# Southern PULSE Agronomy

# 2011 Results Summary

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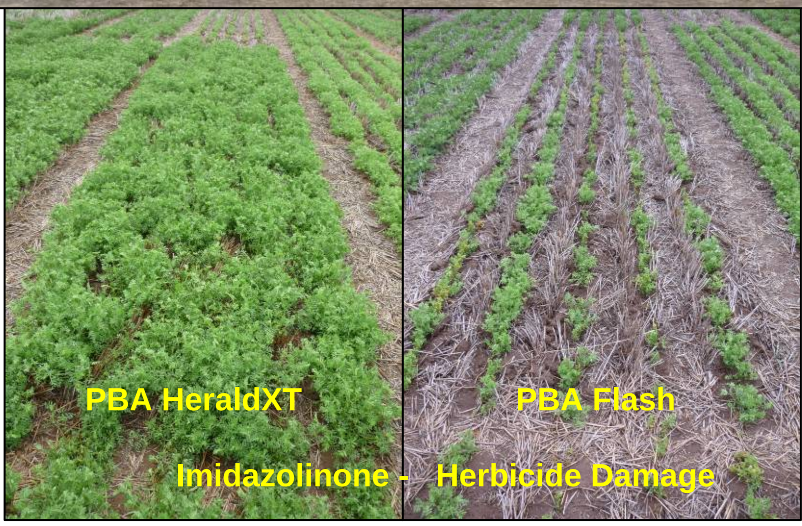


**Results from the DPIVic, SARDI, NSW DPI and GRDC funded project: 'Expanding the Use of Pulses in South-Eastern Australia (DAV00113)'.**

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# INTRODUCTION

The 2011 Southern Pulse Agronomy Program had 40 trials across south-eastern Australia at 18 sites addressing key management issues associated with the 5 pulse crops, lentil, field pea, chickpea, faba bean and lupin. Growing season rainfall was generally below average at all trial sites. However, extreme summer rainfall meant that the soil profiles at all sites were close to field capacity at sowing in 2011.

Field Days were held at Curyo (southern Mallee) and Rupanyup (Wimmera) sites, Victoria and Arthurton (Yorke Peninsula), SA. Visits from local Ag Bureau groups (Owen and Mallala) were also conducted at the Pinery Pulse Agronomy site in South Australia. At each of the field days, key industry production and marketing issues were highlighted and new varieties released as appropriate from Pulse Breeding Australia. In total, five new varieties were released in 2011 - one lentil, PBA HeraldXT; two field peas, PBA Oura and PBA Percy; one faba bean, PBA Rana and one chickpea, Kalkee. 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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Wayne Hawthorne and Trevor Bray, Pulse Australia.
We are grateful for the support we receive from the numerous commercial agronomists and seed commercialising companies.

<u>Biometrics</u>

| | |
|---|---|
| Jennifer Smith | Plain Statistics, Horsham |

<u>Financial Support (Project code - DAV00113)</u>

| | |
|---|---|
| Industry | Grains Research and Development Corporation |
| Government | Department of Primary Industries, Victoria |
| | South Australia Research and Development Institute |
| | New South Wales Department of Primary Industries |


**Co-operators**

| | |
|---|---|
| Curyo, Vic | Peter & Brenda Doran |
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| Lake Bolac, Vic | Southern Farming Systems |
| Cowra, NSW | NSW DPI, Cowra Research and Advisory Station |
| Yenda, NSW | Nick & Kym Eckermann |
| Wagga Wagga, NSW | NSW DPI, Wagga Agricultural Research Institute, |
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| Arthurton, YP, SA | Andrew Knight |
| Balaklava, MN, SA | Grant Macfarlane |
| Tarlee, MN, SA | Pat Connel |
| Melton, YP, SA | Neil Harrop |
| Hart, MN, SA | Matt Dare (c/- Hart Field Site) |
| Turretfield, MN, SA | Government of South Australia |
| Minnipa, EP, SA | Government of South Australia |
| Conmurra, SE, SA | Locky Seears |
| Moyhall, SE, SA | Jack Kay |

# RESEARCH HIGHLIGHTS

- LENTILS
  - Crop Topping – No response to crop-topping at the Recommended timing was noted in Victoria and only one variety (CIPAL0607) showed reduced yield in SA in 2011. Long term, Nugget has the highest average yield loss from crop-topping at Recommended timings. PBA Blitz, the earliest maturing variety, shows the least yield loss from crop-topping, and is therefore considered better suited to this practice. PBA Jumbo has also shown to be better suited to crop-topping that Nugget.
  - Group B Herbicide Tolerance - Trials demonstrated the improvements in tolerance of the new varieties, PBAHeraldXT, CIPAL1101 and CIPAL1102 compared with intolerant commercial variety, PBAFlash. None of the Imi treatments resulted in a significant grain yield loss for the tolerant varieties, despite some minor to moderate visual symptoms of crop damage being observed (eg Imi mix at the higher application rate). In addition, the improved Imi tolerance results in improved tolerance to most sulfonylureas and triazolopyrimides assessed in these trials.
  - Sowing Dates – Earlier sowing was important to maximising grain yield in lentils in the 2011 season across all regions. Generally the mid maturing variety CIPAL0803 was highest or equal highest yielding at all sites. Grain yields were greater than 2t/ha in the drier regions and up to 4.5 t/ha in the medium rainfall, key lentil production zones.
  - Stubble –Residue, both standing and slashed, was again important to maximising grain yield in lentils in 2011. Yield gains of 15-20% compared with burnt stubble were recorded in both Vic and SA, along with delayed maturity. Similar to 2010, in SA PBA Blitz was the most responsive variety. Another early maturing genotype CIPAL0901 was mast responsive in Vic.

- CHICKPEAS
  - Sowing Dates - Early sowing was generally beneficial and maximised yield potential, however responses were not as great as seen in previous seasons.
  - Crop Topping - Some varieties in 2011 did not show yield loss from crop-topping at the Recommended timing, similar previous seasons. Generally earliest maturating lines showed less yield loss, and latest maturing lines showed the highest yield losses. Despite these findings, chickpea are still poorly suited to this practice due to their unacceptably high yield losses compared to other pulse crops at the ideal timing for ryegrass control and this practice is not recommended.
  - Fertiliser toxicity - Both desi and kabuli chickpea varieties suffered severe plant establishment reductions from fertiliser placement with the seed and with increasing fertiliser rates
  - Disease Management - Under higher disease pressure it is still economically beneficial to actively manage ascochyta blight through regular fungicide application even in moderately resistant varieties.

- FIELD PEAS
  - Sowing Dates – Generally, early sowing was highest or equal highest yielding in 2011. It is also important to note that blackspot levels were generally low, so fungicide applications were commonly not economic, except the HRZ southern site. It will be important to sow the new forage peas (eg OZP0902) early to maximise biomass production.
  - Stubble – In SA, differences in plant height and lodging were observed throughout the season which may aid harvestability, particularly in shorter seasons with less biomass, however there were no yield differences in 2011. Retaining anchored standing cereal stubble throughout the year field peas are grown is also seen as having benefits in reducing damage from wind erosion in regions characterised by light textured soils.

- Crop Topping – Research continued to support longer tern findings that later maturing varieties are not as well suited to crop-topping as recent earlier maturing releases by abortion of uppermost (immature) pods. Preliminary results from the 2011 trials have shown that mould in pea samples may be associated with plant maturity at timing of crop-topping. This finding may have implications when crop-topping paddocks which may have varying levels of crop maturity due to variable soil types.

- FABA BEANS
  - Row Spacing – In SA, increasing row spacing from 22.5cm (9 inch) to 45cm (18 inch) has resulted in consistent yield losses over the last three years, from 10% average across all varieties in 2009 to 20% in 2011. However it must be noted that wider row spacings form part of a farming systems package that may generate other benefits.
  - Stubble - Grain yield in the standing stubble trial at Rupanyup averaged 20% more than the burnt stubble trial.
  - Disease Management - Disease, predominately rust at one site (Rupanyup) resulted in grain yield losses of >20%. Disease was worse in burnt stubble treatments. While there were varieties with less susceptibility to the disease present, it did not confer a grain yield advantage in the unsprayed treatment.

- LUPINS
  - Herbicides - Varietal differences in tolerance to post emergent metribuzin were recorded. It is likely that the response from PE use of metribuzin in lupins is similar to the response observed in lentils, and hinges on the climatic conditions around the time of application.

# Southern Pulse Agronomy Trials Sown in 2011

| Experiment ID | Page | Rainfall Zone[1] Region (Location), State | Treatments (No. of treatments) | Varieties |
|---|---|---|---|---|
| ***LENTIL*** | | | | |
| L1 | 19 | MRZ Mid North (Mallala), SA | Sowing Date (3)<br>Stubble (3) | 8 |
| L2 | 24 | MRZ Yorke Peninsula (Paskerville), SA | Sowing Date (2)<br>Disease Management (4) | 8 |
| L3 | 26 | MRZ Yorke Peninsula (Arthurton & Mallala), SA | Herbicide Tolerance (14) | 4 |
| L4 | 29 | MRZ Yorke Peninsula (Melton), SA | Crop Topping (4) | 14 |
| L5 | 32 | H-MRZ (Wagga Wagga), NSW | Sowing Date (2) | 8 |
| L6 | 34 | LRZ (Yenda), NSW | Sowing Date (2) | 8 |
| L7 | 36 | LRZ Southern Mallee (Curyo), Vic | Sowing Date (3)<br>Variety Mixes (4) | 12 |
| L8 | 38 | LRZ Southern Mallee (Curyo), Vic | Crop Topping (4) | 10 |
| L9 | 40 | LRZ Southern Mallee (Curyo), Vic | Herbicide Tolerance (14) | 4 |
| L10 | 43 | MRZ Wimmera (Rupanyup), Vic | Herbicide Tolerance (14) | 4 |
| L11 | 46 | MRZ Wimmera (Rupanyup), Vic | Crop Topping (4) | 12 |
| L12 | 47 | MRZ Wimmera (Rupanyup), Vic | Sowing Date (3)<br>Disease Management (2)<br>Variety Mixes (4) | 12 |
| L13 | 50 | MRZ Wimmera (Rupanyup), Vic | Variety Mixes (4)<br>Varieties (Burnt Stubble) | 12 |
| ***CHICKPEA*** | | | | |
| C1 | 51 | MRZ Yorke Peninsula (Arthurton), SA | Sowing Date (2)<br>Disease Management (4) | 6 |
| C2 | 53 | MRZ Yorke Peninsula (Melton), SA | Crop Topping (4) | 14 |
| C3 | 56 | H-MRZ (Wagga Wagga), NSW | Sowing Date (2)<br>Plant Population (3) | 6 |
| C4 | 59 | LRZ (Yenda), NSW | Sowing Date (2)<br>Plant Population (3) | 6 |
| C5 | 61 | LRZ (Yenda), NSW | P Fertiliser rate (4)<br>Fertiliser placement (2) | 2 |
| C6 | 65 | LRZ Southern Mallee (Curyo), Vic | Sowing Date (3) | 8 |
| C7 | 67 | MRZ Wimmera (Rupanyup), Vic | Row Spacing (2)<br>Disease Management (4)<br>Stubble (2) | 8 |

| Experiment ID | Page | Rainfall Zone[1] Region (Location), State | Treatments (No. of treatments) | Varieties |
|---|---|---|---|---|
| ***FIELD PEA*** | | | | |
| F1 | 71 | MRZ Mid North, (Hart), SA | Sowing Date (2)<br>Fungicide (2) | 8 |
| F2 | 73 | LRZ Upper Eyre Peninsula, (Minnipa), SA | Sowing Date (2)<br>Stubble (2) | 6 |
| F3 | 75 | MRZ Mid North, (Balaklava), SA | Crop Topping (4) | 14 |
| F4 | 78 | H-MRZ (Wagga Wagga), NSW | Sowing Date (2)<br>Fungicide regimes (2) | 8 |
| F5 | 80 | LRZ (Yenda), NSW | Sowing Date (2)<br>Fungicide regimes (2) | 8 |
| F6 | 82 | LRZ Southern Mallee (Curyo), Vic | Sowing Date (3)<br>Variety Mixes (2) | 10 |
| F7 | 84 | LRZ Southern Mallee (Curyo), Vic | Crop Topping (4) | 10 |
| F8 | 85 | MRZ Wimmera (Rupanyup), Vic | Sowing Date (3)<br>Variety Mixes (2) | 10 |
| P9 | 88 | HRZ Southern (Lake Bolac), Vic | Sowing Date (3)<br>Crop Topping (2)<br>Fungicide Regimes (2)<br>Stubble (2) | 4 |
| ***FABA BEAN*** | | | | |
| B1 | 90 | HRZ Mid North, (Tarlee), SA | Sowing Date (2)<br>Row Spacing (2) | 4 |
| B2 | 92 | HRZ South East, (Moyhall), SA | Sowing Date (2)<br>Plant Density (3) | 4 |
| B3 | 94 | HRZ South East, (Conmurra), SA | Sowing Date (2) | 6 |
| B4 | 96 | H-MRZ Wagga Wagga, NSW | Sowing Date (2)<br>Fungicide Treatments (3) | 4 |
| B5 | 98 | MRZ Wimmera (Rupanyup), Vic | Row Spacing (2)<br>Disease Management (4)<br>Stubble (2) | 8 |
| B6 | 102 | HRZ Southern (Lake Bolac), Vic | Row Spacing (2)<br>Disease Management (4)<br>Stubble (2) | 4 |
| **LUPIN** | | | | |
| U1 | 105 | MRZ Lower Eyre Peninsula, (Wanilla), SA | Sowing Date (3)<br>Row Spacing (2) | 4 |
| U2 | 107 | MRZ Lower Eyre Peninsula, (Wanilla and Tooligie), SA | Herbicide Tolerance (5) | 5 |
| U3 | 110 | HRZ Southern (Lake Bolac), Vic | Row Spacing (2) | 4 |

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

# Trial Site Locations for the 2011 Southern Pulse Agronomy Trials

# NEW VARIETIES 2011 and VARIETY AGRONOMIC TABLES

The following varieties were released during the 2011 cropping season
Lentils: PBA HeraldXT (previously CIPAL0702)
Field Peas: PBA Oura (OZP0703) and PBA Percy (OZP0901)
Chickpeas: Kalkee (Genesis 115)
Faba Beans: PBA Rana (974*(974)/15-1)
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, 2011

LENTIL

| Name | Ascochyta Blight | | Botrytis Grey Mould | Vigour | Lodging Resistance | Pod Drop | Shattering | Flowering Time | Boron | Salt | Maturity | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Foliage | Seed | | | | | | | | | | |
| **Aldinga** | MR | MS | MS | Mod | S | R | MR | Mid | I | MI | Mid | tall, primary branches |
| **Boomer** | MR | MS | MR | Good | S | MR | MS | Early/Mid | I | I | Mid/Late | tall/bulky |
| **Nipper** | MR | R | R | Poor/Mod | MR | MR | MR | Mid/Late | I | MT | Mid | short/erect |
| **Northfield** | MR | R | S | Poor/Mod | MR | MR | MR | Mid/Late | I | I | Mid | short |
| **Nugget** | MS/MR | MS | MS/MR | Mod | MS | MR | R | Mid | I | I | Mid/Late | semi-erect-branching |
| **PBA Blitz** | MR | MR | R | Mod/Good | MS | MR | MR | Early/Mid | I | I | Early | vigorous/early flowering |
| **PBA Bounty** | MR | MR | MS | Mod | S | MR | MR | Mid/Late | I | MI | Mid | prostrate/many branches |
| **PBA Flash** | MS | MR | MS | Mod | MR | MR | MR | Mid | MI | MI | Early/Mid | erect/high pods/crop topping |
| **PBA Jumbo** | MR | R | MS | Mod | S | MR | MR | Mid | MI | I | Mid | Aldinga type |
| **CIPAL0501** | MR | MR | MR | Mod | MS | MR | MR | Mid | I | I | Mid/Late | Nugget type |
| **CIPAL0607** | | | | | | | | | | | | |
| **PBAHeraldXT** | R | R | MR | Mod | MR | MR | MR | Mid/Late | I | I | Mid/Late | herbicide tolerant |
| **CIPAL0801** | MR | R | MS | Mod/Good | R | R | R | 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 | Good | MS/MR | R | MS/MR | Mid | I | I | Mid | prostrate/bulky/branching |
| **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 | |
| **CIPAL1101** | | | | | | | | | | | | |
| **CIPAL1102** | | | | | | | | | | | | |

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 | |
| **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 |
| **PBA Boundary** | | | | | | | | |
| **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 |
| **CICA1123** | | | | | | | | |
| **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 | |
| ***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/Late | Late | S* | MR | erect |
| **Kalkee** | 45 | 8-9 | Good | Mid/Late | Late | S | MS/MR | |
| **CICA0857** | | | | | | | | |

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 | MR | S |
| **Morgan** | Dun | C | Late | Mid-Late | MR | S | S |
| **Sturt** | White | C | Mid | Mid-Late | S | MR | MS |
| **PBA Gunyah** | Dun | SL | Early/Mid | Early | R | MR | S |
| **PBA Twilight** | Dun | SL | Early | Early | R | MR | S |
| **Alma** | Dun | C | Late | Late | MR | MS | S |
| **Bundi** | White | SL | Early | Early | S | MR | |
| **Dundale** | Dun | C | Early | Mid | MR | MS | |
| **Glenroy** | Dun | C | Late | Late | MR | MS | |
| **Parafield** | Dun | C | Mid/Late | Mid | MR | MS | MR |
| **SW Celine** | White | SL | Early | Very Early | S | MS | |
| **Yarrum** | Dun | SL | Late | Mid | MR | MR | MS |
| **PBA Oura** | Dun | SL | Early | Early | MR | MR | MR |
| **OZP0805** | Dun | SL | Mid-Late | Mid | R | MR | MS |
| **OZP0819** | White | SL | Mid | Mid | MR | MR | MR |
| **PBA Percy** | Dun | C | Early | Mid | MR | MS | R |
| **OZP0902** | White | C | Very Late | Very Late | MR | MS | S |
| **OZP0903** | Dun | SL | Early | Early | MR | MR | MR |
| **PSL4Early** | Dun | SL | Very Early | Very Early | R | MR | S |

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

FABA BEAN

| Name | Maturity | Seed colour | Height | Lodging Resistance | Ascochyta | Chocolate spot | Cercospora | Rust |
|---|---|---|---|---|---|---|---|---|
| **Nura** | Early-Mid | Light brown | Short | MR | MR-R | MS | S | MR |
| **Farah** | Early-Mid | Light brown | Medium | MS | MR-R | S | S | S |
| **Fiord** | Early | Light brown | Short | MS | S | S | S | S |
| **PBA Kareema** | Late | Light brown | Tall | MS | MR-R | MS-MR | S | MR |
| **AF03063** | Early | Light brown | Medium | | MR-R | S | S | S |
| **PBA Rana** | Mid | Light brown | Medium-tall | MR | R | MS-MR | S | MS- |
| **AF03001** | Early | Light brown | Medium | | R | S | S | S |
| **AF03109** | Early-Mid | Light brown | Medium | | MR-R | S | S | S |
| **AF04053** | | | | | | | | |
| **AF05069** | | | | | | | | |
| **AF05073** | Mid | Light brown | Medium | | MR-R | MS-S | S | S |
| **Aquadulce** | Late | Light brown | Tall | MS | MS | MS | S | MS |

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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Jenabillup** | Early | Tall | Med | MR | R | MS | R | R | MR | MR-MS | R | T |
| **Jindalee** | Late | Tall | Med | MR | R | MS | MR | MR | MS | R | R | MI |
| **Mandelup** | V early | Tall | Fast | MS | MR | MR | MS | R | MS | MR | R | T |
| **01A012R-67** | Early | Med | Med | MR | | | | | | | | |
| **Wonga** | Early | Med | Med | MR | MS | R | MS-MR | S | MR | R | S | MS |

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

# CLIMATE

Growing season rainfall was 20-30% below average at all trial sites (examples below). However, extreme summer rainfall (decile 10) meant that the soil profiles at all sites were close to field capacity at sowing in 2011. This meant that there was sufficient moisture to draw on during dryer periods. Temperatures were close to or slightly above average at all sites throughout 2011. The warmer daytime temperatures at some sites promoted rapid growth and high biomass accumulation. A few isolated frost events or major heat events occurred and resulted in yield losses in some pulse crops in various areas.

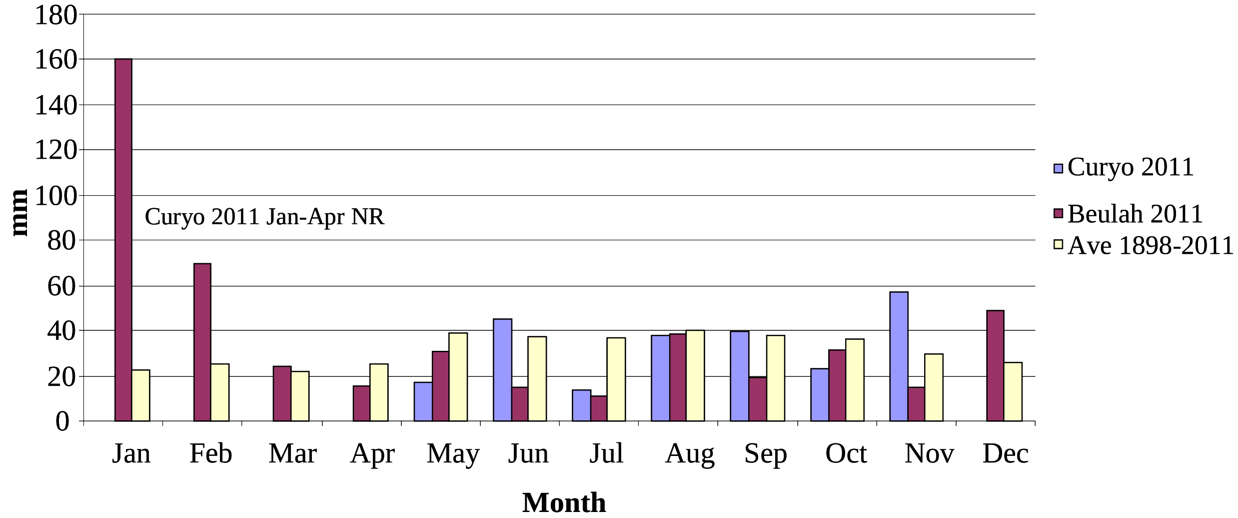


**Figure 1.** Average monthly rainfall at the Curyo trial site (LRZ, Vic) in 2011 compared with the actual and long term average for Beulah.

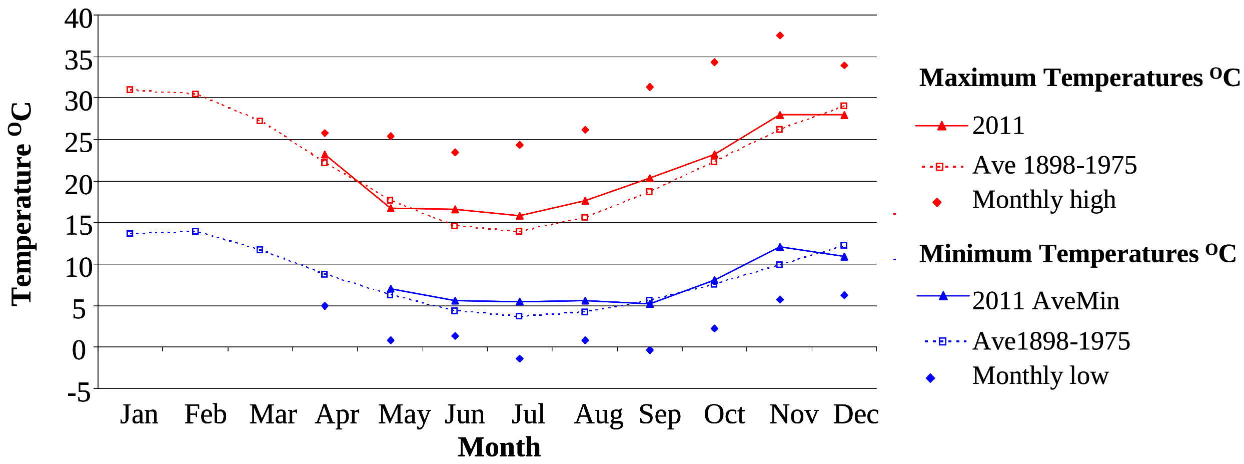


**Figure 2.** Average monthly maximum and minimum temperatures and absolute maximum or minimum at the Curyo trial site (LRZ, Vic) in 2011 compared with the long term average of Beulah.

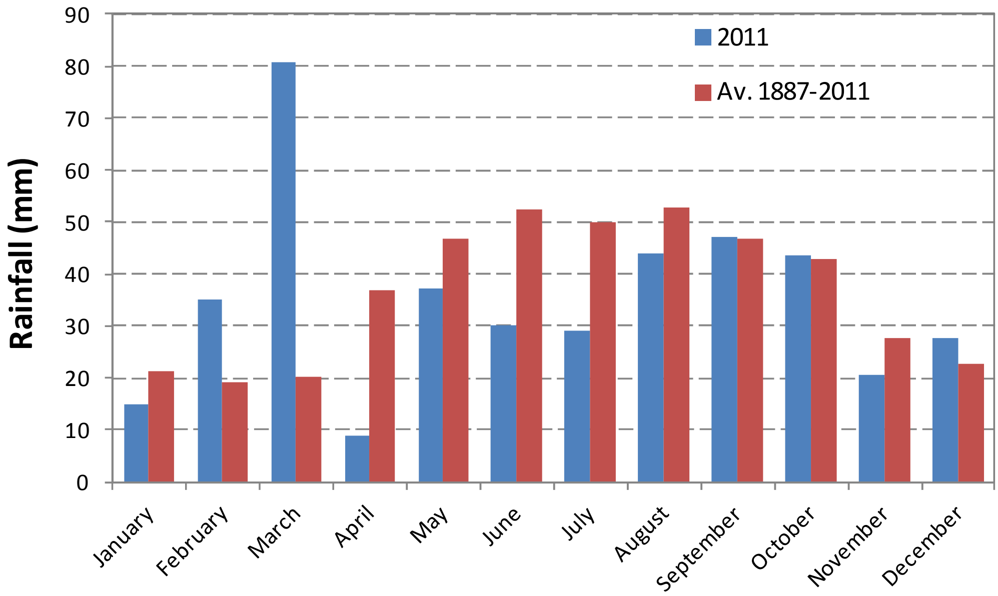


**Figure 3.** Average monthly rainfall at Roseworthy (MHRZ of SA) in 2011 compared with the long term average.

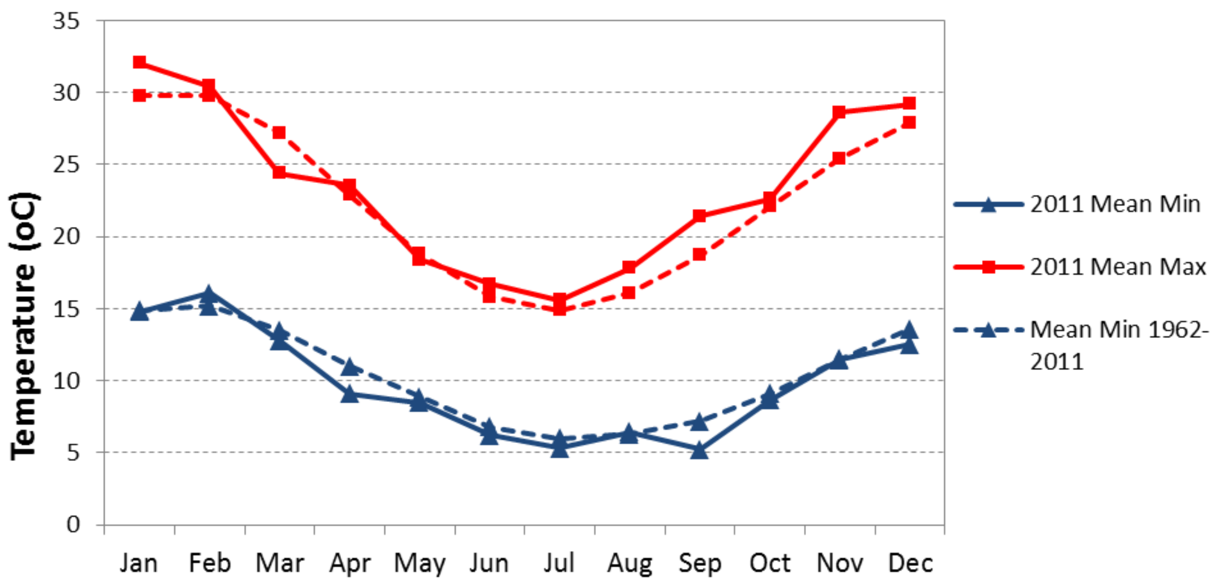


**Figure 4.** Average monthly maximum and minimum temperatures at Roseworthy (MHRZ of SA) in 2011 compared with the long term average (1962-2011).

