicals and seven treatments achieved a significant reduction in height or grain yield difference at the rates tested (Table B8.1).

Table B8.1. Effect of various growth regulant chemistries and timings on plant height and yield of faba bean, Conmurra 2010.

Treatment	Plant Height (cm)	Yield (t/ha)
Nil	140.6	6.6
Cycocel x1	137.8	7.1
Cycocel x2	142.2	6.3
Cycocel x3	137.3	6.7
Glyphosate x1	144.5	6.0
Glyphosate x2	141.0	6.3
Tebuconazole x1	139.7	6.1
Tebuconazole x2	138.2	6.3
LSD (P<0.05)	NS	NS

Key Findings and Comments

Penetration of fungicides into large bean canopies can present a problem, particularly in higher rainfall areas, where canopies are larger and incidence of disease is higher. Manipulation of bean canopies through reducing height and density would allow much easier fungicide application, efficacy and perhaps even reduce disease intensity in itself. This pilot study showed that none of these chemicals tested showed a significant reduction in plant height when applied at the dosage rates tested. Further study could examine higher rates or alternative chemicals to test whether growth regulants can be employed for disease control and improved harvestability of faba bean.

LUPINS

U1. Lupin Sowing Date x Row Spacing, Lower Eyre Peninsula (Wanilla), South Australia

Aim

To determine optimum sowing dates and row spacings for maximising yield of new lupin varieties. In the higher rainfall area lupins have a reputation for producing large bulky growth that isn't being realised in grain yield. The selection of cultivar, time of sowing and row spacing are being evaluated as methods to maximise lupin yield.

Treatments

Varieties:	Mandelup, Jenabillup, Jindalee, WALAN2289
Sowing dates:	29 April (Early), 18 May (Mid), 14 June (Late)
Row Spacing:	Narrow = 24cm (10 inch), Wide = 48cm (20 inch)
Fertiliser:	Map + Zn @ 100kg/ha at sowing

Results and Interpretation

The three times of sowing were all sown into adequate moisture for germination to occur. Emergence counts showed no differences in the establishment of each cultivar and row spacing treatment.

Seasonal conditions were mostly very favourable for lupin growth throughout the 2010 growing season at Wanilla. 380mm of growing season rainfall fell, with conditions almost reaching the point of water logging at the end of August and early September. Temperatures throughout the flowering period were quite mild. This meant that moisture and heat stress were not yield limiting factors.