# TRIAL SUMMARIES

## 1. Lentils

### L1 Sowing Time x Stubble Management, MRZ Mid North (Mallala), South Australia

**Aim**

To investigate the interaction between genotype, sowing date and stubble management on grain yield, disease and agronomic characteristics of lentil in low rainfall modern farming systems of southern Australia.

**Treatments**

| | |
|---|---|
| Varieties: | Boomer, Nipper, Nugget, PBA Blitz, PBA Bounty, PBA Flash, PBA Jumbo and CIPAL0803 |
| Sowing dates: | 6 May (Early), 27 May (Mid), 24 June (Late) |
| Stubble: | 2.2t/ha Barley stubble (30cm high) |
| Treatments: | Removed (cut at ground height and raked bare just prior to sowing)<br>Slashed (cut at ground height to straw on soil surface)<br>Standing (30cm high)<br>All treatments sown inter-row on 9inch (22.5cm) spacings |
| Fertiliser: | MAP + Zn @ 75kg/ha |

**Results and Interpretation**

- Herbicide Damage – Generally low but variable levels of metribuzin damage were observed in lentils due to a combination of dry soil at application and a significant first rainfall event after treatment. Consideration of this factor is required when interpreting results.
  Late season plant mortality scores showed a significant interaction between sowing date and stubble management, and sowing date and variety. Plant mortality was highest at the early sowing date, due to the conditions around the time of application, but was also noted to a lesser extent at the late sowing date (Tables L1.1 and L1.2). At the early sowing date, there was less plant mortality in the Standing stubble than in Removed or Slashed stubble treatments (Table L1.1). There was no significant difference in metribuzin damage between stubble treatments at the mid or late sowing dates.
  Genotypic variation in herbicide damage was also noted, and is presented as a two-way interaction (Sowing Date x Variety) in Table L1.2. Nipper showed greater plant mortality than all other varieties, which showed similar and low levels of mortality. Nipper was the only variety to incur plant mortality at the late sowing date. This variety response is in line with our current understanding of variety sensitivity to metribuzin.
- Disease – winter and spring conditions were not conducive for disease, and there was no disease observed at this site in 2011.
- Lodging – lodging scores taken at maturity showed significant one-way interactions only with sowing date and variety. There was no effect of stubble management on lodging in 2011. Lodging resistance of lentil was improved by delayed sowing (Table L1.3), as is generally noted in previous seasons. Boomer, PBA Jumbo and the advanced breeding line CIPAL0803, followed by PBA Bounty had the highest levels of lodging (Table L1.4). These three varieties have more prostrate growth habits, which make them prone to lodging. Earlier maturing varieties PBA Blitz and PBA Flash had the lowest lodging scores followed by Nipper and Nugget.
- Maturity – maturity scores, taken three weeks prior to harvest, showed a significant interaction between variety and stubble management. Nipper, Nugget and CIPAL0803 showed delayed maturity in retained (Slashed and Standing) stubble treatments compared with Removed stubble (Table L1.5). There was no difference in maturity between Slashed and Standing stubbles in any variety.
- Grain Yield – A complex three way interaction between genotype, sowing date and stubble management occurred for grain yield. Late sown lentils were generally lower yielding than early and mid sown lentils (Figure L1.1).

Standing stubble improved grain yield by an average of 14% compared to the Removed stubble treatment, and up to 36% depending on variety and sowing date (Table L1.6). Grain yield was improved by an average of 8% in Slashed stubble treatments compared to Removed stubble, and up to 34% between varieties.

All varieties except PBA Jumbo and Nipper showed a variable yield response from retained stubble. In some varieties both Standing and Slashed stubble out-performed Removed stubble (eg Late sown PBA Blitz, Late CIPAL803 and Mid PBA Flash) (Figure L1.1). In others only the Standing stubble treatment outyielded the Removed treatment (Late sown Boomer, Early PBA Flash, Mid Nugget). In four further treatments the Standing stubble treatment outyielded both Slashed and Removed stubble plots (Early sown PBA Blitz, Early and Mid PBA Bounty, and Mid CIPAL803, denoted by bold figures in Table L1.6).

CIPAL803, which is an early-mid flowering and mid-late maturing lentil with high early vigour, showed lower grain yield from sowing into standing stubble compared to slashed stubble at the Early sowing date (Figure L1.1).

The early maturing PBA Blitz showed the highest yield advantage from sowing into standing stubble, yielding 28-36% higher at the Late and Early sowing dates, respectively. PBA Blitz also showed a prominent yield advantage from sowing early into Standing stubble in the 2010 trial. There was no effect of stubble on performance of PBA Blitz at the Mid sowing date in 2011.

PBA Flash showed the highest yield response from sowing into slashed stubble, with a 34% yield increase compared to the Removed treatment at the Mid sowing date. PBA Flash also showed high yield increases from sowing into standing stubbles at the Early and Mid sowing dates.

PBA Bounty showed a 19-20% yield advantage from sowing into standing stubbles compared to slashed and removed stubbles at the Early and Mid sowing dates. PBA Bounty is a mid flowering and maturing variety, with a prostrate growth habit. The same trend was seen by PBA Bounty across all sowing dates in 2010.

Nugget showed a varied response to stubble management. There was no effect of stubble management sown early, however Standing stubble showed a significant yield improvement over Removed stubbles at the Mid sowing date. At the Late sowing date Slashed stubble significantly improved yield compared to the Removed treatment, while yield in Standing stubble plots was not quite improved to significant level.

**Table L1.1.** Effect of stubble management on plant mortality score (% thinning) of lentils due to post sowing pre-emergent metribuzin herbicide damage, Pinery 2011.

| Sowing Date | Removed | Slashed | Standing |
|---|---|---|---|
| **6-May** | 5.4 [b] | 7.5 [b] | 2.1 [a] |
| **27-May** | 0 [a] | 0 [a] | 0 [a] |
| **24-Jun** | 1.7 [a] | 0 [a] | 0 [a] |

lsd (P<0.05) SDxStubble = 2.8 (1.9 same SD)

**Table L1.2.** Effect of sowing date on plant mortality score (% thinning) of lentils due to post sowing pre-emergent metribuzin herbicide damage, Pinery 2011.

| Sowing Date | PBA Blitz | Boomer | PBA Bounty | CIPAL803 | PBA Flash | PBA Jumbo | Nipper | Nugget |
|---|---|---|---|---|---|---|---|---|
| **6-May** | 4.4 | 0 | 3.3 | 3.3 | 0 | 5.6 | 22.2 | 1.1 |
| **27-May** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **24-Jun** | 0 | 0 | 0 | 0 | 0 | 0 | 4.4 | 0 |

lsd (P<0.05) SDxVariety = 5.5 Shading denotes significant differences.

**Table L1.3.** Effect of sowing date on lodging (1-9 score) of lentils, Pinery 2011. 1= prostrate, 9= erect.

| Sowing Date | 6 May | 27 May | 24 Jun |
|---|---|---|---|
| Lodging (1-9) | 4.53 [c] | 5.61 [b] | 6.06 [a] |

lsd (P<0.05)SD= 0.35

**Table L1.4.** Mean lodging (1-9 score) of 8 lentil varieties, Pinery 2011. 1= prostrate, 9= erect.

| Variety | PBA Blitz | Boomer | PBA Bounty | CIPAL803 | PBA Flash | PBA Jumbo | Nipper | Nugget |
|---|---|---|---|---|---|---|---|---|
| Lodging (1-9) | 6.70 [a] | 4.07 [g] | 4.89 [d] | 4.04 [g] | 6.85 [a] | 3.85 [g] | 6.63 [ab] | 6.15 [b] |

lsd (P<0.05)Variety = 0.5

**Table L1.5.** Effect of stubble treatment on maturity (1-9 score) of 8 lentil varieties, Pinery 2011. 1= complete senescence, 9= reproductive.

| Variety | PBA Blitz | Boomer | PBA Bounty | CIPAL803 | PBA Flash | PBA Jumbo | Nipper | Nugget |
|---|---|---|---|---|---|---|---|---|
| Removed | 3 [a] | 4 [b] | 3 [a] | 3 [a] | 3 [a] | 3 [a] | 4 [b] | 3 [a] |
| Slashed | 3 [a] | 4 [b] | 3 [a] | 4 [b] | 3 [a] | 4 [b] | 5 [c] | 4 [b] |
| Standing | 3 [a] | 4 [b] | 3 [a] | 4 [b] | 3 [a] | 4 [b] | 5 [c] | 4 [b] |

lsd (P<0.05)Variety x Stubble = 0.5

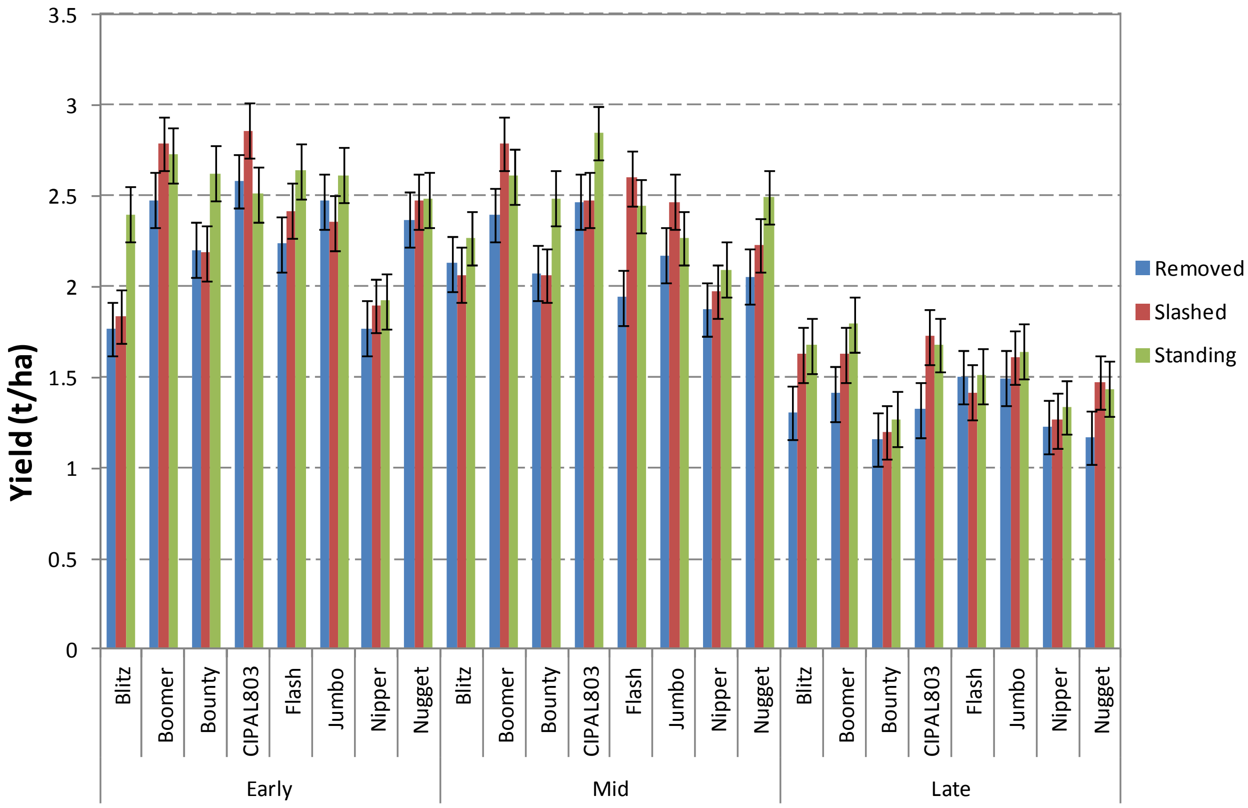


**Figure L1.1.** Effect of sowing date and stubble treatment on grain yield (t/ha) of 8 lentil varieties, Pinery 2011

**Table L1.6.** Effect of sowing date and stubble treatment on grain yield (% of Removed stubble treatment) of 8 lentil varieties, Pinery 2011

| Variety | Sowing Date | Yield | Yield (% of Removed) Slashed | Standing |
|---|---|---|---|---|
| PBA Blitz | Early | 1.77 | 104 | **136** |
| | Mid | 2.13 | 97 | 107 |
| | Late | 1.31 | 124 | 128 |
| Boomer | Early | 2.48 | 112 | 110 |
| | Mid | 2.40 | 116 | 109 |
| | Late | 1.41 | 115 | 127 |
| PBA Bounty | Early | 2.20 | 99 | **119** |
| | Mid | 2.08 | 99 | **120** |
| | Late | 1.16 | 103 | 110 |
| CIPAL803 | Early | 2.58 | 111 | 97 |
| | Mid | 2.47 | 100 | **115** |
| | Late | 1.32 | 131 | 127 |
| PBA Flash | Early | 2.23 | 108 | 118 |
| | Mid | 1.94 | 134 | 126 |
| | Late | 1.50 | 94 | 100 |
| PBA Jumbo | Early | 2.47 | 95 | 106 |
| | Mid | 2.17 | 114 | 104 |
| | Late | 1.49 | 108 | 110 |
| Nipper | Early | 1.77 | 107 | 108 |
| | Mid | 1.88 | 105 | 112 |
| | Late | 1.23 | 103 | 109 |
| Nugget | Early | 2.37 | 104 | 105 |
| | Mid | 2.06 | 108 | 121 |
| | Late | 1.17 | 126 | 123 |

lsd (P<0.05) SD x Variety x Stubble = 0.34 (0.30 same SD x Variety)

Shaded figures denote significant difference to the Recommended stubble treatment

Figures in bold denote significant difference to the Slashed stubble treatment

## Key Findings and Comments

Results must be interpreted with caution due to metribuzin damage in this trial. Damage scores showed varieties performed in line with our current understanding of relative tolerance, and may complicate the interpretation of Nipper (the most sensitive variety to metribuzin) to the imposed treatments.

PBA Jumbo and Nipper showed no response to stubble management, while CIPAL0803 showed a varied response to stubble management at the early sowing date. This is the first season with PBA Jumbo and CIPAL0803 in this trial, and further work is required to understand these findings.

It is difficult to confidently describe differences between stubble treatments however, results show that yields in retained stubble treatments (Standing and Slashed) were equal or higher than the Removed stubble treatment, however genotypes varied in their response.

Retaining stubble (Standing or Slashed) delayed maturity compared to removing stubble, particularly in some later maturing varieties. This is likely due to increased soil moisture retention, as was measured in the 2010 trial. The mulching effect is likely a result of either the stubble itself slowing down evaporation, or the increased biomass (and resulting earlier canopy closure) protecting bare soil from water loss. Although only later maturing varieties showed delayed maturity in 2011 trials, earlier maturing varieties are more likely to benefit most from this delayed maturity by enabling them to capitalise better on late rains.

These results from 2011 provide support to 2010 trial results, where retained stubble increased yield and delayed maturity. Stubble retention improved yields at all sowing dates in 2010, although standing stubble was most important for grain yield at the later sowing date. Boomer showed no difference in grain yield in 2010 but did in 2011, while PBA Blitz was the most responsive variety to stubble retention systems in both 2010 and 2011. This may be due to the stubble conserving soil moisture, and potentially delaying maturity. Blitz has a very erect plant type and is generally late to canopy closure, however upon reaching the reproductive phase it tends to limit vegetative growth and may never reach canopy closure. In this scenario retaining standing stubble in the inter-row may protect bare soil from water loss. Alternatively, this response may be due to delayed maturity in standing stubble plots, enabling better use of late rains.

The mid season, prostrate variety PBA Bounty showed a significant yield response from sowing into standing stubble in both seasons of field testing. Although it was not measured in 2011, PBA Bounty had the greatest increase in plant height from sowing into standing stubble of all varieties tested in 2010. Further work is required to understand why this response is generated.

## L2 Sowing Time x Disease Management, MRZ Yorke Peninsula (Paskeville), South Australia

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

### Aim

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

### Treatments

Varieties: Boomer, Nipper, Northfield, Nugget, PBA Blitz, PBA Bounty, PBA Flash and PBA Jumbo

Sowing dates: 17 May (Early), 14 June (Mid)

Treatments: Nil – no fungicide applied

EarlyAsco – 2L/ha Chlorothalonil early August, flowering, and early podding

NormalAsco – 2L/ha Chlorothalonil during flowering and early podding

Complete - 2L/ha Chlorothalonil at early August, and fortnightly following canopy closure

NOTE: Botrytis Grey Mould completely controlled in all treatments through 500ml/ha Carbendazim at canopy closure, flowering and podding

Fertiliser: MAP + Zn @ 90kg/ha

### Results and Interpretation

- Foliar disease – Low levels of early season ascochyta blight foliar infection did not develop further, and disease was minimal in 2011.
- Grain Yield – Yields were high in 2011 due to favourable growing conditions and minimal disease, averaging 4.2t/ha across all varieties and treatments.
  Early sown (17th May) lentils yielded higher than later (14th June) sown lentils for all varieties except PBA Blitz and PBA Flash which had similar yields at both dates, the earliest maturing varieties in this trial (Figure L2.1). Yield loss from delayed sowing in other varieties ranged from 6% in Boomer to 13% in Northfield.
  PBA Jumbo continued to perform well in 2011, with equal highest yields at both sowing dates. The very early maturing PBA Blitz was not able to capitalise on the favourable season conditions and the high yield potential at this site to the same extent as other varieties, and was equal lowest yielding at both sowing dates. Due to its early maturity PBA Blitz can be prone to shattering and pod loss in some seasons, which may be responsible for some of this lower yield in 2011.
  Although there was little disease at this site, there was a small grain yield response from foliar applications of chlorothalonil (Table L2.1). Complete ascochyta blight control (see Table L2.1) and the NormalAsco (treatment with 2L/ha chlorothalonil at early flower and early podding) yielded higher than the untreated control. These treatment strategies both included podding sprays, which may have prevented some pod abortion.

**Table L2.1.** Effect of fungicide treatment on grain yield (t/ha) of lentils, Arthurton 2011

| Treatment | Nil | EarlyAsco | NormalAsco | Complete |
|---|---|---|---|---|
| **Yield (t/ha)** | 4.08 [a] | 4.12 [ab] | 4.26 [c] | 4.19 [bc] |

lsd (P<0.05) = 0.104

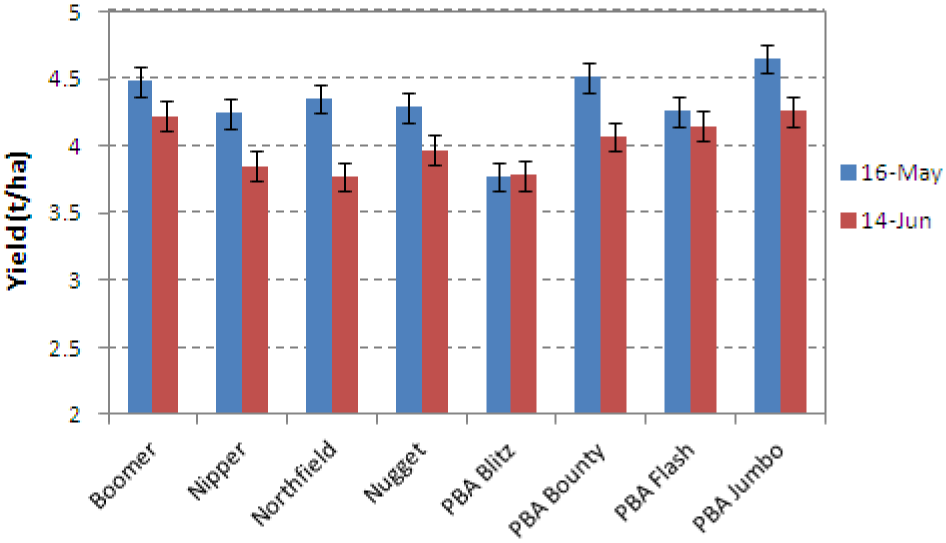


**Figure L2.1.** Effect of sowing date on grain yield (t/ha) of lentil varieties, Arthurton 2011.

**Key Findings and Comments**

- Lentil yields were high in 2011, averaging 4.2 t/ha.
- Favourable growing conditions and minimal disease resulted in equal or higher yields from early sown treatments.
- Despite low ascochyta blight foliar infection in lentils a 4% yield response was produced by treatments including application of chlorothalonil at early podding. This is most likely due to prevention of disease-related pod abortion.
- The recent lentil release PBA Jumbo was the equal highest yielding variety at both sowing dates. The early maturing PBA Blitz was not favoured by the seasonal conditions, particularly sown early, and yielded equal lowest.

## L3 Group B Herbicide Tolerance, MRZ Mid North (Mallala) and Yorke Peninsula (Arthurton), South Australia

**Aim**

The development of PBA Herald XT has been part of a concerted effort by the PBA lentil and the Southern Region Agronomy programs to improve weed control options in lentil. However little is known about performance of Herald to a range of group B herbicides. This trial aims to identify levels of tolerance to a range of group B herbicides, as preliminary work for the application of a registration for post-emergent use in this variety.

**Treatments**

Varieties: Nipper (intolerant)
PBA Herald XT, CIPAL1101 and CIPAL1102 (tolerant)

Sowing date: 27 May (Pinery), 22 June (Arthurton)

Treatments:

| Chemical (Timing ) Rate |
|---|
| Nil |
| *Imidazolinones* |
| Imi (PSPE) L |
| Imi (PSPE) H |
| Imi (PE) L |
| Imi (PE) H |
| Imi mix (PE) L |
| Imi mix (PE) H |
| *Triazolopyrimidines* |
| Flumetsulam (PE) L |
| Flumetsulam (PE) H |
| Metosulam (PE) L |
| *Sulfonylureas* |
| SU-1 (PE) H |
| SU-1 (Res) L |
| SU-2 (Res) L |
| SU-3 (Res) L |

Res = Residual - light rate applied pre sowing to simulate herbicide residues
PSPE = Post Sowing Pre Emergent
PE = Post Emergent
L = low rate, H = high rate

Fertiliser: MAP + Zn @ 75kg/ha

Soil type: Sandy Loam (Pinery), Sandy Clay Loam (Arthurton)

Soil pH: 8.3 (Pinery), 8.2 (Arthurton)

**Results and Interpretation**

- Plant establishment – good early plant establishment was achieved in these trials in 2011.
- Herbicide Damage Scores – the intolerant variety Nipper showed damage in all herbicide treatments at Arthurton except for ‘Imi’ applied post-sowing pre-emergent (both Low and High rates), and ‘SU-1’ and ‘SU-2’ applied at low rates to simulate carryover residues (Table L3.1). At Pinery, Nipper showed significant damage symptoms in all treatments except “residual” ‘SU-2’.

  Flumetsulam, which is registered for PE use on lentils, caused low to moderate damage to Nipper at both sites at both rates. Significant damage to tolerant varieties, PBA Herald XT, CIPAL1101 and CIPAl1102, was also noted at the high rate only at Arthurton.

  Significant visual damage was caused to tolerant varieties at both sites by the application of PE metosulam and ‘SU-1’, and high rates of ‘Imi mix’. Tolerant varieties also showed moderate damage from application of “residual” rates of ‘SU-3’ at Pinery only.

  In most cases where damage symptoms were observed these were much greater in the intolerant variety Nipper. The three tolerant lines generally showed similar damage symptoms for all treatments.

- Grain Yield – Untreated Nipper performed similarly to untreated PBA Herald XT at both sites, but was significantly outperformed by the two herbicide tolerant potential releases at Arthurton. PBA Herald XT was outyielded by CIPAL1101 at Pinery (Table L3.2).
  All herbicide treatments resulted in yield losses (ranging from 22 to 95%) in Nipper at the Pinery site. High yield losses (up to 100%) were observed in Nipper at Arthurton from the application of 'Imi' and 'Imi mix' (at low and high rates), post-emergent metosulam and 'SU-1', and the "residual" rate of 'SU-3' (Table L3.1). A low level of yield loss in Nipper was also generated by a high rate of flumetsulam at this site.
  The 'Imi (PSPE)' treatment behaved differently at the two sites, causing severe yield loss in Nipper at Pinery, but not at Arthurton. No yield loss was generated by this treatment in tolerant varieties at either site.
  Yield losses were generated in all tolerant varieties by application of post-emergent metosulam and 'SU-1' at both sites (except in PBA Herald XT at Pinery, which showed no yield loss from this treatment). High yield losses were also generated in PBA Herald XT and CIPAL1101 from the "residual" rate of 'SU-3' at Pinery. Several isolated incidences of low yield loss in tolerant varieties were caused by application of low rate of flumetsulam and high rate of 'Imi mix' to CIPAL1101 at Pinery, and the high rate of flumetsulam to CIPAL1102 at Arthurton.

**Table L3.1** The effect of various Group B herbicide treatments on visual damage score (0-100) of tolerant and intolerant lentil varieties at Arthurton and Pinery in 2011. (0 = no damage, 100 = complete plant death).

| Herbicide Treatment | Arthurton Damage Score (0-100) | | | | Pinery Damage Score (0-100) | | | |
|---|---|---|---|---|---|---|---|---|
| | Nipper | PBA Herald XT | CIPAL 1101 | CIPAL 1102 | Nipper | PBA Herald XT | CIPAL 1101 | CIPAL 1102 |
| Nil | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Imidazolinones* | | | | | | | | |
| Imi (PSPE) L | 0 | 0 | 0 | 0 | **60** | 8 | 0 | 3 |
| Imi (PSPE) H | 0 | 0 | 0 | 0 | **73** | 7 | 2 | 8 |
| Imi (PE) L | **80** | 0 | 0 | 0 | **30** | 8 | 2 | 2 |
| Imi (PE) H | **87** | 0 | 0 | 0 | **23** | 10 | 3 | **12** |
| Imi mix (PE) L | **87** | 7 | 0 | 7 | **50** | 7 | 0 | 7 |
| Imi mix (PE) H | **100** | **40** | **37** | **57** | **60** | **27** | **13** | **17** |
| *Triazolopyrimidines* | | | | | | | | |
| Flumetsulam (PE) L | **13** | **13** | 10 | 7 | **40** | 10 | 0 | 7 |
| Flumetsulam (PE) H | **40** | **17** | **13** | **13** | **50** | 8 | 0 | 2 |
| Metosulam (PE) L | **90** | **73** | **70** | **73** | **77** | **63** | **63** | **63** |
| *Sulfonylureas* | | | | | | | | |
| SU-1 (PE) H | **99** | **80** | **70** | **73** | **77** | **57** | **57** | **57** |
| SU-1 (Res) L | 10 | 0 | 0 | 0 | **37** | 10 | 0 | 3 |
| SU-2 (Res) L | 0 | 0 | 0 | 0 | 7 | 7 | 3 | 3 |
| SU-3 (Res) L | **73** | 10 | 0 | 0 | **67** | **27** | **20** | **27** |
| **LSD (P<0.05)** | 11 | 7 (same treatment) | | | 10 | 9 (same treatment) | | |

Figures in bold denote significant difference to the Nil treatment
Shaded figures denote significant difference to the corresponding Low rate

**Table L3.2** The effect of various Group B herbicide treatments on grain yield (% of nil treatment) of tolerant and intolerant lentil varieties at Arthurton and Pinery in 2011.

| Herbicide Treatment | Arthurton Grain Yield (t/ha) | | | | Pinery Grain Yield (t/ha) | | | |
|---|---|---|---|---|---|---|---|---|
| | Nipper | PBA Herald XT | CIPAL 1101 | CIPAL 1102 | Nipper | PBA Herald XT | CIPAL 1101 | CIPAL 1102 |
| Nil (t/ha) | 3.79 | 3.98 | 4.37 | 4.36 | 2.3 | 1.99 | 2.56 | 2.13 |
| *Imidazolinones* | | | | | | | | |
| Imi (PSPE) L | 100 | 99 | 103 | 96 | **25** | 109 | 102 | 102 |
| Imi (PSPE) H | 105 | 103 | 101 | 97 | **5** | 106 | 98 | 100 |
| Imi (PE) L | **48** | 112 | 103 | 96 | **72** | 119 | 91 | 98 |
| Imi (PE) H | **29** | 107 | 113 | 102 | **73** | 98 | 99 | 93 |
| Imi mix (PE) L | **8** | 96 | 107 | 98 | **23** | 114 | 93 | 95 |
| Imi mix (PE) H | **0** | 93 | 98 | 99 | **5** | 104 | **85** | 92 |
| *Triazolopyrimidines* | | | | | | | | |
| Flumetsulam (PE) L | 89 | 95 | 105 | 98 | **68** | 99 | **82** | 99 |
| Flumetsulam (PE) H | **87** | 93 | 99 | **89** | **44** | 94 | 93 | 107 |
| Metosulam (PE) L | **22** | **63** | **64** | **50** | **45** | 91 | **73** | **80** |
| *Sulfonylureas* | | | | | | | | |
| SU-1 (PE) H | **0** | **50** | **67** | **63** | **5** | **81** | **67** | **79** |
| SU-1 (Res) L | 93 | 90 | 111 | 95 | **47** | 104 | 95 | 107 |
| SU-2 (Res) L | 105 | 96 | 96 | 99 | **78** | 101 | 90 | 90 |
| SU-3 (Res) L | **21** | 90 | 90 | 98 | **5** | **82** | **74** | 93 |
| **LSD (P<0.05) (% nil)** | 12 | 11 | 10 | 10 | 16 | 18 | 14 | 17 |

Figures in bold denote significant difference to the Nil treatment
Shaded figures denote significant difference to the corresponding Low rate

## Key Findings and Comments

PBA Herald XT, together with tolerant breeding lines CIPAL1101 and CIPAL1102, show much improved tolerance to a range of group B herbicides compared to Nipper. The tolerant varieties showed no yield loss to a number of herbicides, whereas Nipper showed up to 100% yield loss (eg high rate of 'Imi mix').