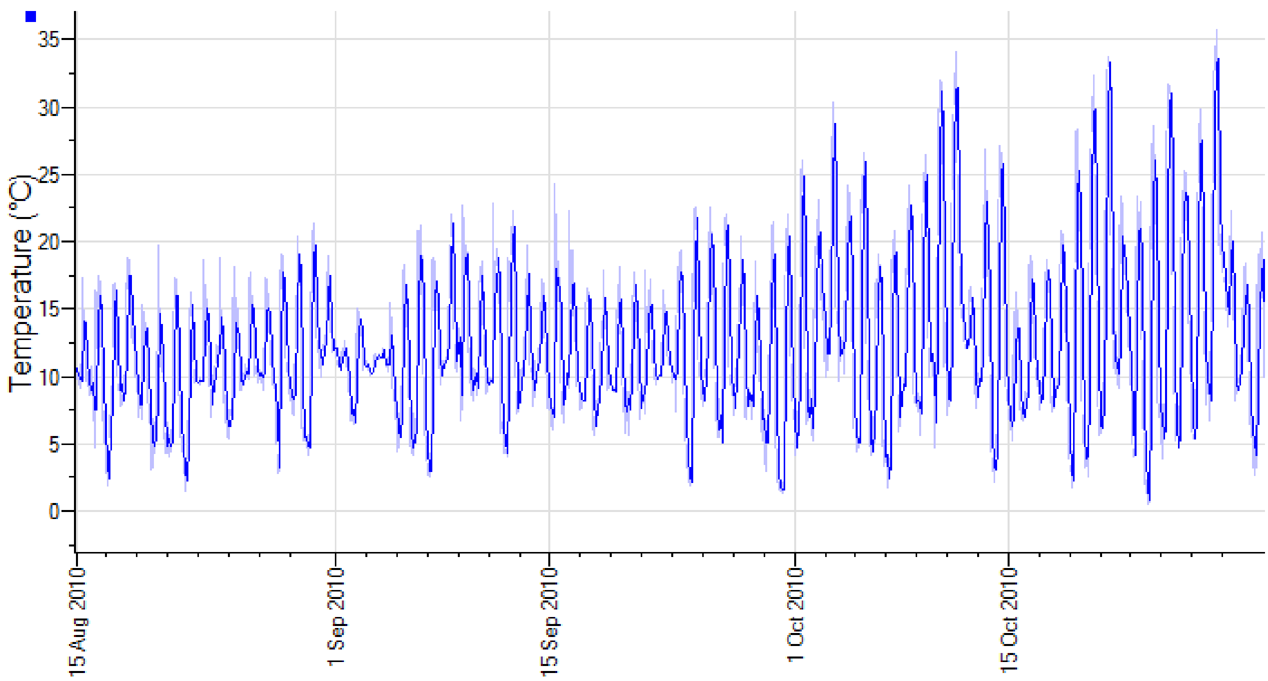

Figure U1.1. Temperature at flowering height, Wanilla, 2010

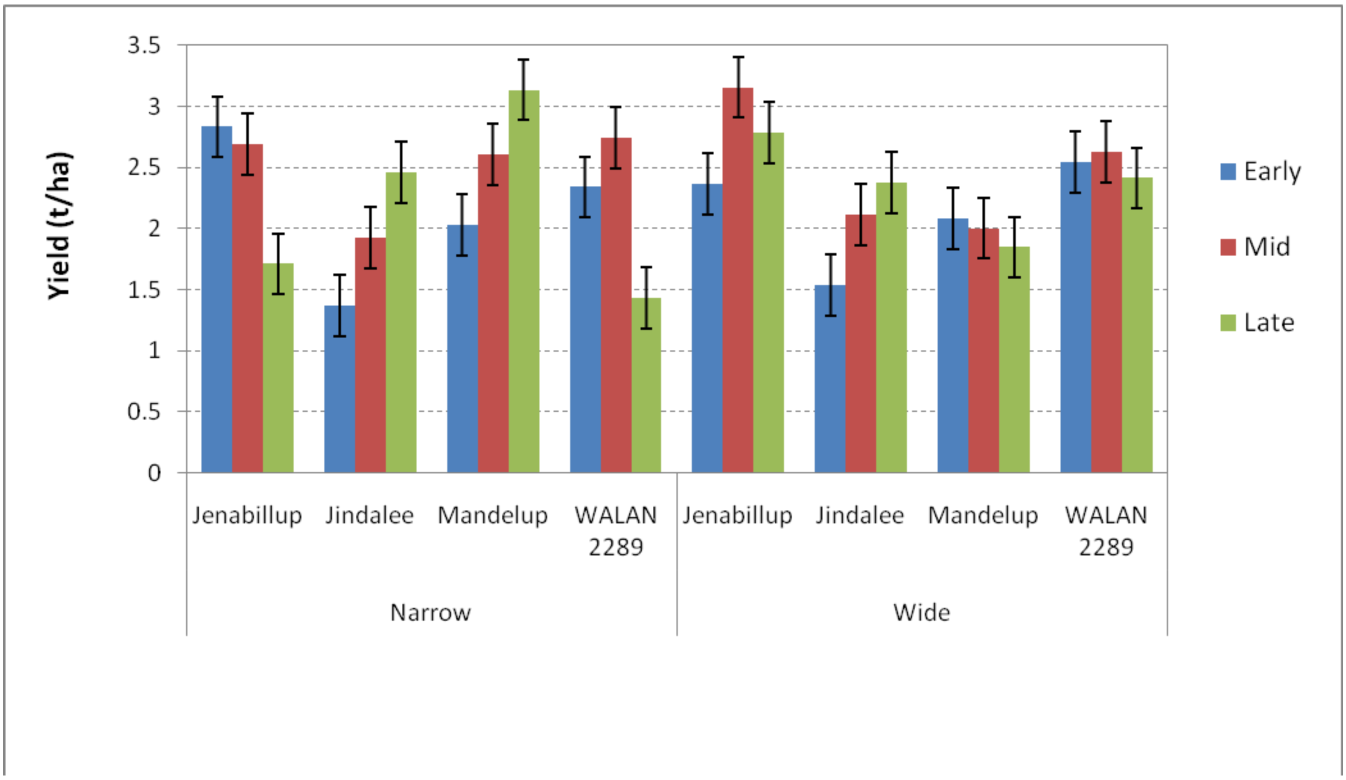

Figure U1.2. Grain Yields Wanilla TOS/ Row Spacing Lupin Trial 2010

The yield response to both row spacing and time of sowing was different for all varieties (Figure U1.2). In general terms no one sowing time produced a consistently higher yield than any other. There were no significant differences between row spacing treatments across all varieties.

The narrow row treatments of Jenabillup and WALAN2289 showed a yield penalty at the later sowing date which was not evident at the wide row treatment. Jenabillup, while flowering only slightly later than Mandelup, does take longer to mature and usually favours sites with extended growing seasons, which helps to explain this result.