While the tolerant varieties showed improved tolerance compared to Nipper to all chemistries tested, significant yield losses were still observed from application of a number of these treatments, especially at high rates. Post-emergent applications of metosulam and 'SU-1' showed consistent yield losses across the three tolerant varieties at both sites. Various yield losses were also seen from applications of flumetsulam, 'SU-3' and the high rate of 'Imi mix', but not as consistently as the previous two chemistries.

The incidence of yield losses was not as great as the incidence of visual damage, suggesting some recovery from early damage symptoms. This was most noticeable in flumetsulam treatments, where significant damage was noted in all varieties at the high rate at Arthurton while only two varieties showed significant yield loss. It is likely that recovery of symptoms was aided by the favourable seasonal conditions in 2011. Repeating these trials in further seasons will allow validation of results across variable seasons.

Different responses to the 'Imi (PSPE)' treatment occurred across the two sites, causing severe yield loss in Nipper at Pinery but not at Arthurton. It is not clear why this response was observed, but may be due to the different soil types at these sites. Soil pH was similar at both sites, however the soil at Arthurton (sandy clay loam) was heavier in texture than at Pinery (sandy loam). This may have resulted in greater tie-up of herbicide in the PSPE treatment at Arthurton.

The resistance of the three tolerant varieties tested in this study appears to be sufficient to support application for registration of these varieties to certain group B herbicide/s. This will have important benefits for current farming systems through improved weed control, both in the year of, and preceding, the lentil crop.

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

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

**Aim**

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

**Treatments**

Varieties: see Table L4.1
Sowing date: 27 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
Chemical: Paraquat at 800ml/ha
Fertiliser: MAP + Zn @ 90kg/ha

**Table L4.1.** Lentil flowering and maturity ratings, Melton crop-top trial 2011.

| Variety | Flower | Maturity |
|---|---|---|
| Boomer | E-M | M-L |
| Nipper | M-L | M |
| Nugget | M | M-L |
| PBA Blitz | E-M | E |
| PBA Bounty | M-L | M |
| PBA Flash | E-M | E-M |
| PBA Jumbo | M | M |
| CIPAL0501 | M | L |
| CIPAL0607 | M-L | M-L |
| CIPAL0801 | E-M | M |
| CIPAL0802 | E-M | E-M |
| CIPAL0803 | E-M | M-L |
| CIPAL0901 | M | E |
| CIPAL0902 | M | E-M |

E = Early, M = Mid, L = Late

**Results and Interpretation**

- Significant two way interactions (Timing x Variety) were observed for grain yield and grain weight (Table L4.2). Despite the reasonably long season these results show little variation across genotypes and maturities, as in previous long seasons.
- Grain Yield – Only one lentil variety (CIPAL0607) showed reduced yield at the Recommended timing in 2011. Maturity scores at each crop-top timing showed CIPAL0607 matured later than Nugget in 2011, but not as late as CIPAL0501. All genotypes showed reduced grain yield from Early crop-topping (2 weeks prior to Recommended timing), and generally followed genotype maturity. The earliest maturing genotypes PBA Blitz and CIPAL0901 showed the least yield loss, while later maturing genotypes Nugget, CIPAL0607 and CIPAL0501 showed the highest yield losses.
  All varieties yielded equal to the untreated at the Late crop-top timing (2 weeks after the Recommended).
  Long term summary of selected variety response to crop-topping (Table L4.3) shows Nugget has the highest average yield loss from crop-topping at both Early and Recommended timings. PBA Blitz, the earliest maturing of the five, shows the least yield loss from crop-topping, and is therefore considered better suited to this practice. PBA Jumbo has also shown to be better suited to crop-topping that Nugget.

- Grain Weight – a similar trend was observed for grain weight as for grain yield. Only one variety (Nugget) showed reduced grain weight at the Recommended timing. All varieties showed reduced grain weight at the Early timing, however earliest maturing varieties PBA Blitz and CIPAL0901 showed the least effect. Late crop-topping had no effect on grain weight.
- Grain Mould – The effect of crop-topping on occurrence of mould in grain samples was investigated in the 2011, however no response to crop-topping on the incidence of mould was detected in lentil (date not shown).

**Table L4.2.** Effect of crop-top timing on grain yield and grain weight of lentils, Melton 2011 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 (2/11)** | **+ 2 wks[b] (10/11)** | **Nil** | **- 2 wks[a] (25/10)** | **Recommended (2/11)** | **+ 2 wks[b] (10/11)** |
| PBA Blitz | 2.72 | 82 | 98 | 115 | 4.333 | 87 | 100 | 102 |
| CIPAL0901 | 3.01 | 82 | 100 | 107 | 4.29 | 85 | 97 | 99 |
| CIPAL0802 | 3.08 | 72 | 99 | 94 | 5.08 | 74 | 96 | 101 |
| PBA Flash | 2.93 | 63 | 112 | 109 | 3.33 | 69 | 99 | 99 |
| CIPAL0902 | 2.99 | 61 | 103 | 100 | 3.79 | 72 | 93 | 98 |
| CIPAL0801 | 3.36 | 60 | 89 | 95 | 4.37 | 83 | 102 | 102 |
| PBA Jumbo | 3.01 | 55 | 102 | 110 | 5.72 | 68 | 96 | 99 |
| PBA Bounty | 2.82 | 54 | 98 | 104 | 4.84 | 70 | 98 | 100 |
| Boomer | 2.75 | 56 | 83 | 113 | 4.23 | 71 | 101 | 99 |
| Nipper | 3.05 | 52 | 96 | 91 | 3.57 | 68 | 96 | 101 |
| CIPAL0803 | 3.02 | 74 | 100 | 109 | 4.79 | 73 | 97 | 97 |
| Nugget | 2.69 | 42 | 91 | 109 | 6.87 | 65 | 90 | 95 |
| CIPAL0607 | 3.08 | 42 | 76 | 99 | 4.79 | 81 | 97 | 103 |
| CIPA0501 | 3.12 | 59 | 98 | 104 | 3.87 | 68 | 97 | 99 |
| **Mean** | **2.97** | **1.81** | **2.86** | **3.09** | **4.5** | **3.4** | **4.4** | **4.5** |

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

NB: Shading denotes significant difference from the Nil treatment.

[a] = 2 weeks prior to Recommended timing

[b] = 2 weeks after Recommended timing

**Table L4.3.** Long term summary (2008-2011) of grain yield response of selected lentil cultivars to crop-topping, Early and Recommended timings.
Varieties are ranked according to their visual maturity rating from earliest to latest

| Variety | Incidence of significant yield losses (# trials) | | Average Yield [Range] (% of Control) | |
|---|---|---|---|---|
| | Early | Recommended | Early | Recommended |
| PBA Blitz | 4 (5) | 1 (5) | 56 [25-82] | 94 [89-101] |
| PBA Flash | 5 (5) | 2 (5) | 49 [30-70] | 92 [80-112] |
| PBA Jumbo | 4 (4) | 1 (4) | 52 [33-82] | 98 [92-102] |
| Nipper | 5 (5) | 2 (5) | 47 [34-65] | 89 [80-98] |
| Nugget | 5 (5) | 2 (5) | 39 [28-63] | 84 [75-95] |

**Key Findings and Comments**

There was limited varietal response from crop-topping in 2011. This may be due to below average rainfall during late October and early November, the rapid finish on a shallow soil and the relatively late sowing date, suppressing some yield potential of untreated plots. However, a strong link between plant maturity and reduced yield and grain weight was observed at the Early crop topping timing , with earlier maturing varieties PBA Blitz and CIPAL0901 showing the least effect and Nugget, CIPAL0607 and CIPAL0501 presenting the greatest effect, although this was not repeated at the Recommended timing. Previous seasons have also shown a strong link between yield loss from crop-topping and variety maturity. Long term summary of selected varieties showed the widely grown commercial variety Nugget to be less suited to crop-topping than other commercial cultivars, with PBA Blitz best suited. PBA Jumbo also showed lower yield loss than other varieties in a similar maturity bracket, and with its high yield potential and other agronomic benefits should be considered by growers.

No link between crop-topping and occurrence of field mould in grain samples could be determined in this trial in 2011. However, this appears to be strongly seasonally (and perhaps regionally) dependent, therefore work is continuing in this area.

## L5 Sowing Time, H-MRZ Wagga Wagga, NSW

### Aim

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

### Treatments

| | |
|---|---|
| Varieties: | Boomer, Nipper, PBA Blitz, PBA Flash, CIPAL0801 (PBA Bolt), CIPAL0802, CIPAL0803 (PBA Ace) and CIPAL0901 |
| Sowing dates: | 10th May (Early), 14$^{th}$ June (Late) |
| Row spacing: | 300mm |
| Fertiliser: | Legume Starter @ 115 kg/ha at sowing banded below the seed |
| Plant population: | 120pl/m$^2$ target |

### Results and Interpretation

In the 2011 season, lentil variety choice significantly influenced grain yield (see Figure L5.1), while sowing time and variety by sowing time effects were not significant (Figure L5.2). The two emerging PBA lentil varieties CIPAL0803 (PBA Ace) and CIPAL0901 yielded higher than current commercial varieties, with CIPAL0803 significantly higher yielding than all commercial varieties. The yields achieved would suggest lentil production within the southern NSW cropping zone could be highly profitable.

PBA Ace is a new high yielding disease resistant mid maturity vigorous lentil variety well suited to southern NSW.  This variety should re-invigorate interest in lentil in this region.

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

### Management significantly affects plot emergence and subsequent growth

For many years at Wagga, we have experienced emergence problems, patchy uneven growth and low yields across our lentil trials, often attributing much of this to an unfavourable southern NSW environment, and in particular our acidic red-brown soils.  However, we altered some of our management practices in 2011 and this resulted in significantly better emergence, establishment and even growth across our trials -

- The sowing boots were modified to separate seed and fertiliser within the sowing row, placing fertiliser approximately 20mm below the seed. This minimised fertiliser toxicity.
- We increased sowing depth from 25mm to 40mm. This assisted separation of seed and herbicide.
- Row spacing was increased from 200mm to 300mm to adopt more of an industry practice and conform to most growers' machinery.
- Herbicide damage from Metrabuzin was reduced by reducing post sowing rate of from maximum to minimum label rates.

Overall, these changes resulted in improved emergence, more even and vigorous crop growth, less variable trials and higher yields. Identifying roles of each factor in improving crop establishment and growth could guide direction for future agronomy investigations.  Weed control during the preceding years becomes even more paramount for lentils.

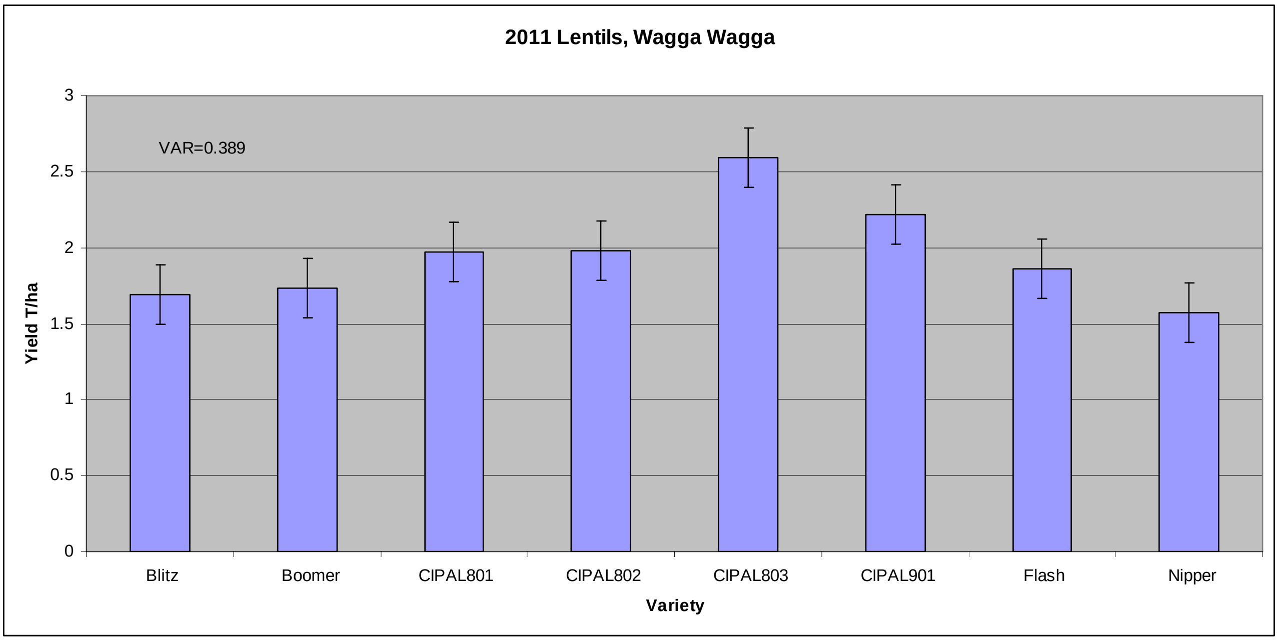


**Figure L5.1.** Effect of variety on grain yield (t/ha) of 8 lentil varieties, Wagga 2011

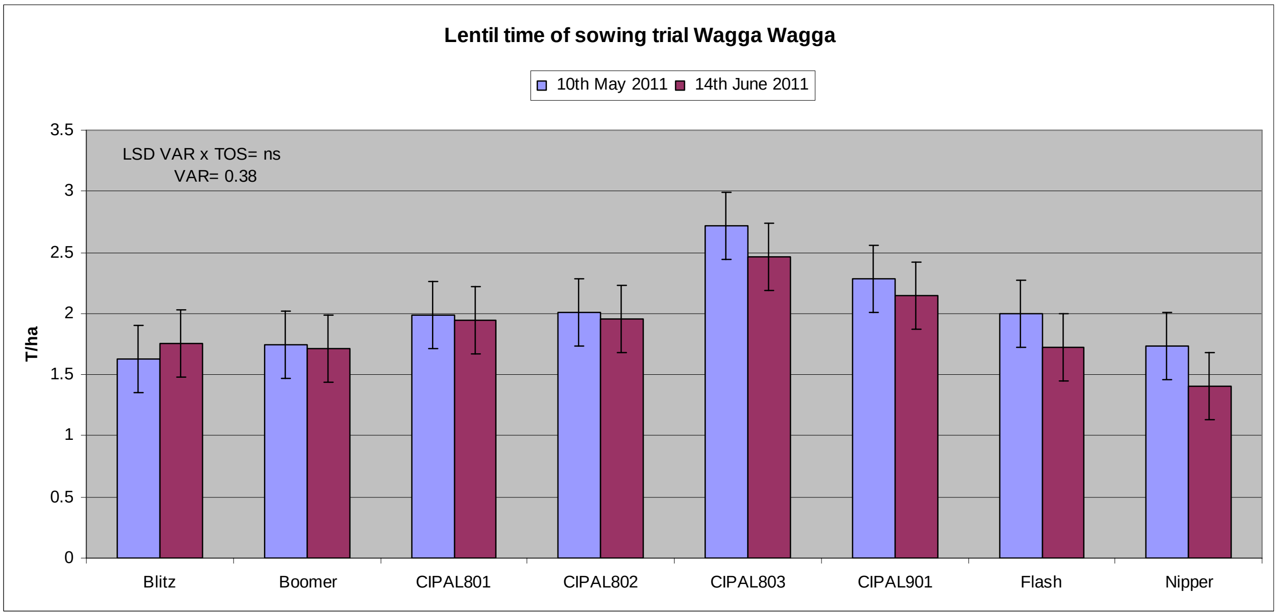


**Figure L5.2.** Effect of sowing date on grain yield (t/ha) of 8 lentil varieties, Wagga 2011.

## Key Findings and Comments

- Lentils grew well on acidic red brown soils of southern NSW
- PBA Ace (CIPAL0803) and CIPAL0901 were the highest yielding varieties.
- Sowing from 10 May to 7 June had no significant affect on yield in 2011 growing season.
- These yields (> 2 t/ha) support a viable and profitable lentil industry in southern NSW
- Lentils are more sensitive to commonly used herbicides and considerable care must be taken.

## L6. Sowing Time, LRZ Yenda, NSW

### Aim

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

### Treatments

Varieties: Boomer, Nipper, PBA Blitz, PBA Flash, CIPAL0801, CIPAL0802, CIPAL0803 and CIPAL0901
Sowing dates: 20th May (Early), 22nd June (Late)
Fertiliser: Legume Starter @ 115 kg/ha at sowing banded below the seed
Plant population: 120pl/m2 target
Herbicides: Pre-sowing; Glyphosate @ 1.5 l/ha and Terbyne® at 0.75 kg/ha. PSPE; Sencor @ 200ml/ha to TOS1 only.

### Results and Interpretation

In the 2011 season at Yenda, lentil variety choice and time of sowing significantly influenced grain yield, Figure L6.1 and Figure L6.2. Varieties by sowing time effects were not statistically significant. The two emerging PBA lentil breeding lines CIPAL0803 and CIPAL0901 yielded higher than current commercial varieties.

The yields achieved would suggest lentil production within the southern NSW cropping zone could be highly profitable, given average cropping season rainfall.
Yields generally trended lower with delayed sowing time, with significant yield reductions in Boomer, CIPAL0803 and CIPAL0901. Spring growth conditions were warmer and thus less favourable, compared to Wagga Wagga resulting in yield penalties for all species except Blitz from delayed sowing.

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

Weed burdens within the site were low and weed growth was minimal and not sufficient to affect crop yields. At the first sowing, Metrabuzin (Sencor®) applied PSPE induced some visual crop damage. Metrabuzin was not applied at the second sowing.

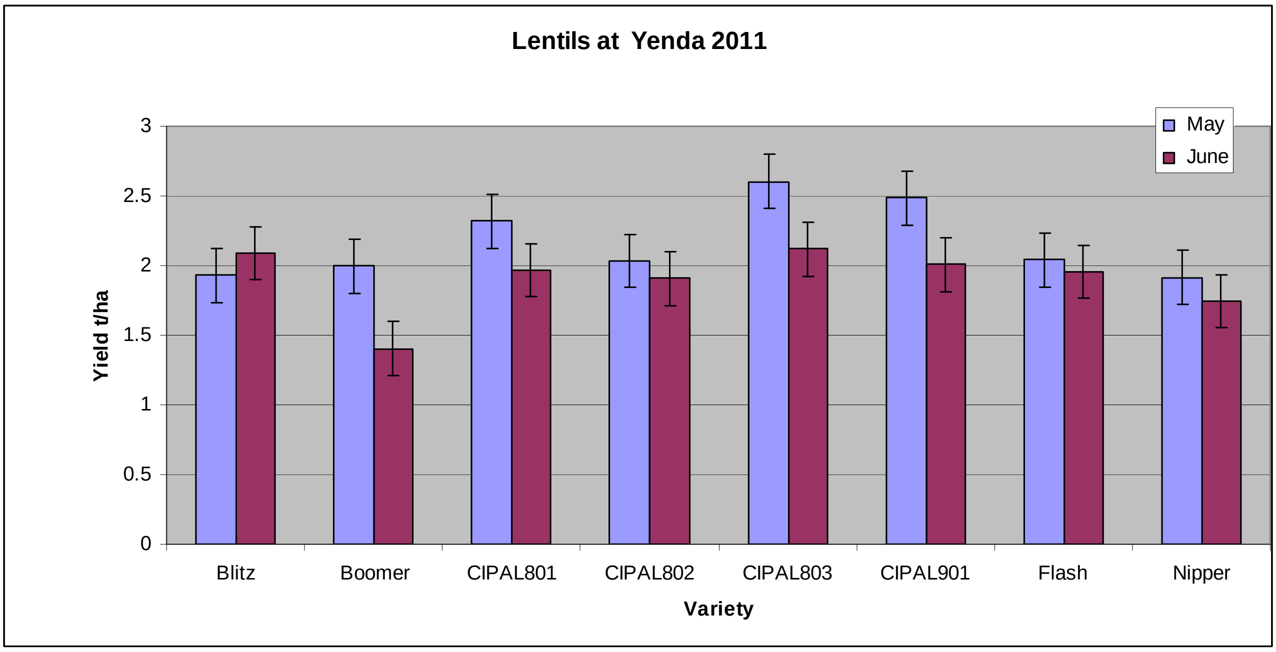


**Figure L6.1.** Effect of variety and sowing date (20 May & 22 June) on grain yield (t/ha) of 8 lentil varieties at Yenda in 2011.

**Key Findings and Comments**

- CIPAL0803 and CIPAL0901 were the highest yielding varieties and show great potential for future lentil production in this region.
- Delayed sowing reduced yields in 2011 at Yenda in most varieties with significant effects in the longer seasoned Boomer, and breeding lines CIPAL0803 and CIPAL0901.
- Established human consumption markets and yields over two tonnes per hectare suggest that lentil production could be profitable in southern NSW cropping zone
- This trial should be repeated in future seasons in order to compare and validate the 2011 findings across variable growing seasons.

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

**Aim**

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

**Treatments**

| | |
|---|---|
| Varieties: | Aldinga, Boomer, Nipper, Northfield, Nugget, PBA Blitz, PBA Flash, PBA Jumbo, CIPAL0801, CIPAL0802, CIPAL0803, CIPAL0901. |
| Variety Mixes: | PBA Flash:Nipper, PBA Flash:Nugget, PBA Flash:PBABlitz, PBA Flash:CIPAL0901. All sown with a 50:50 ratio based on targeted plants/m$^2$. |
| Sowing dates: | 4 May (Early), 27 May (Mid), 22 June (Late). |

**Other Details**

| | |
|---|---|
| Row Spacings/Stubble: | 30 cm row spacing, inter-row, standing stubble. |
| Fertiliser: | MAP + Zn @ 40 kg/ha at sowing. |
| Plant Density: | 120 plants/m$^2$. |

**Results and Interpretation**

- Key Message: Earlier sowing in the Mallee is crucial to maximising grain yield in lentils. If sowing is delayed it is important to carefully select the variety to grow. Early maturing types like CIPAL0901 and early to mid vigorous growing types like CIPAL0803, appear to have better adaption to delayed sowing in this trial.

- Plant establishment – Establishment for all lentil varieties was poor in 2011, primarily due to a mouse plague. Generally densities ranged between 50 and 90 plants/m$^2$ (data not shown).

- Mouse Damage – Significant mouse damage was observed across the trial and each plot was scored for damage on a percentage scale. Mouse damage was used as a covariate in the grain yield analysis.

**Table L7.1.** The effect of the interaction between sowing date and lentil variety grain yield (t/ha) at Curyo in 2011.

| Variety / Variety mix | 4 May | 27 May | 22 June | *Average* |
|---|---|---|---|---|
| PBAFlash:Nugget | 2.61 | 2.46 | 1.89 | *2.32* |
| PBAFlash:CIPAL0901 | 2.49 | 2.39 | 2.02 | *2.30* |
| CIPAL0803 | 2.18 | 2.61 | 2.08 | *2.29* |
| CIPAL0801 | 2.41 | 2.46 | 1.78 | *2.22* |
| Nugget | 2.26 | 2.67 | 1.70 | *2.21* |
| PBAFlash | 2.50 | 2.34 | 1.73 | *2.19* |
| PBAFlash:PBABlitz | 2.36 | 2.26 | 1.80 | *2.14* |
| CIPAL0901 | 1.95 | 2.40 | 2.04 | *2.13* |
| PBAFlash:Nipper | 2.23 | 2.06 | 2.02 | *2.10* |
| Boomer | 1.98 | 2.46 | 1.79 | *2.08* |
| CIPAL0802 | 2.20 | 2.32 | 1.69 | *2.07* |
| PBABlitz | 2.04 | 2.35 | 1.72 | *2.03* |
| Aldinga | 2.21 | 2.12 | 1.71 | *2.01* |
| Nipper | 2.31 | 2.10 | 1.62 | *2.01* |
| PBAJumbo | 1.78 | 2.24 | 1.69 | *1.90* |
| Northfield | 2.18 | 2.10 | 1.37 | *1.88* |
| *Average* | *2.23* | *2.33* | *1.79* | *2.12* |

lsd(P<0.05)SDxVar = NS; lsd(P<0.10)SD = 0.44; lsd(P<0.05)Var = 0.26.

- Grain Yield – Grain yields were excellent, despite the poor establishment, ranging between 1.4 and 2.7 t/ha (Table L7.1). Due to the variability in the trial there was no interaction between sowing date and variety, however the main effects were significant. Generally, the June 22 sowing date resulted in lowest yield, while there was no difference between the May 4 and May

27 sowing dates. The two variety mixes (PBAFlash:Nugget and PBA Flash:CIPAL0901) had the highest average grain yields across the 3 sowing dates, followed by the new lines CIPAL0803 and CIPAL0801. Northfield, PBA Jumbo, Nipper and Aldinga had the lowest grain yields. We also calculated the proportion of each variety in the variety mixes. PBA Flash was between 40 and 50% of the mix with all other varieties. It had the highest proportion when grown with Nipper and at the later sowing dates.

- Grain Weight – Grain weight was reduced by approximated 5% at both of the later sowing dates.

**Table L7.2.** The main effect of sowing date on grain weight (g/100seed) in lentils at Curyo in 2011.

| Sowing Date | Grain weight |
|---|---|
| **4 May** | 4.73 |
| **22 June** | 4.56 |
| **27 May** | 4.49 |

lsd(P<0.05)SD = 0.05

**Key Findings and Comments**

Due to extreme rainfall events during the summer of 2010/11, the soil profile was at field capacity at sowing in 2011. Early growth at Curyo was restricted due to a dry period during May and June, however this does not appear to have had any significant impact on grain yield. Unfortunately, the mouse plague at sowing had a significant impact on establishment, despite multiple applications of mouse bait (ie. the site was baited 6 times from late April through to the end of June). Fortunately, due to mild temperatures and sufficient rainfall during the main growth periods excellent grain yields were achieved. The results again highlighted that earlier sowing in the Mallee is crucial to maximising grain yield in lentils. However the results also indicate that if sowing is delayed it is important to carefully select the variety to grow. Early maturing types like CIPAL0901 and early to mid maturing, vigorous growing types like CIPAL0803, appear to have better adaption to delayed sowing in this trial. This may also be indicative of the yield stability of these varieties. In this trial, generally the later maturing and older varieties, such as Aldinga, Nipper and Northfield were lowest yielding, demonstrating the advances that have been made in new lentil varieties more recently.

The variety mixes were grown this year to asses whether yield stability could be improved by mixing different types of lentils together, which contain differentiating traits for maturity, and disease resistance. Interestingly, the two mixes PBAFlash:Nugget and PBA Flash:CIPAL0901 had the highest average grain yields and were relatively highly ranked at each sowing date. Further work will occur in 2012 to further investigate these responses.

## L8 Crop Topping, LRZ Southern Mallee (Curyo), Victoria

**Aim**

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

**Treatments**

| | |
|---|---|
| Varieties: | Aldinga, Boomer, Nipper, Nugget, PBA Bounty, PBA Flash, PBA Blitz, PBA Jumbo, CIPAL0802, CIPAL0803. |
| Crop Topping: | Nil. |
| | Early: Applied approximately 10-14 days pre rye grass milky dough stage (24th October). |
| | Mid: Applied at rye grass milky dough stage (4th November). |
| | Late: Applied approximately 10-14 days post rye grass milky dough stage (14th November). |

**Other Details**

| | |
|---|---|
| Sowing date: | 4 May. |
| Row Spacing/Stubble: | 30 cm row spacing, inter-row, standing stubble. |
| Fertiliser: | MAP + Zn @ 40 kg/ha at sowing. |
| Plant Density: | 120 plants/$m^2$. |

**Results and Interpretation**

- Key Message: No significant response to crop topping treatments was observed.

- Mouse Damage – Significant mouse damage was observed across the trial and each plot was scored for damage on a percentage scale. Mouse damage was used as a covariate in the grain yield analysis.
- Grain Yield – No significant response to crop topping treatments was observed in 2011. Mean grain yields of varieties were all similar except Nipper, which was significantly lower (Table L8.1). Although not significant there appeared to be a trend toward lower grain yields in the earlier crop topping applications (Table L8.2).

**Table L8.1.** Mean grain yield (t/ha) of lentil varieties grown in the crop topping trial at Curyo in 2011.

| Variety | Grain Yield (t/ha) |
|---|---|
| CIPAL0803 | 2.09 |
| PBA Flash | 2.03 |
| PBA Blitz | 1.97 |
| PBA Bounty | 1.95 |
| CIPAL0802 | 1.95 |
| Boomer | 1.92 |
| Aldinga | 1.90 |
| Nugget | 1.88 |
| PBA Jumbo | 1.83 |
| Nipper | 1.61 |

lsd(P<0.05)Var = 0.26.

**Table L8.2.** Mean grain yield (t/ha) of lentils in each of the crop top treatments at Curyo in 2011.

| Crop Top Application Time | Grain Yield (t/ha) |
|---|---|
| **- 2 weeks (24 Oct)** | 1.79 |
| **Recommended (4 Nov)** | 1.87 |
| **+ 2 weeks (14 Nov)** | 1.92 |
| **Nil** | 2.07 |

lsd(P<0.05)CT = NS.

**Key Findings and Comments**

Although not clearly demonstrated in this trial previous results at various sites across southern Australia have demonstrated that earlier maturing lines generally displayed less yield loss in crop-topping treatments than later maturing types.

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

**Aim**

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

**Treatments**

| | |
|---|---|
| Varieties: | PBA HeraldXT, CIPAL1101, CIPAL1102 (all tolerant), PBA Flash (Control, Intolerant). |
| Herbicides: | Thirteen herbicide treatments (Group B; ALS inhibitors) encompassing a range of imidazolinones, sulfonylureas and triazolopyrimides were applied at various application rates and timings in comparison with an untreated control (Table L11.1). |

**Other Details**

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

**Results and Interpretation**

- Key Message: None of the Imi treatments resulted in a significant grain yield loss for the tolerant varieties, and few visual symptoms of crop damage were observed.

- Plant establishment – Imi applied PSPE had no significant impact on establishment of all varieties.

**Table L9.1.** The effect of various Group B herbicide treatments on visual damage score (1 – no damage, 9 – complete plant death) of the new imidazolinone tolerant lentil varieties, PBA HeraldXT, CIPAL1101 and CIPAL1102 in comparison with an intolerant variety, PBA Flash at Curyo in 2011. Significant damage scores have been shaded.

| Herbicide Treatment[1] | PBAHeraldXT | CIPAL1101 | CIPAL1102 | PBA Flash |
|---|---|---|---|---|
| Nil | 1.0 | 1.0 | 1.0 | 1.0 |
| *Imidazolinones* | | | | |
| Imi (PSPE) L | 1.0 | 1.0 | 1.0 | 5.3 |
| Imi (PSPE) H | 1.5 | 1.3 | 1.0 | 6.5 |
| Imi (PEb) L | 1.8 | 1.3 | 1.3 | 5.9 |
| Imi (PEb) H | 1.5 | 1.0 | 1.8 | 8.3 |
| Imi mix (PEb) L | 4.3 | 2.3 | 2.6 | 8.1 |
| Imi mix (PEb) H | 4.0 | 4.0 | 4.3 | 9.0 |
| *Triazolopyrimidines* | | | | |
| Flumetsulam (PEb) L | 1.3 | 1.3 | 1.3 | 2.3 |
| Flumetsulam (PEb) H | 1.3 | 1.0 | 1.3 | 1.8 |
| Tri (PEb) L | 3.8 | 4.3 | 4.8 | 8.0 |
| *Sulfonylureas* | | | | |
| SU-1 (Res) L | 1.3 | 1.3 | 1.3 | 5.0 |
| SU-1 (PEb) H | 5.0 | 4.5 | 5.3 | 9.0 |
| SU-2 (Res) L | 2.0 | 1.0 | 1.3 | 5.2 |
| SU-3 (Res) L | 2.0 | 1.5 | 2.3 | 6.5 |

lsd(P<0.05)HTxVar = 1.4.

1. Herbicide code or active ingredient if registered for use; application time in brackets: PSPE – Post sowing/pre-emergence; PEb – Applied at the 4 node stage of lentil crop growth targeting small broadleaf weeds; Res – Applied 4-6 weeks prior to sowing to mimic residual concentrations; H or L refers to relative application rate.

- Herbicide symptoms – All of the herbicides used caused some visual damage on the intolerant variety PBA Flash (Table L9.1). However, damage from flumetsulam applied at both rates caused only insignificant damage. In the herbicide tolerant varieties, PBAHeraldXT, CIPAL1101 and CIPAl1102, the only treatments to cause significant visual damage were the higher rate of 'Imi mix', 'Tri' and 'SU-1' applied PEb (Table L9.1). All 'Imi' and flumetsulam treatments generally caused limited or no symptoms except the low rate of 'Imi mix', which caused moderate visual damage in PBA HeraldXT and CIPAL1102.

- Grain Yield – Grain yields for the intolerant variety PBAFlash were generally well related to herbicide damage scores. Most herbicide treatments resulted in a significant grain yield loss, up to 100% for 'SU-1' applied PEb (Table L9.2). The tolerant varieties PBAHeraldXT, CIPAL1101 and CIPAL 1102 showed no significant grain yield loss.

**Table L9.2.** The effect of various Group B herbicide treatments on grain yield (t/ha) of the new imidazolinone tolerant lentil varieties, PBA HeraldXT, CIPAL1101 and CIPAL1102 in comparison with an intolerant variety, PBA Flash at Curyo in 2011. Significant damage scores have been shaded.

| Herbicide Treatment[1] | PBAHeraldXT | CIPAL1101 | CIPAL1102 | PBA Flash |
|---|---|---|---|---|
| Nil | 1.63 | 2.49 | 1.95 | 1.87 |
| *Imidazolinones* | | | | |
| Imi (PSPE) L | 1.65 | 1.73 | 2.18 | 1.54 |
| Imi (PSPE) H | 1.79 | 2.31 | 1.96 | 0.60 |
| Imi (PEb) L | 2.11 | 2.00 | 1.89 | 1.65 |
| Imi (PEb) H | 1.91 | 2.26 | 1.58 | 0.42 |
| Imi mix (PEb) L | 1.50 | 1.77 | 1.77 | 0.50 |
| Imi mix (PEb) H | 1.64 | 2.10 | 1.60 | 0.18 |
| *Triazolopyrimidines* | | | | |
| Flumetsulam (PEb) L | 1.59 | 2.21 | 2.34 | 1.63 |
| Flumetsulam (PEb) H | 1.72 | 1.90 | 1.67 | 1.78 |
| Tri (PEb) L | 1.70 | 2.25 | 2.16 | 0.64 |
| *Sulfonylureas* | | | | |
| SU-1 (Res) L | 1.78 | 2.13 | 2.12 | 1.41 |
| SU-1 (PEb) H | 1.71 | 1.80 | 1.57 | 0.01 |
| SU-2 (Res) L | 0.94 | 2.17 | 2.33 | 0.75 |
| SU-3 (Res) L | 1.58 | 1.99 | 1.65 | 0.41 |

lsd(P<0.05)HTxVar = 0.81.

1. Herbicide code or active ingredient if registered for use; application time in brackets: PSPE – Post sowing/pre-emergence; PEb – Applied at the 4 node stage of lentil crop growth targeting small broadleaf weeds; Res – Applied 4-6 weeks prior to sowing to mimic residual concentrations; H or L refers to relative application rate.

## Key Findings and Comments

This trial demonstrates the improvements in tolerance of the new varieties, PBAHeraldXT, CIPAL1101 and CIPAL1102 compared with intolerant commercial variety, PBAFlash. None of the Imi treatments resulted in a significant grain yield loss for the tolerant varieties, despite some minor to moderate visual symptoms of crop damage being observed (eg Imi mix at the higher application rate). In addition, the improved Imi tolerance results in improved tolerance to most sulfonylureas and triazolopyrimides assessed in these trials. Other research has also found that Imi mix had no impact on nodulation and nitrogen fixation of PBAHeraldXT.

It is important to note that climatic conditions in 2011 were suitable for recovery from earlier damage. This is also supported by the insignificant grain yield loss observed in the intolerant variety in response to Imi applied PEb at a the L rate, despite showing significant crop damage symptoms. Due to the previous summer rainfall there was significant stored moisture that could be accessed and few high or low temperature stress events were experienced during the lentil growth phase. So it will be important to repeat trials in seasons with drier spring conditions to observe the full impact of those herbicides that caused significant visual damage on the tolerant variety, but didn't result in any yield loss.

The introduction of these herbicide tolerant lentils could result in significant farming systems benefits through improved weed control, increased control options in lentil crops and in the previous rotation phase, and decreased pressure on herbicides currently employed for broadleaf weed control in lentil. Earlier this year Pulse Australia was able to gain a ‘permit for use’ of imazethapyr at the low rate that was used in these trials which, when combined with the additional improved tolerance to flumetsulam and sulfonylureas enables growers to realise the full benefits of the tolerance trait.

## L10 Herbicide Tolerance, MRZ Wimmera (Rupanyup), Victoria

**Aim**

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

**Treatments**

| | |
|---|---|
| Varieties: | PBA HeraldXT, CIPAL1101, CIPAL1102 (all tolerant), PBA Flash (Control, Intolerant). |
| Herbicides: | Thirteen herbicide treatments (Group B; ALS inhibitors) encompassing a range of imidazolinones, sulfonylureas and triazolopyrimides were applied at various application rates and timings in comparison with an untreated control (Table L10.1). |

**Other Details**

| | |
|---|---|
| Sowing date: | 17 May. |
| Row Spacings/Stubble: | 30 cm row spacing, inter-row, standing stubble (ST30). |
| Fertiliser: | MAP + Zn @ 60 kg/ha at sowing. |
| Plant Density: | 120 plants/$m^2$. |
| Soil Type | Black cracking clay (pH 8.1 at 10cm, 8.8 at 60cm). |

**Results and Interpretation**

- Key Message: None of the Imi treatments resulted in a significant grain yield loss for the tolerant varieties, and few visual symptoms of crop damage were observed.

- Plant establishment – Imi applied PSPE had no significant impact on establishment of all varieties.

- Herbicide symptoms – All of the herbicides used caused some visual damage on the intolerant variety PBA Flash (Table L10.1). However, damage from SU-1 and SU-2 applied residually at the low rates caused only insignificant damage. In the herbicide tolerant varieties, PBAHeraldXT, CIPAL1101 and CIPAl1102, the only treatments to cause significant visual damage were the higher rate of 'Imi mix', 'Tri' and 'SU-1' applied PEb (Table L10.1). All 'Imi' and flumetsulam treatments generally caused limited or no symptoms except the low rate of 'Imi mix' and flumetsulam, which caused significant visual damage in CIPAL1102 and PBA HeraldXT, respectively.

- Grain Yield – Grain yields for the intolerant variety PBAFlash were generally well related to herbicide damage scores. Most herbicide treatments resulted in a significant grain yield loss, up to 100% for 'Imi mix' applied PEb at the higher rate (Table L10.2). The tolerant varieties PBAHeraldXT, CIPAL1101 and CIPAL1102 showed no significant grain yield loss.

**Table L10.1.** The effect of various Group B herbicide treatments on visual damage score (1 – no damage, 9 – complete plant death) of the new imidazolinone tolerant lentil varieties, PBA HeraldXT, CIPAL1101 and CIPAL1102 in comparison with an intolerant variety, PBA Flash at Rupanyup in 2011. Significant damage scores have been shaded.

| Herbicide Treatment[1] | PBAHeraldXT | CIPAL1101 | CIPAL1102 | PBA Flash |
|---|---|---|---|---|
| Nil | 1.0 | 1.0 | 1.0 | 1.0 |
| *Imidazolinones* | | | | |
| Imi (PSPE) L | 1.0 | 1.0 | 1.0 | 3.8 |
| Imi (PSPE) H | 1.0 | 1.0 | 1.3 | 6.5 |
| Imi (PEb) L | 1.0 | 1.0 | 1.0 | 5.8 |
| Imi (PEb) H | 1.0 | 1.0 | 1.0 | 6.8 |
| Imi mix (PEb) L | 1.5 | 1.3 | 2.0 | 9.0 |
| Imi mix (PEb) H | 3.8 | 2.8 | 4.5 | 9.0 |
| *Triazolopyrimidines* | | | | |
| Flumetsulam (PEb) L | 1.0 | 1.3 | 1.0 | 3.0 |
| Flumetsulam (PEb) H | 2.0 | 1.0 | 1.0 | 4.5 |
| Tri (PEb) L | 3.7 | 5.3 | 5.3 | 8.3 |
| *Sulfonylureas* | | | | |
| SU-1 (Res) L | 1.0 | 1.0 | 1.3 | 1.8 |
| SU-1 (PEb) H | 2.8 | 2.3 | 3.0 | 8.3 |
| SU-2 (Res) L | 1.3 | 1.0 | 1.0 | 1.5 |
| SU-3 (Res) L | 1.0 | 1.3 | 1.0 | 5.0 |

lsd(P<0.05)HTxVar = 1.0.

1. Herbicide code or active ingredient if registered for use; application time in brackets: PSPE – Post sowing/pre-emergence; PEb – Applied at the 4 node stage of lentil crop growth targeting small broadleaf weeds; Res – Applied 4-6 weeks prior to sowing to mimic residual concentrations; H or L refers to relative application rate.

**Table L10.2.** The effect of various Group B herbicide treatments on grain yield (t/ha) of the new imidazolinone tolerant lentil varieties, PBA HeraldXT, CIPAL1101 and CIPAL1102 in comparison with an intolerant variety, PBA Flash at Rupanyup in 2011. Significant damage scores have been shaded.

| Herbicide Treatment[1] | PBAHeraldXT | CIPAL1101 | CIPAL1102 | PBA Flash |
|---|---|---|---|---|
| Nil | 3.31 | 3.64 | 3.41 | 3.47 |
| *Imidazolinones* | | | | |
| Imi (PSPE) L | 3.28 | 3.64 | 3.35 | 3.30 |
| Imi (PSPE) H | 3.27 | 3.81 | 3.73 | 2.40 |
| Imi (PEb) L | 3.25 | 3.83 | 3.41 | 3.49 |
| Imi (PEb) H | 3.27 | 3.93 | 3.45 | 2.20 |
| Imi mix (PEb) L | 3.36 | 3.72 | 3.63 | 0.86 |
| Imi mix (PEb) H | 2.81 | 3.33 | 3.39 | 0.06 |
| *Triazolopyrimidines* | | | | |
| Flumetsulam (PEb) L | 3.26 | 3.64 | 3.71 | 3.06 |
| Flumetsulam (PEb) H | 3.26 | 4.00 | 3.38 | 2.53 |
| Tri (PEb) L | 3.23 | 3.38 | 3.50 | 1.95 |
| *Sulfonylureas* | | | | |
| SU-1 (Res) L | 3.73 | 3.74 | 3.36 | 3.40 |
| SU-1 (PEb) H | 3.15 | 3.72 | 3.35 | 1.50 |
| SU-2 (Res) L | 3.47 | 3.74 | 3.66 | 3.74 |
| SU-3 (Res) L | 3.27 | 3.91 | 3.73 | 1.93 |

lsd(P<0.05)HTxVar = 0.50.

1. Herbicide code or active ingredient if registered for use; application time in brackets: PSPE – Post sowing/pre-emergence; PEb – Applied at the 4 node stage of lentil crop growth targeting small broadleaf weeds; Res – Applied 4-6 weeks prior to sowing to mimic residual concentrations; H or L refers to relative application rate.

**Key Findings and Comments**

This trial demonstrates the improvements in tolerance of the new varieties, PBAHeraldXT, CIPAL1101 and CIPAL1102 compared with intolerant commercial variety, PBAFlash. None of the Imi treatments resulted in a significant grain yield loss for the tolerant varieties, despite some minor to moderate visual symptoms of crop damage being observed (eg Imi mix at the higher application rate). In addition, the improved Imi tolerance results in improved tolerance to most sulfonylureas and triazolopyrimides assessed in these trials. Other research has also found that Im mix had no impact on nodulation and nitrogen fixation of PBAHeraldXT.

It is important to note that climatic conditions in 2011 were suitable for recovery from earlier damage. This is also supported by the insignificant grain yield loss observed in the intolerant variety in response to Imi applied PSPE, PEb at the low rate and flumetsulam applied PEb at the low rate, despite showing significant crop damage symptoms. Due to the previous summer rainfall there was significant amounts of stored moisture that could be accessed and minimal high or low temperature stress events were experienced during the lentil growth phase. So it will be important to repeat trials in seasons with drier spring conditions to observe the full impact of those herbicides that caused significant visual damage on the tolerant variety, but didn’t result in any yield loss.

The introduction of these herbicide tolerant lentils could result in significant farming systems benefits through improved weed control, increased control options in lentil crops and in the previous rotation phase, and decreased pressure on herbicides currently employed for broadleaf weed control in lentil. Earlier this year Pulse Australia was able to gain a ‘permit for use’ of imazethapyr at the low rate that was used in these trials which, when combined with the additional improved tolerance to flumetsulam and sulfonylureas enables growers to realise the full benefits of the tolerance trait.

## L11 Crop Topping, MRZ Wimmera (Rupanyup), Victoria

### Aim

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

### Treatments

| | |
|---|---|
| Varieties: | Aldinga, Boomer, Nipper, Nugget, PBA Bounty, PBA Flash, PBA Blitz, PBA Jumbo, CIPAL0802, CIPAL0803. |
| Crop Topping: | Nil. |
| | Early: Applied approximately 10-14 days pre rye grass milky dough stage (14th November). |
| | Mid: Applied at rye grass milky dough (28th November). |
| | Late: Not applied. |

### Other Details

| | |
|---|---|
| Sowing date: | 16 May. |
| Row Spacing/Stubble: | 30 cm row spacing, inter-row, standing stubble. |
| Fertiliser: | MAP + Zn @ 60 kg/ha at sowing. |
| Plant Density: | 120 plants/$m^2$. |

### Results and Interpretation

- Key Message: No significant response to crop topping treatments was observed.

- Grain Yield – No significant response to crop topping treatments was observed in 2011. Mean grain yields of varieties were high ranging from 3.4 to 4.0t/ha (Table L11.1).

**Table L11.1.** Mean grain yield (t/ha) of lentil varieties grown in the crop topping trial at Rupanyup in 2011.

| Variety | Grain Yield (t/ha) |
|---|---|
| PBA Flash | 3.99 |
| PBA Bounty | 3.88 |
| CIPAL0803 | 3.78 |
| Nipper | 3.74 |
| Nugget | 3.73 |
| PBA Jumbo | 3.70 |
| CIPAL0802 | 3.64 |
| Aldinga | 3.53 |
| Boomer | 3.48 |
| PBA Blitz | 3.43 |

lsd(P<0.05)Var = 0.32.

### Key Findings and Comments

Although not clearly demonstrated in this trial previous results at various sites across southern Australia have demonstrated that earlier maturing lines generally displayed less yield loss in crop-topping treatments than later maturing types.

## L12 Sowing Time x Disease Management, MRZ Wimmera (Rupanyup), Victoria

**Aim**

To investigate the adaptability of a range of lentil varieties and variety mixes to varying sowing dates with and without disease management.

**Treatments**

Varieties: Aldinga, Boomer, Nipper, Northfield, Nugget, PBA Blitz, PBA Flash, PBA Jumbo, CIPAL0801, CIPAL0802, CIPAL0803, CIPAL0901.

Variety Mixes: PBA Flash:Nipper, PBA Flash:Nugget, PBA Flash:PBABlitz, PBA Flash:CIPAL0901. All sown with a 50:50 ratio based on targeted plants/m$^2$.

Sowing dates: 16 May (Early), 6 June (Mid), 23 June (Late).

Fungicide Regimes:

| Regime | Chemical & Application Rate[1] | Timing |
|---|---|---|
| Fortnightly | chlorothalonil 500 @ 2 L/ha | Fortnightly starting 6 weeks after emergence. |
| Nil | Nil | Nil |

**Other Details**

Row Spacing/Stubble: 30 cm row spacing, inter-row, standing stubble.

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

Plant Density: 120 plants/m$^2$.

*Results of this trial have been presented together with results from trial L13 (Lentil varieties on burnt stubble) to allow comparison between burnt and standing stubble treatments.*

**Results and Interpretation**

- Key Message: Earlier sowing and standing residue was important to maximising grain yield in lentils in the Wimmera. Mid to mid/late maturing varieties like CIPAL0803 and PBA Jumbo, where highest yielding in the 2011 season with mild conditions and significant stored moisture.

- Plant establishment – Establishment for all lentil varieties was adequate in 2011 ranging from 80-110plants/m$^2$ (data not shown).

- Biomass – Biomass at maturity ranged for 3.8 t/ha to 14 t/ha dependant on sowing date (Table L12.1). There was no effect disease management on biomass, so results presented focus on the overall response across sowing dates. There was a 30% drop in biomass (11.11 t/ha to 7.62 t/ha) from 16 May sown treatments to the 6 June sown treatments and a further 17% drop (to 5.77 t/ha) to the 23 June sown treatments. All varieties generally responded similarly. Boomer had the highest or second highest biomass at all sowing dates, while Northfield generally had the lowest biomass. In the trial conducted on the burnt stubble (see L15 for details) at one sowing date (10 May), biomass was generally 15% less than the standing stubble treatment sown 16 May (Table L12.1). All varieties had similar biomass (9-10t/ha), except PBA Flash and PBA Blitz, which were lower, and CIPAL0803, which was higher, in the trial on the burnt stubble. It was also notable that most varieties matured approximately 10 days earlier than observed in 16 May sown treatment in the standing stubble trial.

- Grain Yield – Grain yields were excellent, indicative of expectations from biomass measurements, and ranged from 1 t/ha for Northfield sown June 23 to 4.6 t/ha for PBAJumbo sown May 16 (Table L14.2). There was no effect disease management on grain yield, so results presented focus on the overall response across sowing dates. The grain yield decrease across sowing dates was highly significant. The June 6 treatments averaged 20% lower yield than May 16, while June 23 treatments were 60% lower yielding than the June 6 treatments. Unlike Curyo the interaction between sowing date and variety was significant, indicating that varieties responded differently across sowing dates. The only varieties or mixes to show no significant difference from the highest yielding variety at all sowing dates, were PBA Jumbo, Nugget, CIPAL0803, and the mix PBAFlash:CIPAL0901 (Table L12.2). Northfield had significantly lower grain yields at all sowing dates.

In the trial conducted on the burnt stubble at one sowing date (10 May) the average grain yield was 20% less than the standing stubble treatment sown 16 May (Table L12.2), which is similar to delaying sowing to June 6 in standing stubble. CIPAL0901 had the great reduction in grain yield (37%) on the burnt stubble and CIPAL0803 and PBA Jumbo had the least reduction in grain yield (8% and 10%, respectively).

- Grain Weight – Grain weight did not change with delayed sowing for any of the varieties.

**Table L12.1.** The effect of the interaction between sowing date and lentil variety on biomass (t/ha) sown in standing stubble at Rupanyup in 2011. Results from the variety trial sown on burnt stubble (L13) have been included for comparison in the final column. Each trial was analysed independently and results in table have been ranked according to grain yields from the 16 May sowing date treatment.

| **Variety / Variety mix** | **16 May** | **6 June** | **23 June** | ***Average*** | **Burnt (10 May)** |
|---|---|---|---|---|---|
| PBAJumbo | 12.04 | 8.13 | 6.79 | *8.99* | 10.08 |
| PBAFlash:PBABlitz | 11.01 | 7.20 | 7.00 | *8.40* | 9.37 |
| Nugget | 13.84 | 7.92 | 5.04 | *8.93* | 9.27 |
| PBAFlash:CIPAL901 | 9.03 | 7.78 | 6.15 | *7.65* | 9.75 |
| CIPAL0803 | 11.37 | 9.62 | 3.91 | *8.30* | 12.42 |
| CIPAL0901 | 11.44 | 6.99 | 4.90 | *7.78* | 9.50 |
| Nipper | 10.90 | 7.30 | 5.59 | *7.93* | 8.90 |
| PBAFlash | 11.32 | 8.84 | 6.51 | *8.89* | 8.27 |
| PBAFlash:Nugget | 11.93 | 7.59 | 5.83 | *8.45* | 9.47 |
| PBABlitz | 10.15 | 5.91 | 5.80 | *7.29* | 7.98 |
| PBAFlash:Nipper | 8.71 | 6.34 | 5.10 | *6.72* | 9.45 |
| Boomer | 13.58 | 8.43 | 6.80 | *9.60* | 9.97 |
| Northfield | 10.19 | 6.52 | 3.82 | *6.84* | 9.39 |
| CIPAL0802 | 11.54 | 6.81 | 4.48 | *7.61* | 9.40 |
| CIPAL0801 | 8.46 | 8.35 | 7.19 | *8.00* | 9.22 |
| Aldinga | 12.25 | 8.12 | 7.39 | *9.25* | 9.29 |
| *Average* | *11.11* | *7.62* | *5.77* | *8.16* | *9.48* |

Trial L14: lsd(P<0.05)SDxVar = NS; lsd(P<0.05)SD = 2.12; lsd(P<0.05)Var = 1.61.
Trial L15: lsd(P<0.05)Var = 1.63

**Table L14.2.** The effect of the interaction between sowing date and lentil variety on grain yield (t/ha) sown in standing stubble at Rupanyup in 2011. Results from the variety trial sown on burnt stubble (L13) have been included for comparison in the final column. Each trial was analysed independently and results in table have been ranked according to grain yields from the 16 May sowing date treatment. The variety with the highest yield at each sowing date is underlined.

| Variety / Variety mix | 16 May | 6 June | 23 June | *Average* | Burnt (10 May) |
|---|---|---|---|---|---|
| PBAJumbo | 4.60 | 3.67 | 2.01 | *3.42* | 4.11 |
| PBAFlash:PBABlitz | 4.51 | 3.08 | 1.84 | *3.14* | 3.69 |
| Nugget | 4.51 | 3.77 | 1.93 | *3.40* | 3.18 |
| PBAFlash:CIPAL901 | 4.49 | 3.52 | 1.70 | *3.24* | 3.46 |
| CIPAL0803 | 4.41 | 3.92 | 1.53 | *3.29* | 4.04 |
| CIPAL0901 | 4.39 | 3.24 | 1.70 | *3.11* | 2.75 |
| Nipper | 4.31 | 3.31 | 1.56 | *3.06* | 3.43 |
| PBAFlash | 4.26 | 3.13 | 1.37 | *2.92* | 3.15 |
| PBAFlash:Nugget | 4.19 | 3.43 | 1.84 | *3.15* | 3.52 |
| PBABlitz | 4.18 | 2.96 | 1.69 | *2.94* | 3.42 |
| PBAFlash:Nipper | 4.17 | 3.01 | 1.37 | *2.85* | 3.50 |
| Boomer | 4.09 | 3.80 | 1.92 | *3.27* | 3.32 |
| Northfield | 4.06 | 3.09 | 1.05 | *2.73* | 3.07 |
| CIPAL0802 | 3.89 | 3.36 | 1.55 | *2.93* | 3.32 |
| CIPAL0801 | 3.77 | 3.90 | 1.79 | *3.15* | 3.35 |
| Aldinga | 3.70 | 3.43 | 1.59 | *2.91* | 2.99 |
| *Average* | *4.22* | *3.41* | *1.65* | *3.09* | *3.39* |

Trial L14: lsd(P<0.05)SDxVar = 0.57 except when comparing within a sowing date = 0.48.
Trial L15: lsd(P<0.05)Var = 0.63

## Key Findings and Comments

Due to extreme rainfall events during the summer of 2010/11, soil profiles were at or near field capacity at sowing in 2011. Unlike Curyo early growth at Rupanyup was not affected by the dyer period during May and June. Mild temperatures and sufficient rainfall during the main growth periods resulted in excellent grain yields (>4t/ha). The results, similar to Curyo, highlighted that earlier sowing is beneficial in lentils for all varieties. In 2011, the consistently highest yielding varieties PBA Jumbo, CIPAL0803, Nugget where all in the mid to mid/late maturity group, which could be expected given mild seasonal conditions and significant stored moisture. The earlier maturity varieties, which were consistently highest yielding through the drier seasons, generally had slightly lower yields relative to Nugget in 2011. As indicated previously the variety mixes were grown this year to assess whether we could improve yield stability by mixing different types of lentils together, which contain differentiating traits for maturity, and disease resistance. Results from Rupanyup were inconclusive, with no significant difference from the components of the mix in each situation. Further work will occur in 2012 to further investigate these responses.

The trial conducted on the burnt stubble highlighted the importance of residue when seasonal conditions are dry to maintain stored moisture. The main reason for reduced yields was likely to be greater evaporation from the soil surface, as evidenced from the earlier maturity of this trial indicates. The mid maturing varieties CIPAL0803 and PBA Jumbo had the least reduction in grain yield on the burnt stubble, possibly due to their vigorous growth habit earlier in the season.

## L13 Variety Comparison, MRZ Wimmera (Rupanyup), Victoria

**Aim**

To investigate the adaptability of a range of lentil varieties and variety mixes in a burnt stubble. This trial allows for comparison of varieties grown in the standing stubble on trial L14.