Mandelup had the earliest flowering times and was relatively quick to mature. The early sowing time produced a tremendous amount of growth, which wasn't realised in grain yield. The later sowing times produced much less biomass but exceptional grain yields, especially at the narrow row spacing. Mandelup showed yield improvements with each sowing delay at the narrow row spacing, while there was no sowing date response at wide row spacing.

The later flowering Jindalee produced a surprising result. It would be thought that early sowing times would favour Jindalee, however this trial showed the converse with later sowing producing equal or highest yields. Jinderlee showed no row spacing response for any sowing date.

The potential Mandelup replacement breeding line, WALAN2289, produced its highest yields at the middle sowing date.

The different row spacing treatments on individual varieties proved inconclusive and needs further investigation.

Key Findings and Comments

This trial demonstrates that the varieties trialed have the potential to react differently to sowing time and row spacing in the higher rainfall environment and in the favourable growing season of 2010. The development of specifically tailored management packages designed to maximise yield of each variety will be developed with the continuation of this trial over the coming years.

U2. Lupin Herbicide Tolerance, Wanilla (Lower Eyre Peninsula), Tooligie (Upper Eyre Peninsula, South Australia

Aim

To determine the crop safety of applying metribuzin herbicide to commercial lupin varieties.

Wild Radish (*Raphanus raphanistrum*) is increasingly becoming a significant weed in the lupin growing areas of eastern Australia. Metribuzin (in combination with diflufenican) is registered for post-emergent control of Wild Radish in WA. These trials aim to build a case towards obtaining a permit its use in the eastern states.

Treatments

Sites:	Wanilla (high rainfall Lower Eyre Peninsula)
	Tooligie (low-medium rainfall Upper Eyre Peninsula)
Varieties:	Coromup, Jenabillup, Jindalee, Mandelup, Wonga,
Sowing Date:	Wanilla = 18 May 2010
	Tooligie = 25 May 2010
Treatments:	Control: Nil herbicides
	Treat 1: Low Metribuzin (100g/ha)
	Treat 2: High Metribuzin (200g/ha)
	Treat 3: Low Metribuzin (100g/ha) plus Diflufenican (100ml/ha)
	Treat 4: High Metribuzin (200g/ha) plus Diflufenican (100ml/ha)
Treatment dates	Wanilla = 28 August 2010
	Tooligie = 28 August 2010
Fertiliser:	Map + Zn @ 100kg/ha at sowing

Results and Interpretation

Table U2.1. Effect of various herbicide treatment combinations on grain yield (% of control) of lupin varieties at Wanilla, Lower Eyre Peninsula 2010.

Wanilla	Mandelup	Wonga	Jenablliup	Jindalee	Corromup
Treat 1 (% Control)	101%	93%	98%	90%	91%
Treat 2 (% Control)	101%	89%	98%	92%	100%
Treat 3 (% Control)	94%	88%	84%	87%	80%
Treat 4 (% Control)	93%	92%	94%	86%	85%
Contol (t/ha)	1.00	1.00	1.00	1.00	1.00
lsd 0.05%	ns	ns	ns	ns	ns
CV = 12.87					

Table U2.2: Effect of various herbicide treatment combinations on grain yield (% of control) of lupin varieties at Tooligie, Lower Eyre Peninsula 2010.

Tooligie	Mandelup	Wonga	Jenablliup	Jindalee	Corromup
Treat 1 (% Control)	91%	87%	91%	102%	94%
Treat 2 (% Control)	91%	91%	87%	106%	93%
Treat 3 (% Control)	88%	82%	79%	105%	90%
Treat 4 (% Control)	94%	85%	87%	100%	96%
Contol (t/ha)	3.96	3.65	3.94	3.20	3.60
lsd 0.05%	9%	9%	9%	ns	9%
CV = 6.13					

Herbicide treatments were applied later than originally planned due to a string of wet and windy days throughout August.

All varieties were noticeably affected from the various herbicide applications, but there was no visual difference between varieties.

A cool, wet finish to the year is thought to have reduced the effect of the herbicide damage, producing non significant results at Wanilla. The varieties Wonga and Jenabillup both showed the most yield loss due to the application of metribuzin at Toolige (Table U2.2). West Australian data shows that Jenabillup is not resistant to metribuzin and is not recommended for treatment with this herbicide. Mandelup, Coromup and Jindalee showed no significant yield loss at either site. Treatments spiked with diflufenican yielded similarly to metribuzin alone.

Key Findings and Comments

Metribuzin did demonstrate good crop safety on several varieties in 2010, which indicates it may be relatively safe for the late control of wild radish in some lupin varieties. However, 2010 was an incredibilly ‘soft’ finish which allowed plants to make unchecked compensatetory growth after the herbicide was applied.

These trials will be repeated in 2011.