**Treatments**

| | |
|---|---|
| Varieties: | Aldinga, Boomer, Nipper, Northfield, Nugget, PBA Blitz, PBA Flash, PBA Jumbo, CIPAL0801, CIPAL0802, CIPAL0803, CIPAL0901. |
| Variety Mixes: | PBA Flash:Nipper, PBA Flash:Nugget, PBA Flash:PBABlitz, PBA Flash:CIPAL0901. All sown with a 50:50 ratio based on targeted plants/$m^2$. |

**Other Details**

| | |
|---|---|
| Sowing dates: | 10 May. |
| Row Spacings/: | 30 cm row spacing, inter-row, burnt stubble. |
| Fertiliser: | MAP + Zn @ 60 kg/ha at sowing. |
| Plant Density: | 120 plants/$m^2$. |

**Results and Interpretation**

Key Message: See discussion from trial L12

## 2. Chickpeas

**C1 Sowing Date x Disease Management, Yorke Peninsula (Arthurton), South Australia**

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

**Aim**

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

**Treatments**

Varieties: Genesis 079, Genesis 090, Genesis 114, PBA Slasher, CICA0603 and CICA0857

Sowing dates: 17 May (Early), 14 June (Mid)

Treatments: Nil – no fungicide applied
Podding – 2L/ha Chlorothalonil at Podding
Strategic – 2L/ha Chlorothalonil at 8-10 weeks, Early Flower and Podding.
Complete - 2L/ha Chlorothalonil fortnightly.

Fertiliser: MAP + Zn @ 90kg/ha

**Results and Interpretation**

- Foliar disease – There was no foliar disease observed in this trial in 2011, and fungicide treatments had no effect on grain yield.
- Grain Yield – Grain yield averaged 3.8t/ha across all varieties and sowing dates. A sowing date by variety response for grain yield was observed for Genesis079, Genesis114 and PBA Slasher, all of which yielded higher at the early sowing date (Figure C1.1). Of these varieties PBA Slasher showed the highest yield improvement from early sowing (13%).
  The potential desi release CICA0603 was the highest or equal highest yielding chickpea variety at both sowing dates. Genesis079 was the highest yielding kabuli variety sown early, and equal with CICA0857 at the late sowing date.
- Lodging – Lodging of chickpeas was high in 2011, particularly at the earlier sowing date (Table C1.3). CICA0857 and CICA0603 showed the highest amount of lodging, followed by Genesis079. These are the earliest maturing varieties, indicating a link between lodging and plant maturity. The late maturing erect kabuli type Genesis114 showed the lowest amount of lodging at harvest.

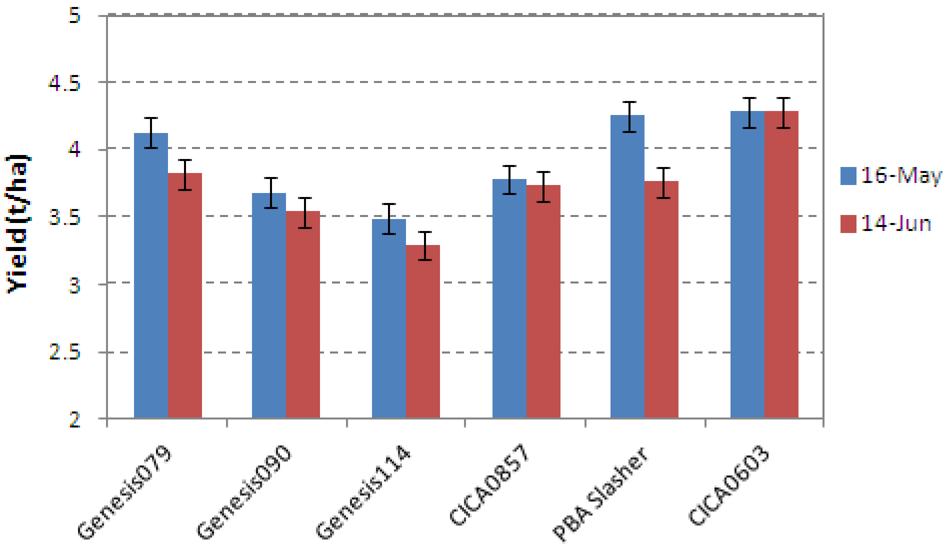


**Figure C1.1.** effect of sowing date on grain yield (t/ha) of chickpea varieties, Arthurton 2011.

**Table C1.1.** effect of sowing date on lodging (1-9) of chickpea varieties, Arthurton 2011
1 = prostrate,   9 = erect

| Variety | Genesis079 | Genesis090 | Genesis114 | CICA0857 | PBASlasher | CICA0603 |
|---|---|---|---|---|---|---|
| **16-May** | 4.8 | 5.9 | 7.8 | 2.9 | 6.7 | 3.3 |
| **14-June** | 7.8 | 8.6 | 9.0 | 7.6 | 8.1 | 6.7 |

lsd (P<0.05) SD x Variety = 0.65    (0.48 same SD)

**Key Findings and Comments**

- Chickpea yields were again high in 2011, averaging 3.8t/ha.
- Favourable growing conditions and minimal disease resulted in equal or higher yields from early sown treatments.
- Lodging of chickpeas was high in 2011, particularly where sown early. CICA0603, CICA0857 and Genesis079 were the most susceptible varieties to lodging.
- PBA Slasher and the potential chickpea release CICA0603 was the equal highest yielding desi varieties sown early, and CICA0603 yielded highest late.  Genesis079 was the highest yielding of the kabulis. CICA0857 also shows a lot of promise as a high yielding medium seeded kabuli, and may attract price premiums over smaller types based on its larger seed size.

## C2 Crop-topping/Desiccation, Yorke Peninsula (Melton), South Australia

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

### Aim

To identify optimum maturity profiles for improved suitability to crop-topping of chickpea.

### Treatments

Varieties: see Table C2.1
Sowing date: 27 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
Chemical: Paraquat at 800ml/ha
Fertiliser: MAP + Zn @ 90kg/ha

**Table C2.1.** Chickpea flowering and maturity ratings, Melton crop-top trial 2011.

| Variety | Type | Flower | Maturity |
|---|---|---|---|
| Genesis 079 | Kabuli | E | E-M |
| Genesis 090 | Kabuli | M | M |
| Genesis 114 | Kabuli | M-L | M-L |
| Genesis 509 | Desi | E-M | E-M |
| PBA HatTrick | Desi | M | M |
| PBA Slasher | Desi | M | M |
| Sonali | Desi | E | E |
| CICA0603 | Desi | E-M | E-M |
| CICA0717 | Desi | M | M |
| CICA1123 | Desi | M | M |
| 01-481*03HS010 | Desi | VE | E |
| 01-482*03HS009 | Desi | VE | E |
| 02-150C*04HS003 | Desi | E-M | M |
| 03-028C*04HS004 | Desi | E-M | M |

E = Early, M = Mid, L = Late

### Results and Interpretation

- Due to varying soil depth, and a relatively rapid finish in 2011, variable growth was observed over the trial in 2011. This carried through to variable grain yield across the trial, despite an acceptable cv value (9.9%). This can be seen from the low relative yield of untreated PBA HatTrick (all three Nil treatments were randomly located in poor areas) and the high percentage yield at the Recommended and Late crop-top timings (Table C2.2).
- Significant two way interactions (Timing x Variety) were observed for grain yield and grain weight (Table 2).
- Grain Yield – All cultivars showed yield loss from crop-topping at the Early timing (Table C2.2). Seven of the 14 varieties in this trial also showed significant yield loss from crop-topping at the Recommended timing. These included Sonali, Genesis 079, Genesis 090, Genesis 114, CICA0717, CICA1123, and the breeding line 02-150C*04HS003. Sonali also showed yield loss from crop-topping at the Late timing.
  There was no clear effect of maturity on crop-topping response in this trial in 2011, most likely due to the variable plant growth which occurred across the trial site. However the latest maturing varieties did show the highest yield losses at the Early timing, and the three earliest maturing cultivars showed no yield loss from crop-topping at the Recommended timing.
  Long term grain yield responses to crop-topping (Table C2.3) show a clear link between cultivar maturity and response to crop-topping. The earliest maturing varieties showed the lowest incidence of yield loss and the lowest average yield loss percentages at the Early and Recommended crop-top timing, and are therefore better suited to crop-topping than later

maturing varieties. However high average yield losses at the Recommended timing still confirm that chickpea are poorly suited to this practice.

- Grain Weight – grain weight does not generally influence profitability of pulses, however premiums are paid on seed size of kabuli chickpea. A close link exists between seed size and grain weight, and therefore grain weight was measured in this study to extrapolate the effect of crop-topping on seed size of chickpeas.
  All varieties showed reduced grain weight at the Early timing (Table C2.2), and ten of the 14 cultivars showed reduced grain weight at the Recommended timing. These were generally earlier maturing cultivars (breeders lines 01-482*03HS009, 01-481*03HS010 and the commercial cultivar Sonali), while the mid maturing breeders line 02-150C*04HS003 also showed no effect on grain weight from this treatment. The late maturing variety Genesis 090 was the only variety to show yield loss at the Late crop-top timing.
  Long term summary of crop-topping on grain weight (Table C2.3) shows a link between cultivar maturity and grain weight following crop-topping. Later maturing varieties Genesis 090 and Genesis 114 show more sensitivity to reduced grain weight from crop-topping, particularly at the Late timings. Decreased sensitivity in these varieties at the earlier timings may be due to the abortion of later developing flower and pods, greatly limiting grain yield by reducing total number of seeds per plant but with limited effect on grain weight.
- Grain Mould – The effect of crop-topping on occurrence of mould in grain samples was also investigated in the 2011 trials. Assessments of a number of varieties detected high levels of mould in the Early crop-top treatment (Table C2.4). Recommended and Late treatment timings had similar mould levels to the Nil. This data shows that maturity at timing of crop-topping is likely to be important in determining the incidence of mould in crop-topped chickpea crops.

**Table C2.2.** Effect of crop-top timing on grain yield and grain weight of chickpeas, Melton 2011 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 (2/11)** | **+ 2 wks[b] (10/11)** | **Nil** | **- 2 wks[a] (25/10)** | **Recommended (2/11)** | **+ 2 wks[b] (10/11)** |
| 01-482*03HS009 | 2.1 | 58 | 96 | 97 | 20.0 | 60 | 90 | 100 |
| 01-481*03HS010 | 2.6 | 52 | 89 | 99 | 27.6 | 64 | 93 | 96 |
| CICA0603 | 2.7 | 55 | 93 | 94 | 21.7 | 60 | 85 | 98 |
| Sonali | 2.9 | 43 | 69 | 78 | 18.1 | 68 | 92 | 102 |
| Genesis 079 | 2.8 | 44 | 80 | 94 | 23.2 | 72 | 90 | 101 |
| Genesis 509 | 2.5 | 44 | 87 | 97 | 16.6 | 57 | 81 | 98 |
| CICA0717 | 2.9 | 47 | 84 | 87 | 24.3 | 62 | 87 | 99 |
| 02-150C*04HS003 | 2.5 | 50 | 85 | 99 | 19.4 | 54 | 93 | 103 |
| 03-028C*04HS004 | 2.6 | 51 | 93 | 104 | 22.2 | 61 | 83 | 91 |
| CICA1123 | 2.6 | 43 | 81 | 89 | 35.4 | 51 | 88 | 102 |
| PBA Hatrick | 1.8 | 55 | 114 | 137 | 20.5 | 60 | 83 | 93 |
| PBA Slasher | 2.2 | 50 | 91 | 118 | 18.6 | 73 | 82 | 97 |
| Genesis 090 | 2.2 | 40 | 77 | 100 | 32.3 | 83 | 83 | 91 |
| Genesis 114 | 2.1 | 38 | 65 | 99 | 38.3 | 95 | 85 | 93 |
| **Mean** | **2.46** | **1.18** | **2.09** | **2.42** | **24.1** | **16.2** | **21.0** | **23.4** |

lsd (P<0.05)timing.var = 0.33, (Grain Yield), 2.0 (Grain Weight)

NB: Shading denotes significant difference from the Nil treatment.

[a] = 2 weeks prior to Recommended timing

[b] = 2 weeks after Recommended timing

**Table C2.3.** Long term summary (2008-2011) of grain yield response of selected chickpea cultivars to crop-topping. Varieties are ranked according to their visual maturity rating from earliest to latest.

| Variety | Incidence of significant yield losses (# trials) | | Average Yield [Range] (% of Control) | | Incidence of significant grain weight loss (# trials) | | | Average Grain Weight [Range] (% of Control) | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Early | Rec. | Early | Rec. | Early | Rec. | Late | Early | Rec. | Late |
| CICA0603 | 4 (4) | 2 (4) | 49 [31-68] | 81 [74-93] | 2 (4) | 2 (4) | 0 | 82 [60-97] | 87 [80-99] | 97 [93-99] |
| Genesis 079 | 4 (4) | 3 (4) | 48 [25-81] | 82 [71-96] | 3 (4) | 2 (4) | 0 | 83 [72-95] | 95 [86-104] | 101 [99-104] |
| PBA Slasher | 4 (4) | 3 (4) | 45 [30-64] | 78 [65-91] | 2 (4) | 2 (4) | 0 | 83 [73-92] | 85 [78-96] | 98 [94-101] |
| Genesis 090 | 4 (4) | 4 (4) | 40 [25-61] | 77 [64-84] | 3 (4) | 2 (4) | 3 | 87 [79-96] | 88 [83-93] | 94 [91-97] |
| Genesis 114 | 4 (4) | 3 (4) | 38 [17-57] | 81 [65-94] | 3 (4) | 3 (4) | 1 | 90 [83-96] | 94 [85-102] | 96 [90-104] |

**Table C2.4.** Effect of crop-topping timing on incidence of mould on chickpea seed (# infected seeds/sample) at Melton, SA 2011.

| **Treatment Timing** | **Early** | **Recommended** | **Late** | **Nil** | **LSD (0.05)** |
|---|---|---|---|---|---|
| No. Infected seeds/sample | 25.8 | 4.4 | 2 | 7.1 | 7.9 |

**Key Findings and Comments**

Chickpea are generally considered to be unsuited to crop-topping due to their high yield losses, and are the least suited of the four pulse crops commonly grown in South Australia. This work aims to identify plant types and maturity profiles which may be better suited to this practice.

Variable early season growth arising from variable soil depth resulted in variable grain yield across the trial, and may have resulted in a lower correlation between variety maturity and yield losses from crop-topping than in previous seasons. In previous seasons yield losses have been observed in all varieties at the Early treatment timing and Recommended timings. Some varieties in 2011 did not show yield loss from crop-topping at the Recommended timing, although a similar trend was observed to previous seasons where earliest maturities generally showed less yield loss, and latest maturities generally showed the highest yield losses. Long term grain yield summary showed less yield loss in earlier maturing cultivars. However chickpea are still poorly suited to this practice due to their unacceptably high yield losses compared to other pulse crops at the ideal timing for ryegrass control and this practice is not recommended.

Grain weight response from crop-topping in 2011 aligned much more closely with cultivar maturity. Earliest maturities showed no reductions in grain weight at the Recommended timing, while latest maturities showed highest weight loss at all timings. Long term grain weight analysis also support these results. The common commercial cultivar Genesis 090 showed greater sensitivity of grain weight to crop-topping applications than most other cultivars, particularly at the Late treatment timing, indicating that it may be subject to price penalties where this agronomic practice is used.

Incidence of field mould in grain samples has become an important issue for growers, and appears to be highly season dependent. However, preliminary results from the 2011 trials have shown that mould in chickpea samples may be associated with crop-topping while plants are still immature. This finding may have implications when crop-topping paddocks which may have varying levels of crop maturity due to variable soil types. Work is ongoing in this area.

The Pulse Breeding Australia Chickpea breeding program is committed to producing chickpea varieties with improvements in varietal performance and better suitability to common agronomic practices such as crop-topping. A recent focus has been on the development of varieties with earlier maturity, which will be better suited to this practice. These varieties will be evaluated over the coming years.

## C3 Sowing Time x Plant Population, H-MRZ, Wagga Wagga, NSW

### Aim

To test the yield response of six chickpea varieties across 2 different sowing times (TOS) and three 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 090.<br>Desi – Genesis 509, PBA Slasher, PBA Hattrick, PBA Boundary, CICA0603 (PBA Striker). |
| Sowing dates: | 10th May and 14th June 2011. |
| Plant populations: | Targeted 15, 30 & 45 plants/$m^2$. |
| Row Spacing/Stubble: | 30 cm into standing light stubble. |
| Fertiliser: | Legume Starter @ 115 kg/ha at sowing. |
| Fungicide: | Seed dressed with P-Pickle T. |

### Results and Interpretation

The results for grain yield show that effects of variety, plant population, variety x TOS, variety x plant population were all significantly different ***(P<0.05)***. All other effects and interactions were not statistical different.

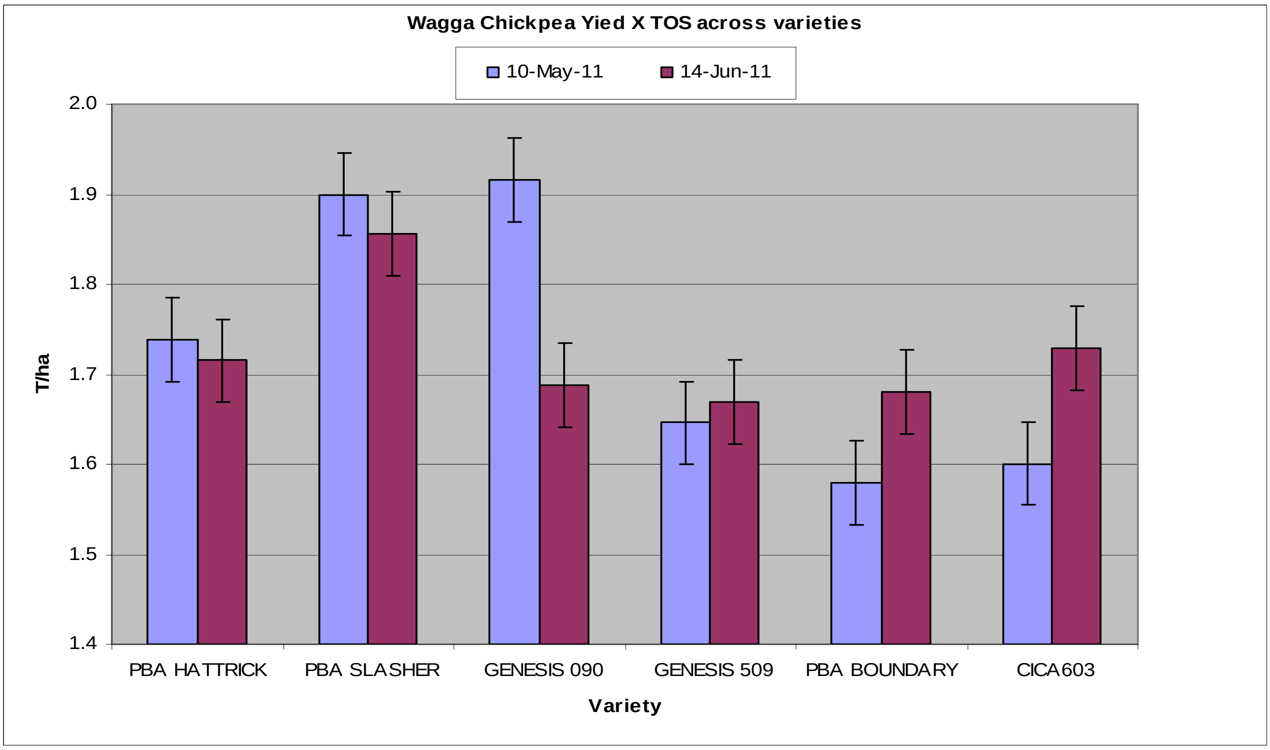


**Figure C3.1.** Effect of variety on grain yield (t/ha) across time of sowings.

Sowing time affected varieties differently; yield of Gen 090 fell away rapidly with delayed sowing, yield of PBA Boundary & CICA0603 increased with delayed sowing while the remaining varieties behaved indifferent for reasons that are unclear.

PBA Slasher was the highest and most stable yielder overall. Genesis 090 followed, particularly at the earliest sowing. Yield of other varieties were around 10% behind (P<0.005).

Previous years studies demonstrate the highest and most stable yields of chickpea in most seasons across southern NSW result from early May sowing.

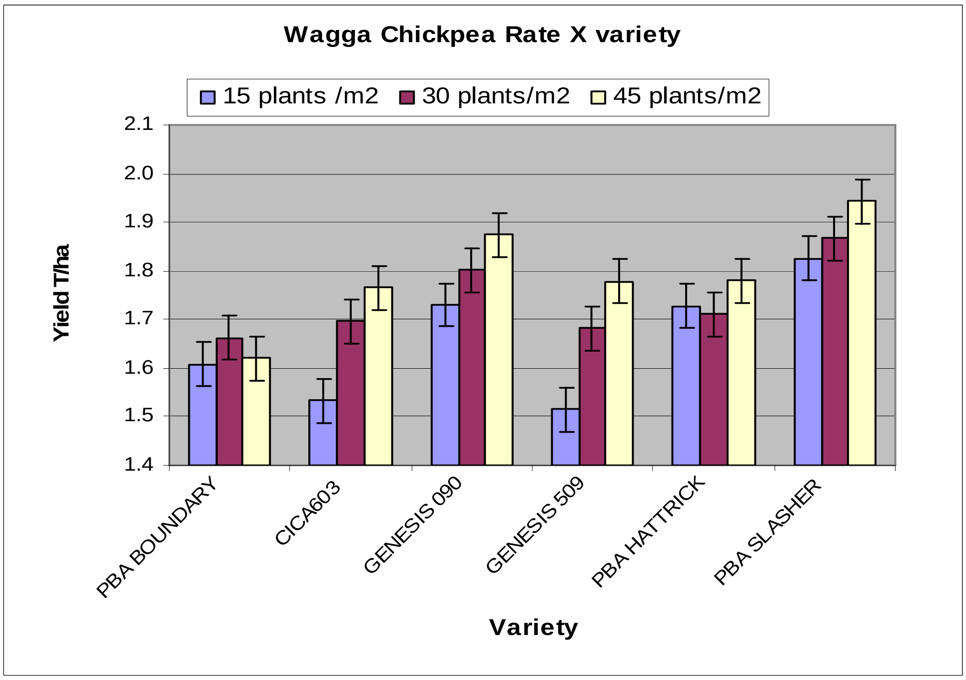


**Figure C3.2.** The effects of plant density and variety on grain yield (t/ha).

A positive and significant response was detected with increasing plant populations averaged across TOS and varieties. On closer inspection, whilst the difference was significant, there was only small differences at the higher rates of 30 & 45 plants/$m^2$. From previous work and across a range of seasons, a population of between 30 & 45 plants would be considered optimum.

In milder winter seasons, higher populations lead to increase disease pressure, and potentially lodging issues. This situation leads to ineffective penetration of fungicides into the canopy.

At the other end, low densities (irrespective of TOS) result is low grain yields. Therefore growers need to ensure that plant populations of >30plant/$m^2$.

**Lodging**

Delayed sowing and increasing density increases plant lodging in chickpea (see Figure C3.3). Lodging scored: 1 = erect; 5 = flat on the ground.

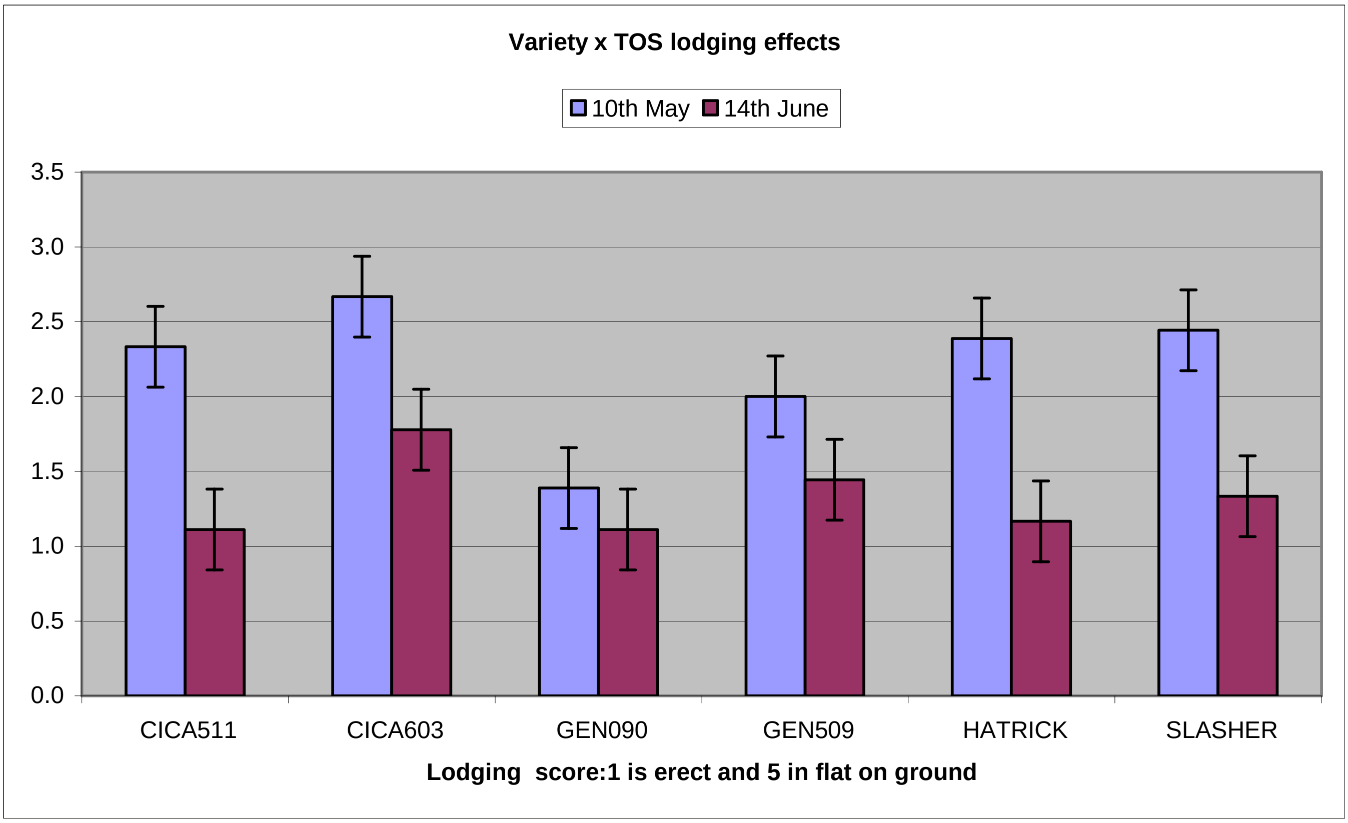


**Figure C3.3.** The effect of variety & TOS on lodging in chickpea.

## Key Findings and Comments

- PBA Slasher is consistent the highest & most stable yielding variety across different sowing dates on acidic red brown soils in southern NSW.
- Target early May sowing in southern NSW to maximise grain yield.
- Low plant populations (<30plant/m$^2$) decrease grain yields. Excessively high populations, particularly in favourable seasons, increase lodging and disease risks.

## C4 Sowing Date x Plant Population, LRZ (Yenda), NSW

**Aim**

To test the yield response of six chickpea varieties across 2 different sowing times (TOS) and three 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 090.<br>Desi – Genesis 509, PBA Slasher, PBA Hattrick, PBA Boundary, CICA0603. |
| Sowing dates: | 19th May and 22nd June. |
| Plant populations: | Targeted 15, 30 & 45 plants/m$^2$. |
| Row Spacing/Stubble: | 30 cm into standing light stubble. |
| Fertiliser: | Legume Starter @ 115 kg/ha at sowing. |

**Results and Interpretation**

There was significant effects ***(P<0.05)*** of variety, plant population and plant population x time of sowing detected in this trial. All other effects and interactions were not statistical different. There was a small time of sowing effect detected at the *P<0.08* level.

**Table C4.1.** The effect of variety on grain yield (t/ha) across time of sowings and plant populations.

| **Variety** | **Grain yield T/ha** |
|---|---|
| PBA Boundary | 1.64 |
| CICA0603 | 1.85 |
| Genesis 090 | 1.90 |
| Genesis 509 | 1.78 |
| PBA Hattrick | 1.81 |
| PBA Slasher | 1.92 |
| **LSD *(P<0.05)*** | 0.27 |

As can be seen in the above Table, there were small yield differences across varieties. As with previous studies, PBA Slasher has shown to be the highest yielding; this is consistent with all other trials in this region.

When looking further into the data, the interactions of TOS and plant populations show interesting but predictable results. This result shows a general yield decline with the lower plant population treatments across both TOS. However the difference is greater with late TOS.

With both planting dates in 2011, there is no yield advantage with increasing plant population beyond 30plants/m$^2$. There is however a significant yield advantage by sowing earlier in the sowing window. With previous year's studies, it has been suggested that early May is the optimum sowing window.

Results over the past few seasons (2008-2011) indicates that late April-early May is the optimal time to plant in this region. Sowing earlier than this can be predisposed to disease, particularly ascocyta, and can lead to excessive vegetative growth resulting in poor pod set and lodging.

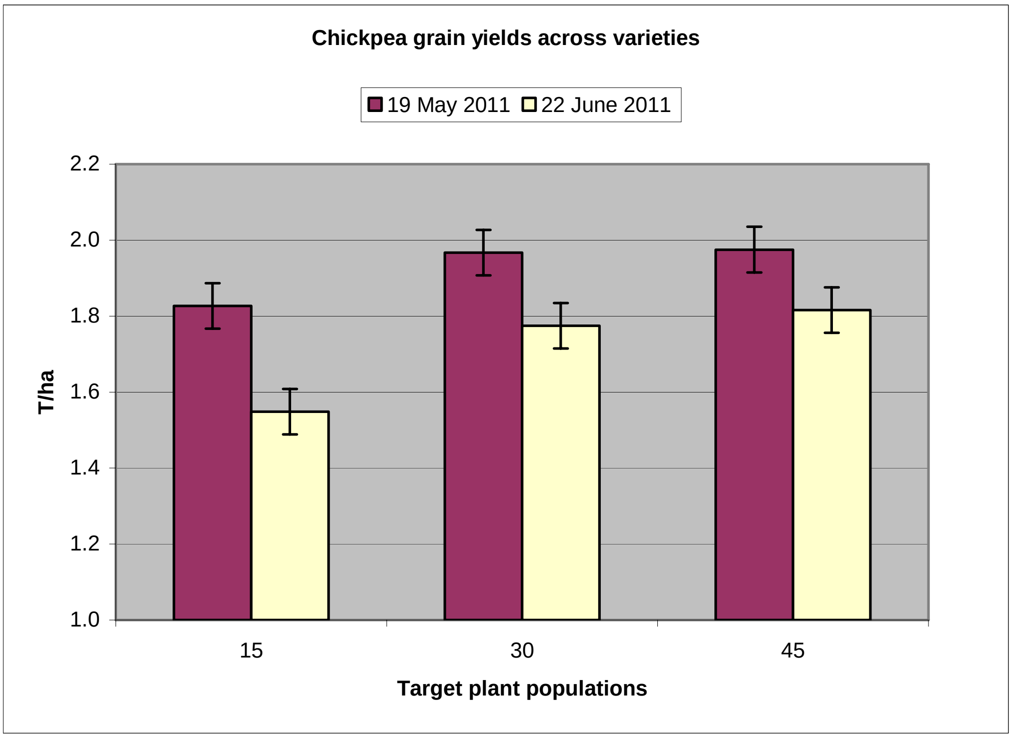


**Figure C4.1.** The effect of TOS and plant populations on grain yield (t/ha) across varieties.

**Seedsize**

Variety x TOS x target plant population were significantly different (***P<0.005***). The kabuli line, Genesis 090 had a larger seed size (as expected) than the Desi lines which varied between 13-17g/100 seeds. Genesis 509 had the smallest seeds (13g/110seeds). Sowing time effects were quite marked especially in the Kabuli variety where the late sowing had larger seeds which were also the case for PBA Boundary. The early sown CICA0603 and Hattrick had significantly larger seed sizes in the early sowing, however Genesis 509 and Slasher were very similar across sowing dates.

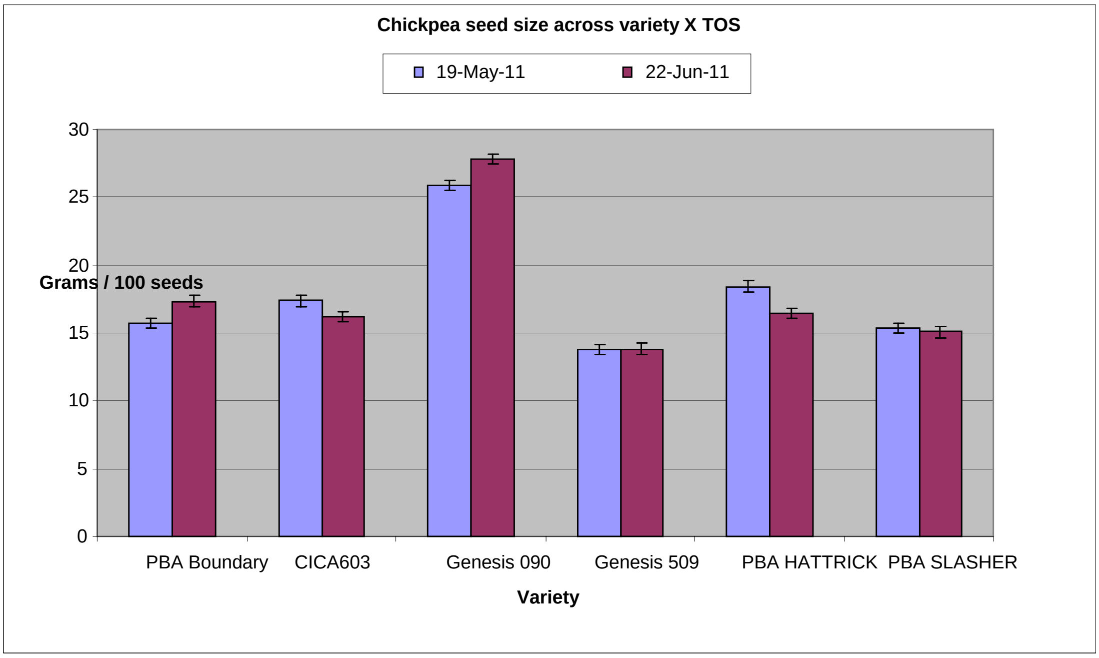


**Figure C4.2.** The effect of TOS on grain yield (t/ha) across varieties and plant populations.

**Key Findings and Comments**

- Early sown chickpea in a LRZ were generally higher yielding than the mid June sowing date.
- PBA Slasher again topping the grain yields across sowing dates and plant populations.
- Plant populations of 30 plants/m$^2$ show significant advantage over 15plants/m$^2$. There was not yield advantage in sowing heavier and achieving 45 plants/m$^2$.

## C5 Fertiliser Rate x Fertiliser Placement, LRZ Yenda, NSW

**Aim**

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

**Treatments**

| | |
|---|---|
| Varieties (2): | Desi - PBA Slasher. |
| | Kabuli – Genesis 090. |
| Fertiliser rate (4): | Nil, 10, 20 & 30kg/ha of Phosphorus. |
| Fertiliser type: | Single super |
| Sowing dates: | 16th May |
| Row Spacing/Stubble: | 30 cm into standing light stubble. |
| Fertiliser placements: | Sown with seed in same sowing boot (WITH) |
| | Sown separately to seed (AWAY) |
| Plant density: | 35 plants/$m^2$ |

**Results**

**Plant establishment**

There were highly significant effects of fertiliser rates and placement detected across all treatments. There was also a slight effect detected between varieties (Desi v Kabuli) on plant establishment. Increasing rates on fertiliser reduced plant establishment when banded with the seed.

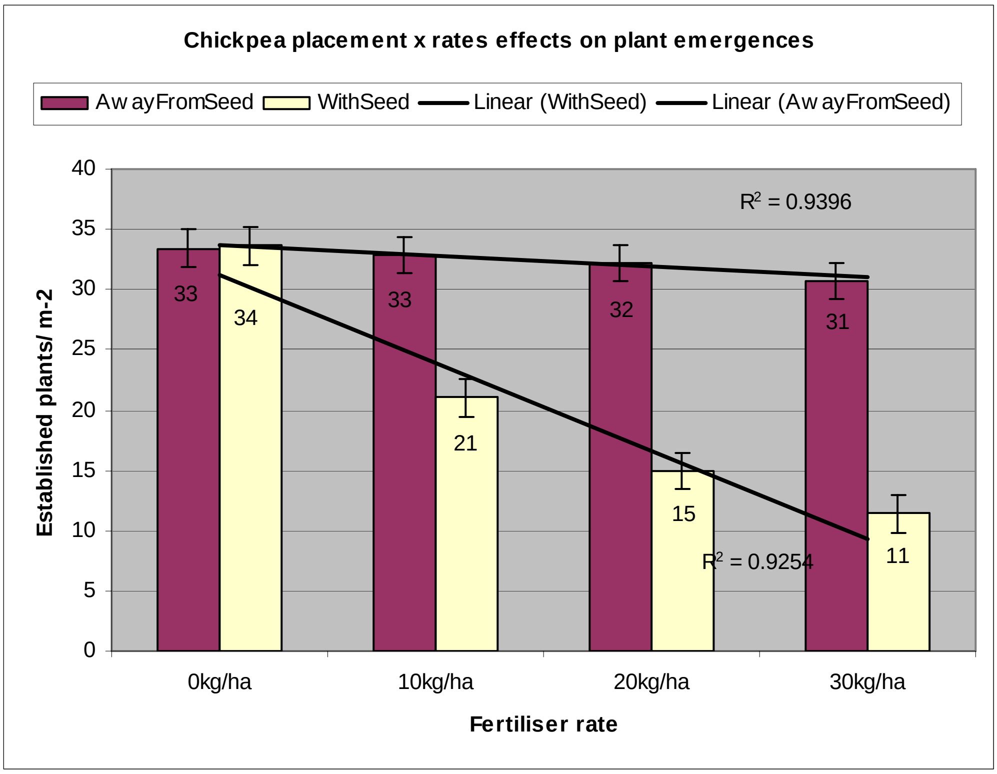


**Figure C5.1.** The effects of fertiliser rate and placement on chickpea emergence averaged across varieties.

Generally there was 39%, 55% and 67% reduction in plant establish when the seed was sown with the fertiliser at 10, 20 and 30kg/ha of fertiliser.

As can be seen below, there was a strong variety effect on establishment from fertiliser placement and rate. Genesis090 a kabuli had a severely reduced establishment rate. However it can be clearly stated that both varieties suffered severe plant establishment losses from fertiliser placement and with increasing fertiliser rates.

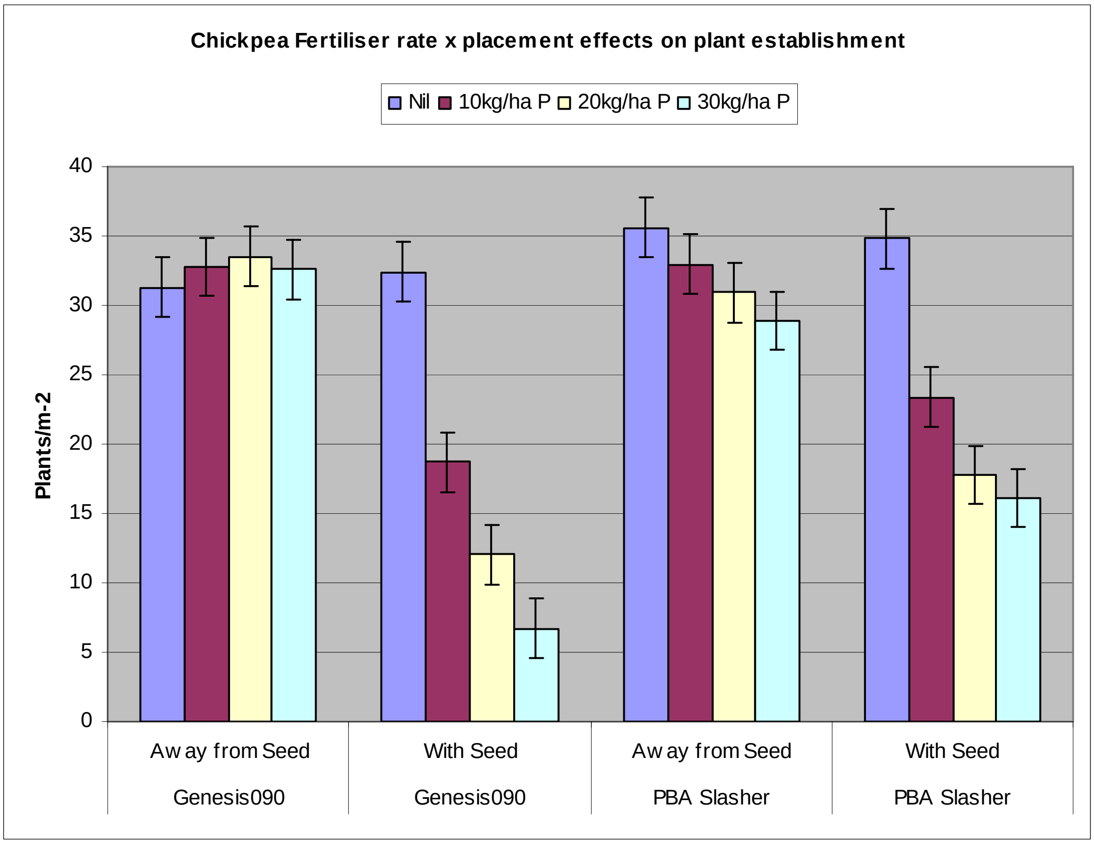


**Figure C5.2.** The effects of fertiliser rate and placement on chickpea emergence within varieties.

**Yield results**

There was a highly significant interaction effect detected for variety x location x rate for this trial. There was also a significant effect within variety from the location of fertiliser. All other effects were found not to be significant at the 5% confidence level.

As can be seen below with PBA Slasher, there were yield increases achieved by all treatment over the nil fertiliser treatment except for the maximum rate treatment which was placed with the seed. This was not statistically different from the nil treatment.

Interestingly, the kabuli Genesis090 showed greater sensitivity and yield declines with the fertiliser placements. All amounts of fertiliser placed with the seed had a significant negative effect of kabuli grain yields

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

At the 10kg/ha, despite the reduction in plant numbers, this did not impede the grain yields compared to the fertiliser away treatment. At 10kg/ha of P there was not difference detected.

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

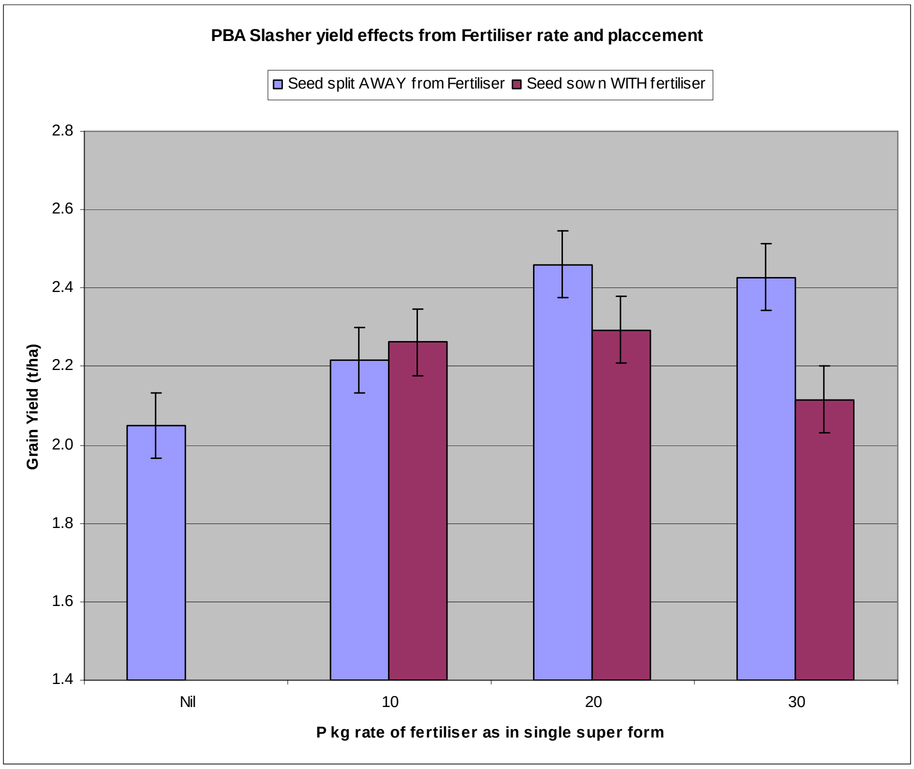


**Figure C5.3.** The effects of fertiliser rate and its placement on desi type PBA Slasher grain yields.

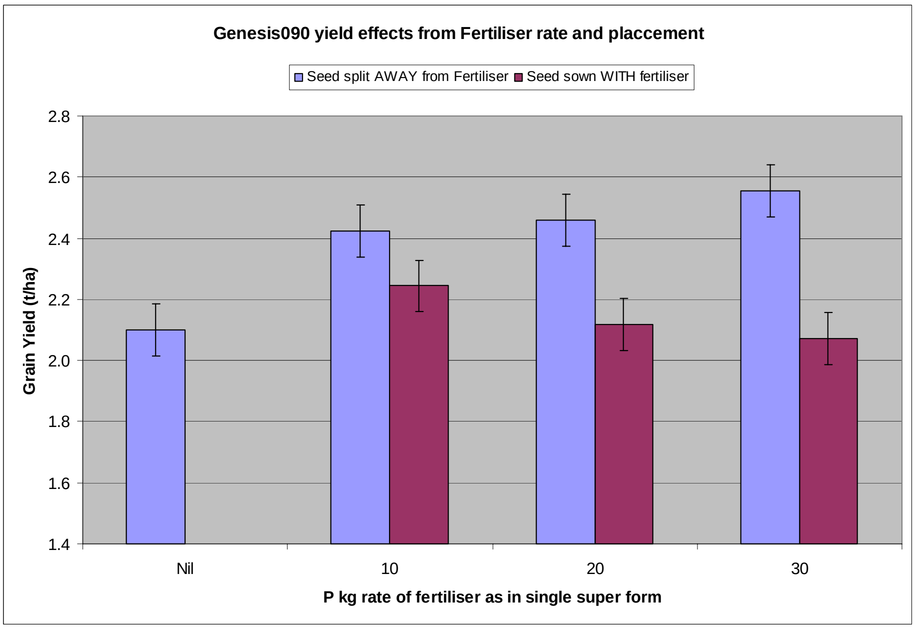


**Figure C5.4.** The effects of fertiliser rate and its placement on kabuli type Genesis 090 grain yields

This research whilst is only one year could lead to possible explanation of why some southern NSW growers have had difficulty getting the crop established successfully especially with the kabuli types.

Further work is required to validate this research over different soil types and seasons. The use of other fertilisers would also help validate the findings.

Irrespective of this, there is merit from this trial that show the effects of fertiliser damage on plant emergence and associated grain yields.

**Summary**

- Both desi and kabuli chickpea varieties suffered severe plant establishment reductions from fertiliser placement with the seed and with increasing fertiliser rates.
- All amounts of fertiliser placed with the seed had a significant negative effect of kabuli grain yields.
- Desi type PBA Slasher can tolerate low rate of fertiliser with the seed.
- Yields increased with fertiliser rate up to about 20kg/ha of P in this particular season and soil type
- More work is required to further validate and extend these findings.

## C6 Sowing Time, LRZ Southern Mallee (Curyo), Victoria

**Aim**

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

**Treatments**

| | |
|---|---|
| Varieties: | Genesis090, Genesis079, Genesis114, Genesis509, PBASlasher, Almaz, CICA0604, CICA0857. |
| Sowing dates: | 4 May (Early), 27 May (Mid), 22 June (Late). |

**Other Details**

| | |
|---|---|
| Row Spacings/Stubble: | 30 cm row spacing, inter-row, standing stubble. |
| Fertiliser: | MAP + Zn @ 40 kg/ha at sowing. |
| Plant Density: | 30 plants/m$^2$. |

**Results and Interpretation**

- Key Message: Earlier sowing in the Mallee is critical to maximising grain yield in chickpeas.

- Plant establishment – Establishment for all chickpea varieties was poor in 2011, primarily due to a mouse plague. Generally densities ranged between 10 and 25 plants/m$^2$ (data not shown).

- Mouse Damage – Significant mouse damage was observed across the trial and each plot was scored for damage on a percentage scale. Mouse damage was used as a covariate in the grain yield analysis.

- Grain Yield – Similar to lentils grain yields were excellent, despite the poor establishment, ranging between 1.5 and 2.6 t/ha (Fig C6.1). There was no interaction between sowing date and variety, however the main effects were significant. Generally, the June 22 sowing date resulted in lowest yield, while there was no difference between the May 4 and May 27 sowing dates. PBA Slasher, Genesis090 and CICA0604 had the highest average grain yields across the 3 sowing dates. Only Geneisis509 had significantly lower grain yield.

- Grain Weight – Similar to grain yield, grain weights were excellent in 2011. Sowing date generally had minimal effect on grain weight in 2011 (Fig C6.1), with the only noticeable trend in Genesis079, were grain weight increased as sowing was delayed.

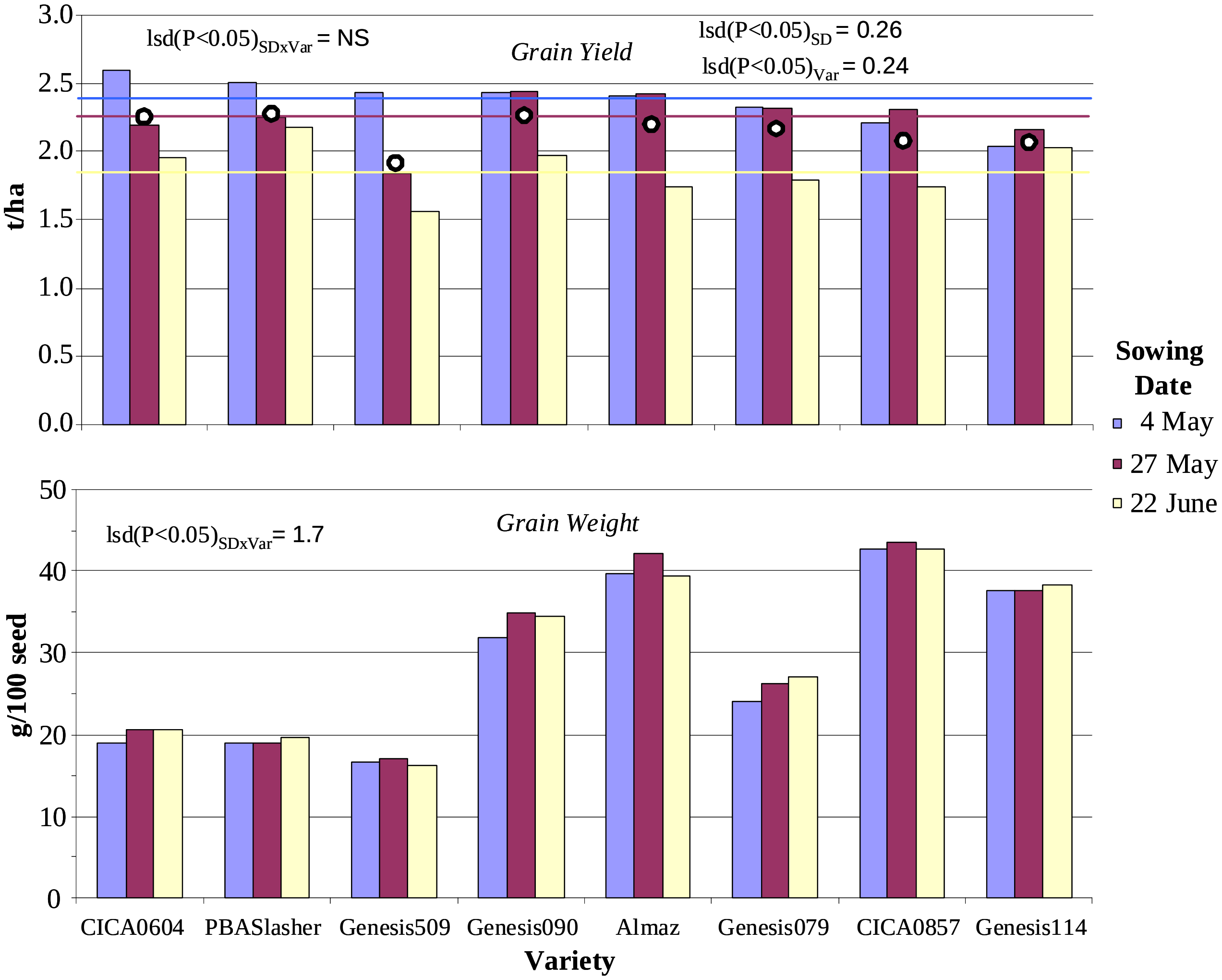

**Figure C6.1.** The effect of the interaction between sowing date and chickpea variety on grain yield and grain weight at Curyo in 2011. Mean sowing date grain yield indicated by horizontal lines; mean variety grain yield indicated by circles.

**Key Findings and Comments**

Due to extreme rainfall events during the summer of 2010/11, soil profiles were at or near field capacity at sowing in 2011. Early growth at Curyo was restricted due to a dry period during May and June, however this does not appear to have had any significant impact on grain yield. Unfortunately, the mouse plague at sowing had a significant impact on establishment, despite multiple application of mouse bait (ie. the site was baited 6 times from late April through to the end of June). Fortunately, due to mild temperatures and sufficient rainfall during the main growth periods excellent grain yields were achieved. The results again highlighted that earlier sowing in the Mallee is critical to maximising grain yield in chickpeas. In mild seasonal conditions the Kabulis types are like to be far more profitable due to the higher prices received to the larger sized grain.

## C7 Row Spacing x Disease Management x Stubble, MRZ Wimmera (Rupanyup), Victoria

**Aim**

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

**Experimental Treatments**

Varieties: Genesis 090, Genesis 079, Genesis 114, Kalkee, 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: 30 cm row spacing, standing stubble (ST30),
30 cm row spacing, burnt stubble (B30),
60 cm row spacing, inter-row, standing stubble (ST60),
60 cm row spacing, inter-row, burnt stubble (B60).

*Note: Stubble treatments were sown as independent trials.*

**Other Details**

Sowing date: 10 May (burnt stubble); 17 May (standing stubble).
Fertiliser: MAP + Zn @ 60 kg/ha at sowing.
Plant Density: 35 plants/m$^2$.

**Results and Interpretation**

- Key Message: Under higher disease pressure it is still economically beneficial to actively manage ascochyta blight through regular fungicide application even in moderately resistant varieties.

- Establishment – Visually, establishment for all varieties in the burnt stubble trial was excellent, except for Kalkee which was variable and low in some treatments. In the standing stubble trial, there was significant rabbit damage (grazing), which delayed early growth. Plants were able to reshoot and recover.
- Ascochyta Blight Damage – Due to suitable winter and spring time conditions, ascochyta blight was present at high levels in the susceptible variety (Howzat) in the trial on burnt stubble. However, in the standing stubble trial, due to the rabbit damage and delayed growth, symptoms of damage were delayed and significantly less. Therefore, data for disease scores has only been presented for the trial in the burnt stubble. Unlike 2010, ascochyta blight symptoms were the same in both row spacing's, so data presented is based on the interaction between fungicide regime and variety only (Fig C7.1). In the 'nil' treatment Genesis 090 showed only slight symptoms of disease, while Howzat was almost completely killed. Moderate disease symptoms (score between 3 and 5) were observed in all other varieties except PBASlasher, which was slightly worse than Genesis090. The podding fungicide regime only slightly reduced disease symptoms in most varieties, however significant reduction in disease were seen with the strategic and fortnightly regimes (Fig C7.1). In the strategic regime, disease scores were reduced to less than 3 in all varieties except Howzat, indicating a low presence of disease. In the fortnightly treatments, almost no disease was seen in all varieties except Howzat, which still had a low level present (Fig C7.1).

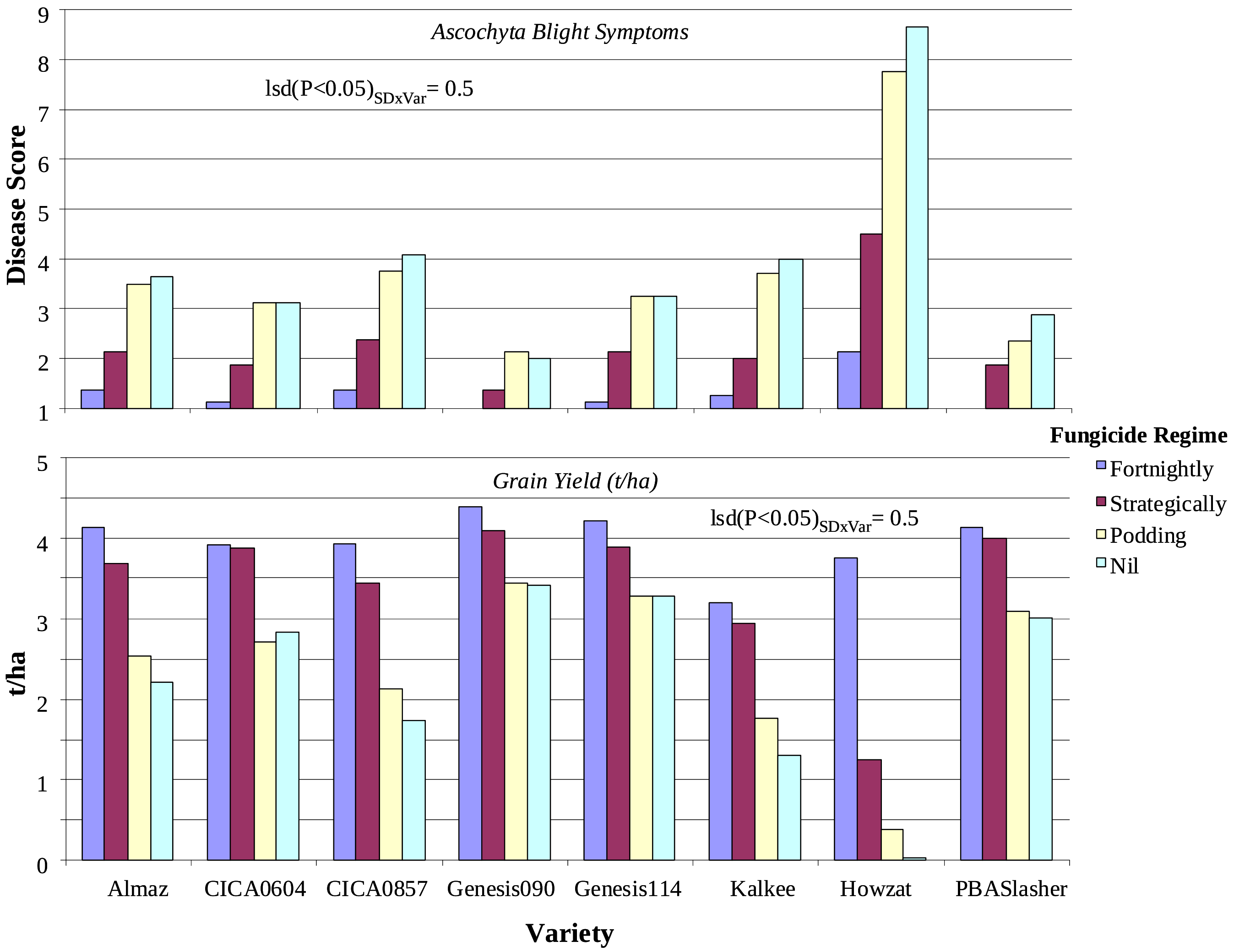


**Figure C7.1.** The interaction effect of fungicide regime and variety on ascochyta blight damage score (1 – no symptoms present, 9 – complete plot death) and grain yield of chickpeas in burnt stubble at Rupanyup in 2011.

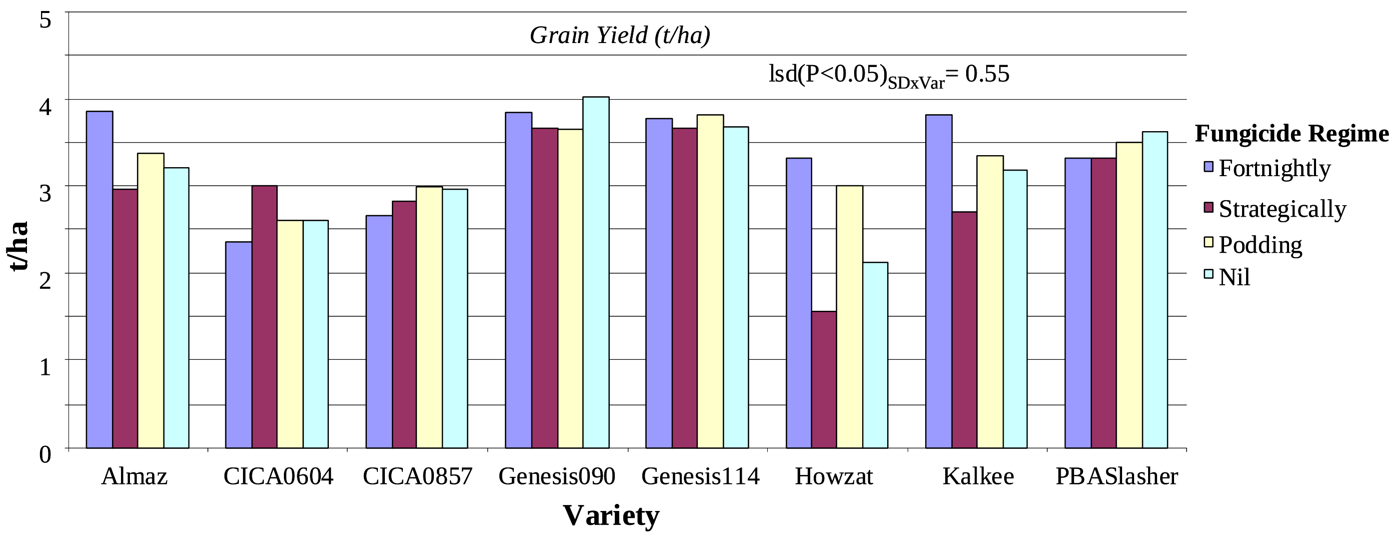


**Figure C8.2.** The interaction effect of fungicide regime and variety on grain yield of chickpeas in standing stubble at Rupanyup in 2011.

- Grain Yield – Grain yields on burnt stubble in 2011 were relatively high ranging from 3.2 to 4.4 t/ha in the fortnightly fungicide regime (Fig C7.1). Grain yields were similar in both row spacing's, so data presented is based on the interaction between fungicide regime and variety only. Trends in grain yield across fungicide regimes in the trial were similar to ascochyta scores.

Grain yield loss in the nil treatment compared with fortnightly ranged from approximately 20% in Genesis090 and Genesis114 to 100% in the susceptible variety Howzat. The podding fungicide application had almost no effect on relative grain yield loss, while the strategic application reduced grain yield losses to less than 10% in all varieties except Howzat and Almaz. Grain from this trial was also assessed for the presence of ascochyta blight and indicated little disease despite the high disease pressure experienced throughout the growing season.

Despite the early setback from rabbit grazing in the trial sown on standing stubble excellent grain yields were achieved, ranging from 2.4 to 3.9 t/ha in the fortnightly fungicide treatment (Fig C7.2). The maturity of this trial was delayed by approximately 3-4 weeks compared with the burnt stubble trial. Although very little disease was observed in this trial, there was still evidence of grain yield loss in the more susceptible varieties, such as Almaz, Kalkee and Howzat (Fig C7.2).

**Table C7.1.** The interaction effect of fungicide regime and variety on seed size index in kabuli chickpeas in burnt stubble at Rupanyup in 2011.

| Regime | Almaz | CICA0857 | Genesis090 | Genesis114 | Kalkee |
|---|---|---|---|---|---|
| **Fortnightly** | 8.21 | 8.38 | 7.61 | 8.02 | 8.67 |
| **Strategically** | 8.15 | 8.29 | 7.59 | 7.85 | 8.43 |
| **Podding** | 7.82 | 7.99 | 7.46 | 7.77 | 8.17 |
| **Nil** | 7.80 | 7.82 | 7.34 | 7.67 | 8.01 |

lsd(P<0.1) regimexvar = 0.15

- Seed Size Index – Seed size index provides a guide to the proportion of grain sizes in a sample of seed. The higher the number the greater proportion of larger seed. In the fortnightly treatment Kalkee produced the largest seed size, significantly higher than the other large seeded Kabulis' Genesis114, Almaz or CICA0857 (Table C7.1). Similar to grain yield, seed size index was significantly reduced when disease was no fully controlled.

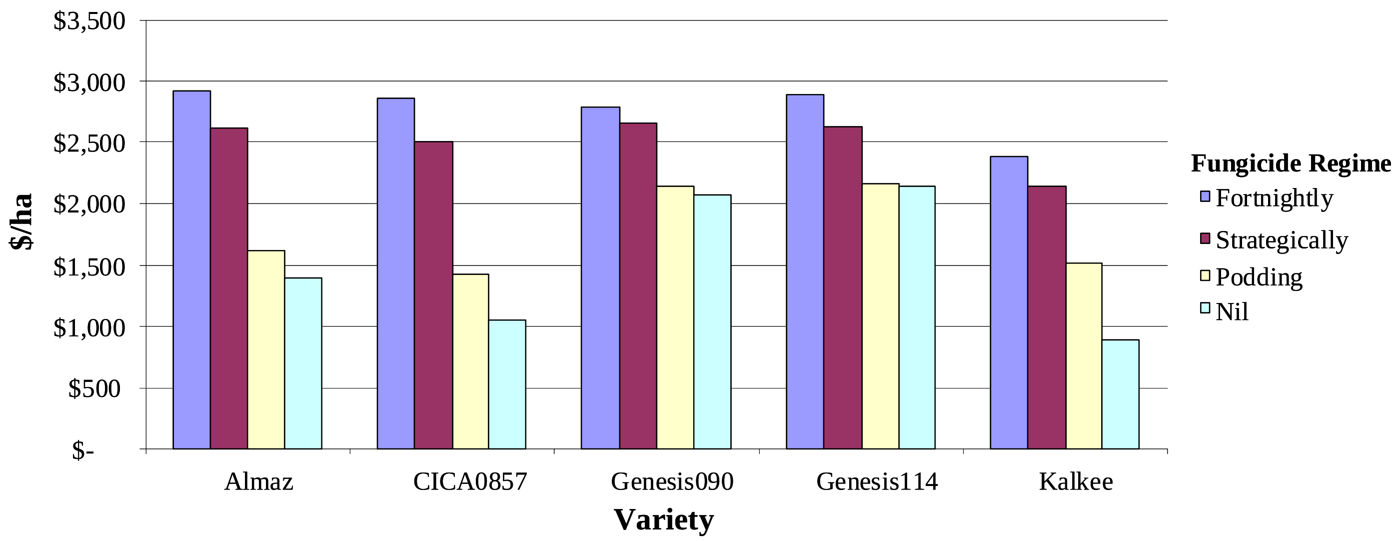


**Figure C7.3.** The interaction effect of fungicide regime and variety on profitability of chickpeas in burnt stubble at Rupanyup in 2011. *Profitability calculated as income – production costs. Income is based on the grain yield x price received for each seed size as at February 2012 (10mm - $1000/t; 9mm - $900/t; 8mm - $780/t; 7mm - $650/t; 6mm - $350/t). Production costs are based on a fixed rate of $250/ha + $15/ha per fungicide application.*

- Profitability – The profitability of all varieties was greatest in the fortnightly fungicide regime ranging between $2800 and $2900/ha for all varieties, except Kalkee ($2400/ha; Fig C7.3).

**Key Findings and Comments**
Growing conditions in 2011 were ideal for chickpeas, due to extreme rainfall events during the summer of 2010/11 which resulted in soil profiles at or near field capacity at sowing. In addition, temperatures were mild in the in the flowering and podding periods with few frost or high temperatures, so yield potential was high. Grain yields up to 4.4t/ha and profitability estimates of up to $2900/ha in the fortnightly fungicide treatment where indicative of this potential.

Unlike 2010 wider row spacing’s had no significant effect on visual symptoms of ascochyta blight and grain yields in 2011. Disease pressure was very high in this trial on the burnt stubble and results should be viewed accordingly, as this sort of pressure is unlikely to occur in a field situation were a resistant variety is being grown. The importance of improved resistance in chickpeas combined with appropriate fungicide strategies was again demonstrated. The resistant varieties Genesis090 and PBASlasher, similar to previous research, were in the group with the lowest level of grain yield loss in the nil and podding fungicide treatments. However Genesis114, which is classified moderately resistant to ascochyta blight showed a similar response, which needs further investigation. CICA0604, appeared slightly worse than this group and caution would be needed if it were released as a variety. Almaz, Kalkee and CICA0857, all suffered significant yield and profitability loss under these conditions, indicating the importance of a strategic fungicide management strategy to ensure disease id controlled adequately.

Visual seed quality was excellent in this trial with little or no seed staining from ascochyta blight. The low level of disease apparent on seed from this trial is probably due to the relatively dry podding conditions that were experienced meaning that little disease was transferred from the pod onto the seed. Even though seed quality was excellent, seed size was reduced proportionally to the reduction in fungicide sprays applied. This is important as seed size can have a significant impact on profitability (see Fig C7.3). Ongoing work will occur in 2012 to expand on the findings of this trial.

## 3. Field Peas

**F1 Sowing Date, MRZ Mid North (Hart), South Australia**

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

### Aim

To maximise yield of new field pea varieties through the identification of optimum sowing dates, and to confirm yield advantages from previously identified best practice blackspot management strategies.

### Treatments

| | |
|---|---|
| Varieties: | Kaspa, Alma, PBA Gunyah, PBA Twilight, PBA Oura, PBA Percy, PBA Pearl and OZP0903 |
| Sowing dates: | 20 May (Early-Mid), 14 June (Mid-Late) |
| Treatments: | Nil – no fungicide applied |
| | Strategic – P-Pickel T plus 2kg/ha Mancozeb at 9 node and Early Flower |
| Fertiliser: | MAP + Zn @ 75kg/ha |

### Results and Interpretation

- Foliar Disease – The severity of blackspot in 2011 was a lot lower than previous years. This was due to the early release of spores from pea stubble, facilitated by high summer rainfall, so that most spores were dispersed prior to field pea emergence. The blackspot infection levels were rated at the end of August as the number of nodes girdled with disease. There was significantly more disease in the first time of sowing (average of 5.6 diseased nodes) compared to the second time of sowing (average of 0.2 diseased nodes). There were also significant differences between varieties (Table F1.1) with most blackspot recorded in Alma and least recorded in PBA Gunyah, PBA Percy and OZP0903. There was no significant interaction for blackspot severity between varieties and time of sowing. Scores showed no significant difference in disease severity between fungicide treated and untreated plots, however a small yield response was noted, as outlined below.

**Table F1.1.** Blackspot severity (# nodes infected) of field pea cultivars (averaged across fungicide treatments and sowing dates) at Hart, 2011, rated August 27.

| Variety | Alma | Kaspa | PBA Gunyah | PBA Twilight | PBA Oura | PBA Percy | PBA Pearl | OZP0903 |
|---|---|---|---|---|---|---|---|---|
| **Blackspot (# nodes infected)** | 3.6 [c] | 3.1 [bc] | 2.5 [a] | 3.1 [bc] | 2.7 [ab] | 2.6 [ab] | 2.8 [ab] | 2.5 [ab] |

lsd (P<0.05) Variety = 0.5

- Grain Yield – Grain yield of field peas averaged 2.9t/ha at Hart in 2011, slightly higher than in the previous favourable seasons of 2009 (2.4t/ha) and 2010 (2.5t/ha). Gain yield showed no response to sowing time in 2011 due to generally low blackspot severity (5- 6 infected nodes does not cause yield loss) and a favourable season finish, so that neither sowing date was favoured.

  All varieties performed similarly to the site mean except Alma, which was the lowest performing variety (Table F1.2) at 7% lower than Kaspa. Recent releases PBA Gunyah, PBA Twilight, PBA Oura and PBA Percy all performed similarly to Kaspa, while potential releases PBA Pearl (erect, white pea) and OZP0903 (high yield potential) yielded 8% greater than Kaspa. At present prices of ~$270/tonne this represents a gross increase of ~$60/ha. OZP0903 was also the highest yielding line in the 2010 trial, although PBA Pearl was not included.

  A grain yield response was observed from the application of fungicides. Neither interactions of fungicide with sowing date or variety were significant, meaning that the treatment response was similar at both sowing dates and across all varieties.

  Treatment with Mancozeb (2kg/ha) at 9 node and early flower resulted in a 4% increase in yield across all varieties (Table F1.3). This corresponded to an average 120kg/ha increase in yield, or

$33/ha, which means this practice was not economic in 2011 as it has been in previous years under higher disease pressures.

**Table F1.2.** Grain yield (t/ha) of field pea cultivars at Hart, 2011.

| Variety | Alma | Kaspa | PBA Gunyah | PBA Twilight | PBA Oura | PBA Percy | PBA Pearl | OZP0903 | LSD (P<0.05) |
|---|---|---|---|---|---|---|---|---|---|
| **Yield (t/ha)** | 2.57 [a] | 2.76 [b] | 2.91 [bc] | 2.89 [bc] | 2.9 [bc] | 2.91 [bc] | 2.98 [c] | 2.99 [c] | 0.18 |

lsd (P<0.05) Variety = 0.18

**Table F1.3.** Grain yield (t/ha) of field peas untreated or treated with fungicide, Hart 2011.

| Treatment | Nil | Fungicide | LSD (P<0.05) |
|---|---|---|---|
| **Yield (t/ha)** | 2.8 [a] | 2.92 [b] | 0.09 |

lsd (P<0.05) Fung = 0.09

## Key Findings and Comments

- Despite only close to average growing season rainfall, yields in 2011 (average 2.9t/ha) were buoyed by stored soil moisture from summer rainfall, low disease levels and generally favourable growing conditions, and performed significantly higher than the wetter seasons of 2009 (2.4t/ha) and 2010 (2.5t/ha) where growing season rainfall was higher but disease was more prevalent. These favourable growing conditions are also likely responsible for the lack of sowing date response in 2011.
- The earlier flowering and maturing recent PBA releases, PBA Gunyah, PBA Twilight, PBA Oura and PBA Percy, all performed similarly to Kaspa and the site mean, demonstrating their flexibility in a season which generally favoured later maturing varieties and produced high yields. Over the recent run of favourable seasons these varieties have generally performed slightly lower than Kaspa, however long term data (2005-2011) shows similar or slightly higher yield, and regional benefits generally associated with lower rainfall areas and in years when delayed sowing is required.
- PBA Pearl and the potential release OZP0903 were the highest yielding lines in the 2011 trial. OZP0903 was also the highest yielding line in the 2010 trial, while PBA Pearl was not included. These lines show a lot of promise as new varieties for their high yield potential and also their agronomic and disease resistance profiles.
- Fungicides for control of blackspot in field peas are generally not economic unless the blackspot risk is severe. If field peas are sown according to recommendations of Blackspot Manager, i.e. after 50% of spores have been released, then the disease is unlikely to reach severe levels. If the peas are sown before the peak spore release e.g. the spores are released in late May or June and peas are sown mid May, then foliar fungicides are warranted for disease control. Trials in previous years have shown that potential yield needs to be at least 2 t/ha for foliar fungicides to be economic in field peas even when blackspot is severe. Whilst yields were high in 2011, blackspot severity was generally low, and application of fungicides was not economic in 2011.

## F2. Sowing Date x Stubble Management, LRZ Upper Eyre Peninsula (Minnipa), South Australia

### Aim

To compare and identify optimum sowing times of 6 field pea varieties to maximise grain yield and minimise impacts of disease. This trial also aims to investigate whether field peas could benefit from sowing into standing stubble compared to slashed stubble in low rainfall areas in terms of grain yield, disease infection or harvestability.

### Treatments

Varieties: Kaspa, Parafield, PBA Gunyah, PBA Twilight, PBA Oura, and PBA Pearl
Sowing dates: 2 May (Early), 31 May (Late)
Stubble: 3.0t/ha Wheat stubble (30cm high)
Treatments: Slashed (cut at ground height to leave 20-30cm length straw)
Standing (30cm high)
Fertiliser: DAP + Zn @ 63kg/ha

### Results and Interpretation

- Vegetative Standing Height – Early vegetative standing height measurements (taken late July) showed that standing height of peas sown into standing stubbles was higher at both sowing dates (11-13cm) than those in slashed stubbles **(**Table F2.1**)**. Standing height of late sown peas was also higher than early sown peas, due to greater vegetative lodging in early sown peas. Visual observations showed the peas tendrils “netting” onto the standing stubble, which provided a trellis for the peas to grow up, leading to more erect plants (see photos).


- Mature Standing Height – standing height at maturity showed a similar trend to vegetative standing height. Peas sown into standing stubbles averaged 12cm higher than those sown into slashed stubbles (Table 1).

**Table F2.1.** Effect of sowing date and stubble treatment on vegetative standing height (cm), and stubble management on mature standing height (cm) of field peas, Minnipa 2011

| Measurement | TOS | Crop Stage | Slashed Stubble | Standing Stubble | LSD (P<0.05) |
|---|---|---|---|---|---|
| Vegetative Standing Height (cm) | Early | 17-18 node | 26 | 34 | **6.2** |
| | Late | 9-10 node | 37 | 47 | **(1.4 same TOS)** |
| Mature Standing Height (cm) | | Maturity | 27.5 | 39.6 | **2.07** |

- Lodging – Lodging scores showed a significant three-way interaction between sowing date, variety and stubble treatment. Early sown peas were more erect at maturity when sown into standing stubble, except for Parafield which showed no difference between stubble management methods (Figure F2.1). However standing stubble did reduce lodging in Parafield at the late sowing date.

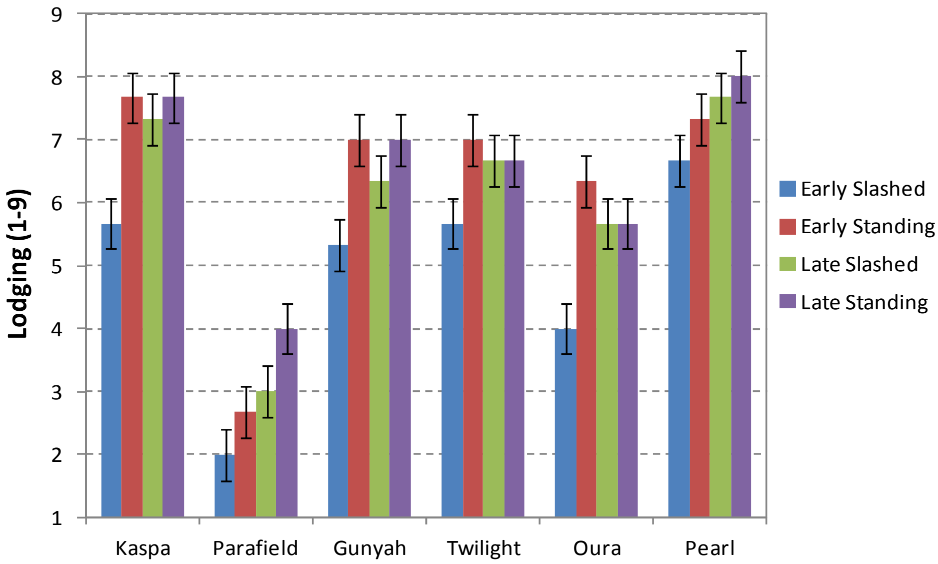


**Figure F2.1.** Lodging scores (1-9) at maturity of six field pea varieties sown at different sowing dates and stubble management methods, Minnipa 2011. 1 = prostrate, 9 = erect.

- Grain Yield – although effects of stubble treatment were visually apparent early in the season through differences in standing plant height and growth habit, however these did not translate to differences in grain yield in 2011.
  A significant sowing date by variety interaction was observed for grain yield (Table F2.2). All varieties yielded higher sown early (average 2.72t/ha) than sown late (average 1.85t/ha), averaging 32% (30kg/ha/day) higher when sown early. This is higher than in previous years, where the average yield loss from delayed sowing at Minnipa previous to 2010 (which showed no sowing date response) was 26kg/ha/day.
  The high yielding white pea line PBA Pearl was the highest yielding variety sown early, yielding 31% higher than Kaspa, while PBA Oura also outyielded Kaspa by 10% when sown early. Parafield was outyielded by all other varieties at the early sowing date.
  At the later sowing date all varieties generally performed similarly, except that PBA Pearl and PBA Twilight outyielded Kaspa (21 and 16%, respectively). PBA Pearl showed the greatest penalty from delaying sowing (40%, or 46kg/ha/day delay in sowing), while Parafield showed the least (21%, or 16kg/ha/day sowing delay) (Table F2.3).

**Table F2.2.** Effect of sowing date on grain yield (t/ha) of 6 field pea lines, Minnipa 2011

| | Sowing Date | Kaspa | Parafield | Gunyah | Twilight | Oura | PBA Pearl | LSD (P<0.05) |
|---|---|---|---|---|---|---|---|---|
| **Yield (t/ha)** | **Early** | 2.55 | 2.33 | 2.68 | 2.64 | 2.79 | 3.33 | **0.276** |
| | **Late** | 1.65 | 1.85 | 1.84 | 1.92 | 1.83 | 2 | **(0.21 same TOS)** |
| **Yield loss (kg/ha/day)** | | 31 | 17 | 29 | 25 | 33 | 46 | **4.2** |

## Key Findings and Comments

- Stubble treatments showed no yield difference in 2011, however differences in plant height and lodging were observed throughout the season which may aid harvestability, particularly in shorter seasons with less biomass. Retaining anchored standing cereal stubble throughout the year field peas are grown is also seen as having benefits in reducing damage from wind erosion in regions characterised by light textured soils. With good quality cereal stubbles again in 2011, this agronomic trial will be continued with the new varieties to aim to validate these findings under variable seasonal conditions.

## F3 Crop-topping/Desiccation, MRZ Mid North (Balaklava), South Australia

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

**Aim**

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

**Treatments**

| | | |
|---|---|---|
| Varieties: | see Table F3.1 | |
| Sowing date: | 15 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 |
| Chemical: | Paraquat at 800ml/ha | |
| Fertiliser: | Map + Zn @ 90kg/ha | |

**Table F3.1.** Field Pea flowering and maturity ratings, Balaklava crop-top trial 2011.

| Variety | Flower | Maturity |
|---|---|---|
| Alma | L | L |
| Bundi | E | E |
| Dundale | E | M |
| Glenroy | L | L |
| Kaspa | L | M |
| OZP0903 | M | E-M |
| Parafield | M-L | M-L |
| PBA Gunyah | E | E |
| PBA Oura | M | E |
| PBA Twilight | E | E |
| Sturt | M | M-L |
| SWCeline | E | VE |
| Yarrum | L | M |

E = Early, M = Mid, L = Late

**Results and Interpretation**

- Significant two way interactions (Timing x Variety) were observed for grain yield and grain weight (Table F3.2).
- Grain Yield – No varieties showed yield loss from Late crop-topping in 2011, and only two varieties showed reduced yield at the Recommended timing; the later maturing conventional type peas Alma and Parafield.
  Many genotypes showed reduced grain yield at the Early crop-top timing (2 weeks prior to Recommended). Those varieties which showed no yield loss at this timing included the six earliest maturing lines PBA Twilight, PBA Oura, OZP0903, PBA Gunyah, SW Celine and Sturt. Yarrum also showed no yield loss from crop-topping in 2011 at this timing, and has previously shown a variable response to crop-topping across seasons. Despite being rated as having late flowering and mid maturity timing, Yarrum is noted for its rapid maturity and has shown relatively low yield loss from this practice in some previous seasons.
  Long term summary of crop-top timing on grain yield (Table F3.3) shows the earliest maturing varieties to be consistently better suited to crop-topping than the later maturing lines, with fewer yield loss incidences and lower average yield losses. Yield loss results show common commercial cultivars Kaspa and Parafield are less suited, with Parafield showing yield loss in three of six trials at the Recommended timing. Again, Yarrum shows variable response across seasons, with fewer incidence of yield loss than Kaspa at the Early timing, but more at the Recommended timing.
- Grain Weight – as for grain yield, there was no effect of crop-topping on grain weight of field pea at the Late timing, and little effect at the Recommended timing. Only two cultivars (PBA

Oura and OZP0903) showed reduced grain weight from crop-topping at the Recommended timing, while ten of the 13 cultivars showed reduced grain weight from Early crop-topping. Interestingly more of the earlier maturing pea cultivars showed reduced grain weight than the later maturing cultivars at both Early and Recommended timings and little correlation between yield and grain weight occurred. Previous results have also found poor correlation between maturity at crop-topping and grain weight.

- Grain Mould – The effect of crop-topping on occurrence of mould in grain samples was investigated in the 2011 trials. Assessments of a number of varieties detected increased incidence of mould in the Early crop-top treatment (Table F3.4). Recommended and Late treatment timings had similar mould levels to the Nil. These data show that maturity at timing of crop-topping may influence the incidence of mould in crop-topped field pea crops.

**Table F3.2.** Effect of crop-top timing on grain yield and grain weight of field peas, Balaklava 2011
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 (28/10)** | **+ 2 wks[b] (4/11)** | **Nil** | **- 2 wks[a] (20/10)** | **Recommended (28/10)** | **+ 2 wks[b] (4/11)** |
| PBA Twilight | 2.56 | 95 | 113 | 98 | 20.2 | 91 | 99 | 99 |
| PBA Oura | 2.39 | 110 | 127 | 121 | 22.3 | 89 | 91 | 100 |
| OZP0903 | 2.66 | 101 | 124 | 115 | 20.1 | 87 | 91 | 94 |
| PBA Gunyah | 2.89 | 87 | 102 | 106 | 19.9 | 83 | 97 | 93 |
| Celine | 2.5 | 104 | 130 | 107 | 23.1 | 93 | 96 | 98 |
| Sturt | 2.7 | 94 | 103 | 104 | 19.7 | 96 | 94 | 98 |
| Bundi | 2.75 | 77 | 100 | 107 | 19.5 | 91 | 105 | 100 |
| Yarrum | 2.89 | 88 | 110 | 106 | 18.9 | 82 | 100 | 103 |
| Kaspa | 2.95 | 81 | 86 | 100 | 18.5 | 79 | 106 | 105 |
| Parafield | 2.68 | 77 | 82 | 84 | 16.7 | 92 | 92 | 101 |
| Dundale | 2.93 | 73 | 87 | 87 | 18.3 | 102 | 102 | 103 |
| Alma | 2.88 | 70 | 73 | 85 | 17.4 | 89 | 98 | 98 |
| Glenroy | 2.23 | 65 | 99 | 94 | 13.9 | 91 | 98 | 101 |
| **Mean** | **2.69** | **2.29** | **2.73** | **2.68** | **19.1** | **90.2** | **97.7** | **99.5** |

lsd (P<0.05)timing.var = 0.48, (Grain Yield), 1.3 (Grain Weight)
NB: Shading denotes significant difference from the Nil treatment.
[a] = 2 weeks prior to Recommended timing
[b] = 2 weeks after Recommended timing

**Table F3.3.** Long term summary (2008-2011) of grain yield response of selected field pea cultivars to crop-topping, Early and Recommended timings.
Varieties are ranked according to their visual maturity rating from earliest to latest.

| Variety | Incidence of significant yield losses (# trials) | | Average Yield Loss [Range] (% of Control) | |
|---|---|---|---|---|
| | Early | Rec. | Early | Rec. |
| PBA Twilight | 5 (7) | 0 (7) | 27 [20-57] | 0 [0-9] |
| PBA Oura | 5 (7) | 0 (7) | 28 [23-58] | 0 [0-11] |
| PBA Gunyah | 4 (7) | 0 (7) | 32 [13-61] | 0 [0-10] |
| Yarrum | 3 (6) | 1 (6) | 35 [13-68] | 0 [0-28] |
| Kaspa | 6 (7) | 0 (7) | 41 [26-69] | 8 [0-19] |
| Parafield | 6 (6) | 3 (6) | 40 [20-55] | 1 [0-27] |

**Table F3.4.** Effect of crop-topping timing on incidence of mould on field pea seed (# infected seeds/sample) at Balaklava, SA 2011.

| Treatment Timing | Early | Recommended | Late | Nil |
|---|---|---|---|---|
| No. Infected seeds/sample | 10 [a] | 5 [b] | 3 [b] | 3.9 [b] |

lsd (P<0.05) = 3.7

## Key Findings and Comments

Yield losses from Early crop-topping generally followed cultivar maturity, with latest maturities showing highest losses. Parafield and Alma were the only varieties to show yield loss at the Recommended timing, supporting previous findings that these later maturing varieties are not as well suited to crop-topping as recent releases PBA Twilight, PBA Gunyah and PBA Oura. Kaspa and Yarrum continue to show a variable result across seasons at this timing.

The effect of crop-topping on grain weight of field peas was opposite to the effect on grain yield in 2011, with later maturing cultivars showing less effect on grain weight from crop-topping at Early and Recommended timings. A similar trend has been observed in previous seasons, with some extremely late maturing cultivars actually showing increased grain weight from Early crop-topping. It was supposed that this was due to removal of smaller seeds by removal of either later maturing plants before pod set or by abortion of uppermost (immature) pods.

Preliminary results from the 2011 trials have shown that mould in pea samples may be associated with plant maturity at timing of crop-topping. This finding may have implications when crop-topping paddocks which may have varying levels of crop maturity due to variable soil types. Work is ongoing in this area.

## F4 Sowing Time x Impact Dressed Fertiliser, H-MRZ (Wagga Wagga), NSW

### Aim

To compare early and late sown commercial and advanced varieties of field pea in an eastern cropping environment of southern NSW and to evaluate Impact®In-Furrow fertiliser to assist in disease control.

### Treatments

Varieties: Kaspa, PBA Gunyah, PBA Twilight, Yarrum, PBA Oura (OZP703), PBA Percy (OZP901), OZP805, OZP819 (PBA Pearl),
Sowing dates: 30 May & 1 July 2011 – representing the earlier and later phases of the field pea sowing window
Stubble: 2t/ha Barley stubble (30cm high)
Fungicide Treatments: With and without Impact®In-Furrow.
Fertiliser: Grain legume super (0:15:7) @ 115 kg/ha placed separately under the seed.

### Results and Interpretation

Variety, TOS and Variety x TOS were the only significant yield differences in this trial, but these differences in reality were only small ($P<0.01$). Impact fungicide applied on fertiliser at sowing had no benefit yield this season.

**Table F4.1**. Yield terms and their statistical significance

| Fixed term | F prob | |
|---|---|---|
| TOS | 0.021 | * |
| FUNG | 0.222 | ns |
| VARIETY | 0.003 | ** |
| TOS.FUNG | 0.574 | ns |
| TOS.VARIETY | 0.002 | ** |
| FUNG.VARIETY | 0.357 | ns |
| TOS.FUNG.VARIETY | 0.026 | * |

Field pea yields were above average during the 2011 season at Wagga. Yield did decline by around 11% when delaying sowing from 30 May to 1 July, most evident in OZP819, Percy and Yarrum (15-18%) and least in Twilight, Gunyah and OZP805.

The highest yielding treatments in this trial were the early sown PBA Percy and OZP819.

Seed sizes were highly significant across treatments ($P<0.001$). Later sowing increased seed size; PBA Oura and PBA Percy had the largest seeds.

### Key Findings and Comments

- The 2011 season was well suited field pea at Wagga, resulting in high yields and little disease at either sowing.
- Field pea is less sensitive to delays in sowing compared to chickpea, faba bean & lupin.
- Yield declined by only around 11% when sowing was delayed from late May to early July.
- PBA Oura, PBA Percy and OZP819 were consistently in the top ranking group for both yield and seed size.

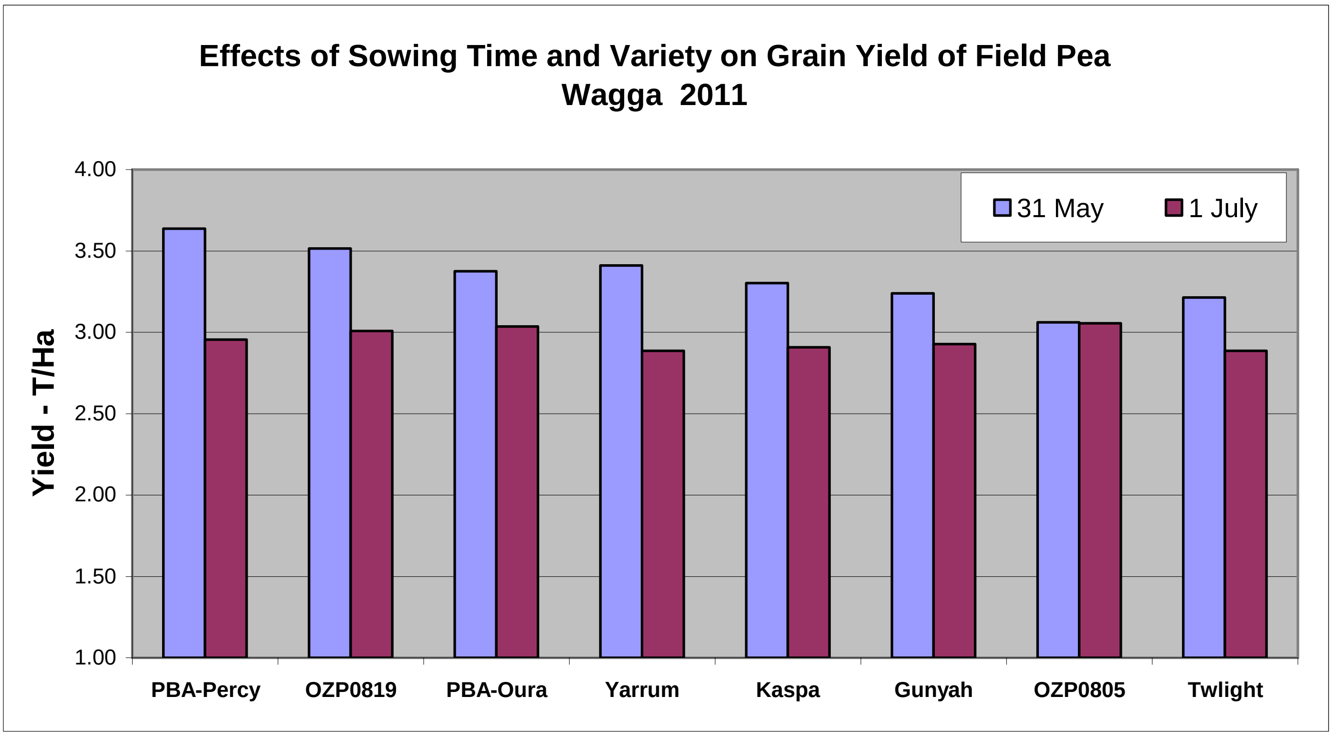


**Figure F4.2.** The effects of sowing time on grain yield (t/ha) of eight varieties of field pea at Wagga in 2011.

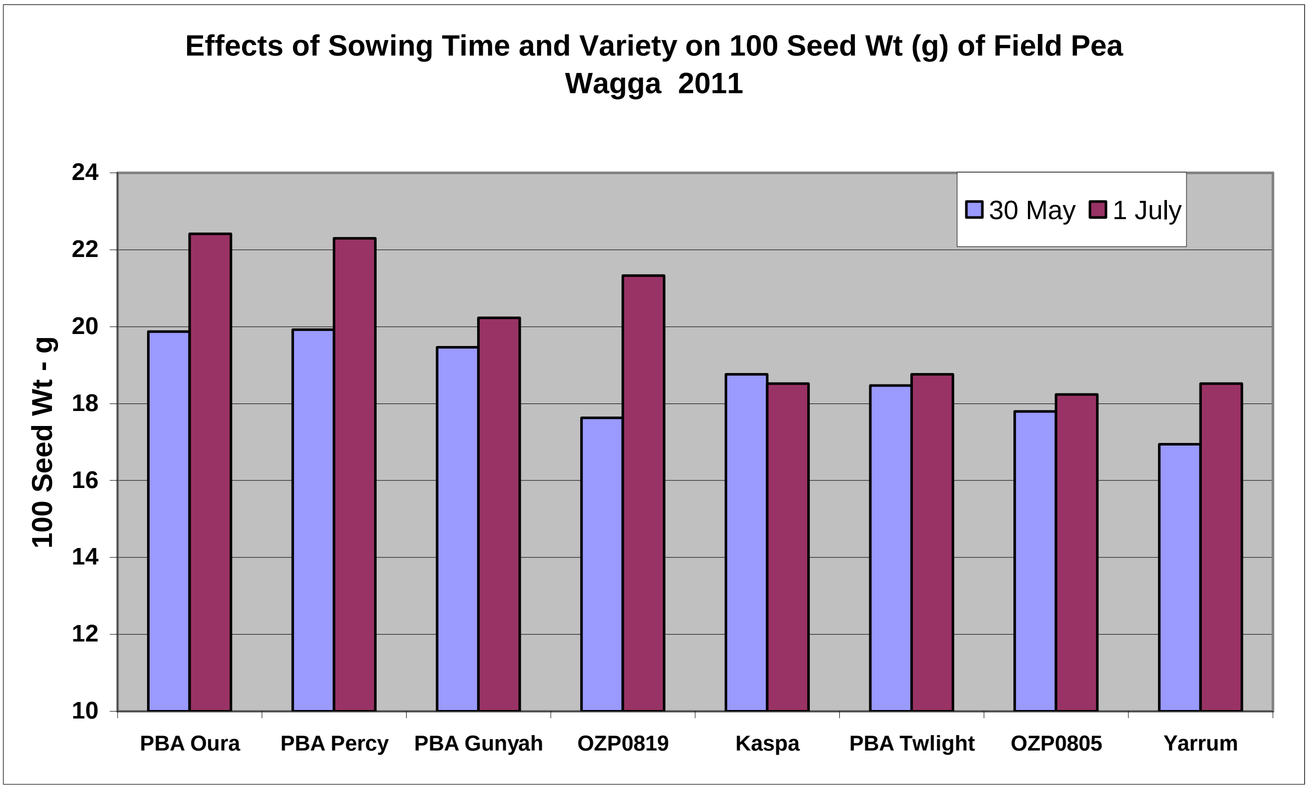


**Figure F4.3.** The effects of sowing time on seed size (100 Sd Wt) of eight varieties of field pea at Wagga in 2011.

## F5 Sowing Time x Seed Dressing, LRZ (Yenda), NSW

**Aim**

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

**Treatments**

Varieties: Kaspa, PBA Gunyah, PBA Twilight, Yarrum, PBA Oura (OZP703), PBA Percy (OZP901), OZP805, OZP819.

Sowing dates: 20 May, 22 June 2011 – representing the earlier and later phases of the field pea sowing window

Stubble:

Fungicide Treatments: With and without Impact fertiliser.

Fertiliser: Grain legume super (0:15:7) @ 115 kg/ha placed separately under the seed.

**Results and Interpretation**

The 2011 season on "Hillview" was well suited to pulse production. The season started with a full profile of moisture from February rains followed by below average rainfall during winter. This resulted in very little disease pressure. Above average rainfall in August provided sufficient moisture to carry the crops through to maturity.

Impact fungicide applied on fertiliser had little or no affect on growth and grain yield under these conditions. 3

Differences in grain yield between varieties were small. OZP0819, PBA Percy and PBA Oura all performed well. Yields declined by about 10 % (P<0.05) as sowing was delayed from 20 May to 22 June.

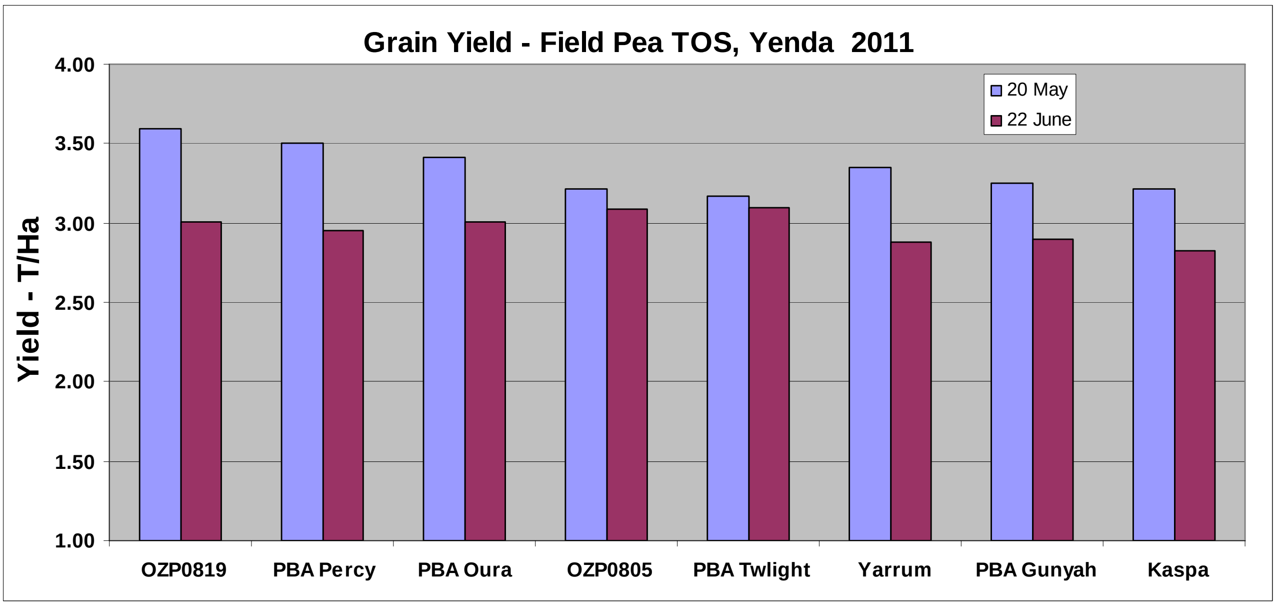


**Figure 2.** The effect of TOS on grain yield (t/ha) of eight field pea varieties.

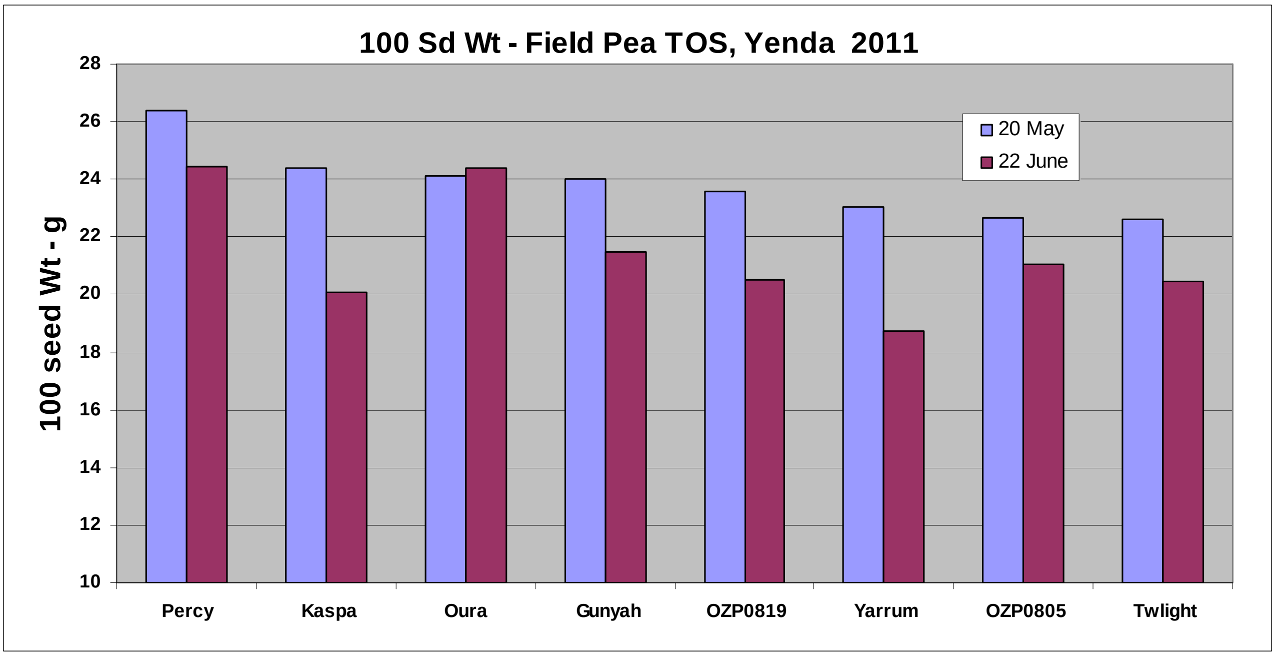


**Figure 3.** The effect of TOS on 100 seed weight of eight field pea varieties.

## Key Findings and Comments

- This was a very favourable field pea season at "Hillview", resulting in high DM and grain production.
- There were only small differences between varieties
- Yield and seed size dropped by around 10% as sowing was delayed from 20 May to 22 June

## F6 Sowing Time, LRZ Southern Mallee (Curyo), Victoria

**Aim**

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

**Treatments**

| | |
|---|---|
| Varieties: | Kaspa, Morgan, PBA Oura, OZP0805, OZP0819, OZP0902, PBA Percy, PBA Gunyah, PBA Twilight, Sturt. |
| Variety Mixes: | Morgan:Sturt. sown with a 50:50 ratio based on targeted plants/m$^2$. |
| Sowing dates: | 4 May (Early), 27 May (Mid), 22 June (Late). |

**Other Details**

| | |
|---|---|
| Row Spacings/Stubble: | 30 cm row spacing, inter-row, standing stubble. |
| Fertiliser: | MAP + Zn @ 40 kg/ha at sowing. |
| Plant Density: | 35 plants/m$^2$. |

**Results and Interpretation**

- Key Message: The results again highlighted that earlier sowing in field peas is generally beneficial in the Mallee. The new varieties, OZP0805, OZP0819, OZP0902 had the highest average grain yields in this trial. Results for the forage type indicate that it has significant potential as a dual purpose crop that can produce high biomass and good yields given appropriate seasonal conditions.

- Plant establishment – Establishment for all field pea varieties was on target for the May 4 sowing (30 plants/m$^2$) but reduced by 20% at the 27 May sowing and 50% at the 22 June sowing (data not shown).

- Mouse Damage – Significant mouse damage was observed across the trial and each plot was scored for damage on a percentage scale. Mouse damage was used as a covariate in the grain yield analysis.

- Grain Yield – Grain yields were generally good, ranging between 0.9 and 2.2 t/ha (Fig. F6.1). Variability in the trial was relatively high due to mouse damage and there was no interaction between sowing date and variety, however the main effects were significant. Generally, the June 22 sowing date resulted in lowest yield (approximately 50% reduction), while there was no difference between the May 4 and May 27 sowing dates (Fig. F6.1). The new varieties, OZP0805, OZP0819, OZP0902 had the highest average grain yields in this trial. Although not significant, there appeared a trend that varieties such as OZP0805, Kaspa and Morgan, all benefit from earlier sowing. Conversely, OZP0819, OZP0902 and Sturt showed a slight decline in yield from the May 4 to May 27 sowing dates. The variety mix showed grain yield approximately half way between in its two components. We also calculated the proportion of each variety in the variety mixes. The proportion of Morgan in the mix increased from 40% to 45% to 52% as sowing was delayed from May 4 to May 27 to June 22, respectively.

- Grain Weight – Grain weight was reduced at both the later sowing dates compared with 4 May, in all varieties except OZP0902, which was consistent across all sowing dates (data not shown).

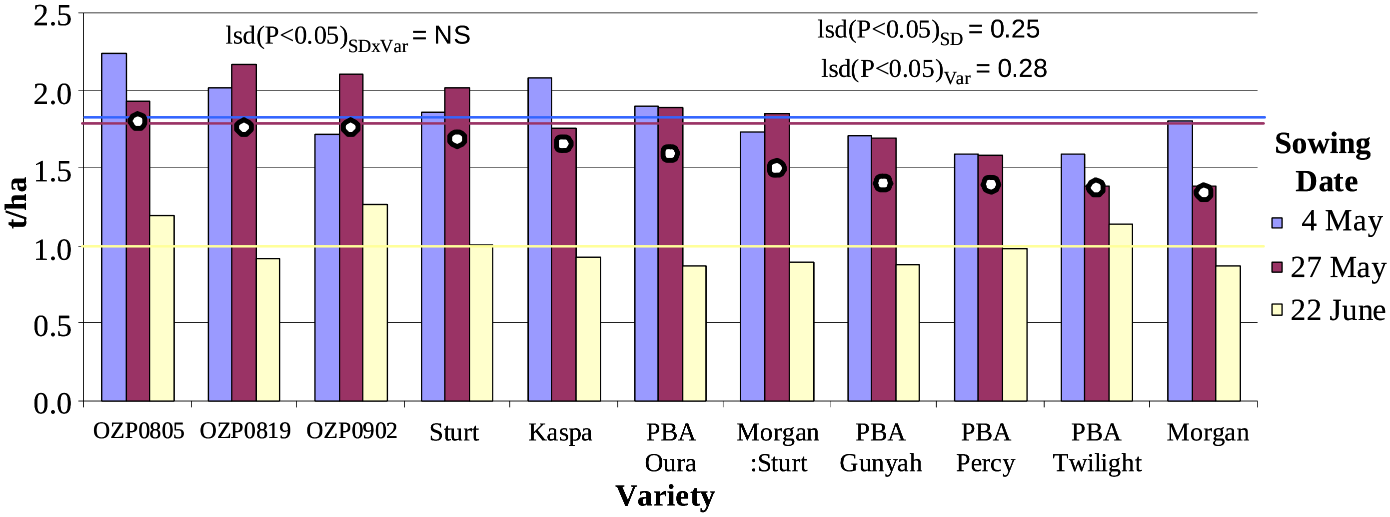


**Figure F6.1.** The effect of the interaction between sowing date and field pea variety on grain yield at Curyo in 2011. Mean sowing date grain yield indicated by horizontal lines; mean variety grain yield indicated by circles.

**Key Findings and Comments**

Due to extreme rainfall events during the summer of 2010/11, soil profiles were at or near field capacity at sowing in 2011. Early growth at Curyo was restricted due to a dry period during May and June, an this may have had any significant impact on grain yield. In addition the lower plant population achieved at late sowing dates are likely to reduce grain yields. Unfortunately, similar to other trials at Curyo, the mouse plague at sowing had a significant impact on establishment, particularly at the May 27 and June 22 sowing dates, despite multiple application of mouse bait (ie. the site was baited 6 times from late April through to the end of June).

The results again highlighted that earlier sowing in field peas is generally beneficial in the Mallee. However the results also indicate that if sowing is delayed it is important to be aware of the effects on the grain yield of the variety that is chosen. Varieties such as OZP0805, Kaspa and Morgan all appear to show greater response to early sowing than OZP0819, OZP0902 and Sturt. The results also clearly indicate the yield gains that are being made through the breeding program. The performance of OZP0902 was surprising as it has been developed as a forage type, for biomass production, rather than grain yield. In other trials its yield can be 30% less than the best adapted varieties (eg. see field pea trial from Rupanyup below, F8.1). These results indicate that given suitable growing conditions, its yield can be comparable to other commonly grown varieties, meaning that this variety has potential for use as a dual purpose crop.

The variety mix (Morgan:Sturt) was grown this year to asses whether yield stability could be improved by mixing different types of peas together. Overall yields were approximately half way between the difference in its two components, which could be expected as there were no stress event that would adversely affect one variety over the other. Interesting the proportion of Morgan in the mix increased from markedly as sowing was delayed indicating that if seed was retained for sowing from one year to the next it is likely to have a significant impact on the relative proportions in the mix for the following season. Further work will occur in 2012 to further investigate these responses.

## F7 Crop Topping, LRZ Southern Mallee (Curyo), Victoria

**Aim**

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

**Treatments**

| | |
|---|---|
| Varieties: | Kaspa, Morgan, PBA Oura, OZP0805, OZP0819, PBA Percy, PBA Gunyah, PBA Twilight, Sturt, PSL4Early. |
| Crop Topping: | Nil<br>Early: Applied approximately 10-14 days pre rye grass milky dough stage (24th October)<br>Mid: Applied at rye grass milky dough (4th November)<br>Late: Applied approximately 10-14 days post rye grass milky dough stage (14th November) |

**Other Details**

| | |
|---|---|
| Sowing date: | 4 May |
| Row Spacing/Stubble: | 30 cm row spacing, inter-row, standing stubble. |
| Fertiliser: | MAP + Zn @ 40 kg/ha at sowing |
| Plant Density: | 120 plants/$m^2$ |

**Results and Interpretation**

- Key Message: No significant response to crop topping treatments was observed.

- Mouse Damage – Damage from mice was observed across the trial and each plot was scored for damage on a percentage scale. Mouse damage was used as a covariate in the grain yield analysis.

- Grain Yield – No significant response to crop topping treatments was observed in 2011. Mean grain yields of varieties followed a similar pattern to the sowing time trial (F6). OZP0819 was significantly higher yielding than all varieties except Sturt and OZP0805 (Table F7.1).

**Table F7.1.** Mean grain yield (t/ha) of field pea varieties grown in the crop topping trial at Curyo in 2011.

| Variety | Grain Yield (t/ha) |
|---|---|
| OZP0819 | 2.26 |
| Sturt | 2.13 |
| OZP0805 | 2.06 |
| Kaspa | 1.96 |
| PBAOura | 1.93 |
| Morgan | 1.91 |
| PBA Percy | 1.60 |
| PSL4Early | 1.52 |
| PBA Twilight | 1.43 |
| PBA Gunyah | 1.28 |

lsd(P<0.05)Var = 0.29.

**Key Findings and Comments**

The new varieties OZP0819 and OZP0805 were among the highest average grain yields in this trial.

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

### Aim

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

### Treatments

| | |
|---|---|
| Varieties: | Kaspa, Morgan, PBA Oura, OZP0805, OZP0819, OZP0902, PBA Percy, PBA Gunyah, PBA Twilight, Sturt. |
| Variety Mixes: | Morgan:Sturt. sown with a 50:50 ratio based on targeted plants/$m^2$. |
| Sowing dates: | 16 May (Early), 6 June (Mid), 23 June (Late). |

### Other Details

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

### Results and Interpretation

- Key Message: The results again highlighted that delayed sowing in field peas will generally reduce yields. The new varieties, OZP0805, OZP0819 had the equal highest average grain yields in this trial, along with Sturt. The new forage line, OZP0902, produced significantly more biomass at maturity than Kaspa or Morgan at all sowing dates.

- Plant establishment – Establishment for all field pea varieties was on target for the May 16 sowing (30 plants/$m^2$) and reduced slightly in the 6 June and 23 June sowing dates (data not shown).

- Bacterial Blight Damage – Significant levels of bacterial blight were noted in this trial and scored on October 27. Generally bacterial blight damage was worse in the early sown plots and reduced in the late sown plots. OZP0902, the new forage line, showed no symptoms of bacterial blight, while PBA Twilight and PBA Gunyah, were most severely affected (Fig F8.2).

- Biomass Production – The new forage line, OZP0902, produced significantly more biomass at maturity than Kaspa or Morgan at all sowing dates. In particular, 13.7t/ha of biomass were produced in the early sown treatment, 35% more than Kaspa and 25% more than Morgan (Fig. F8.1).

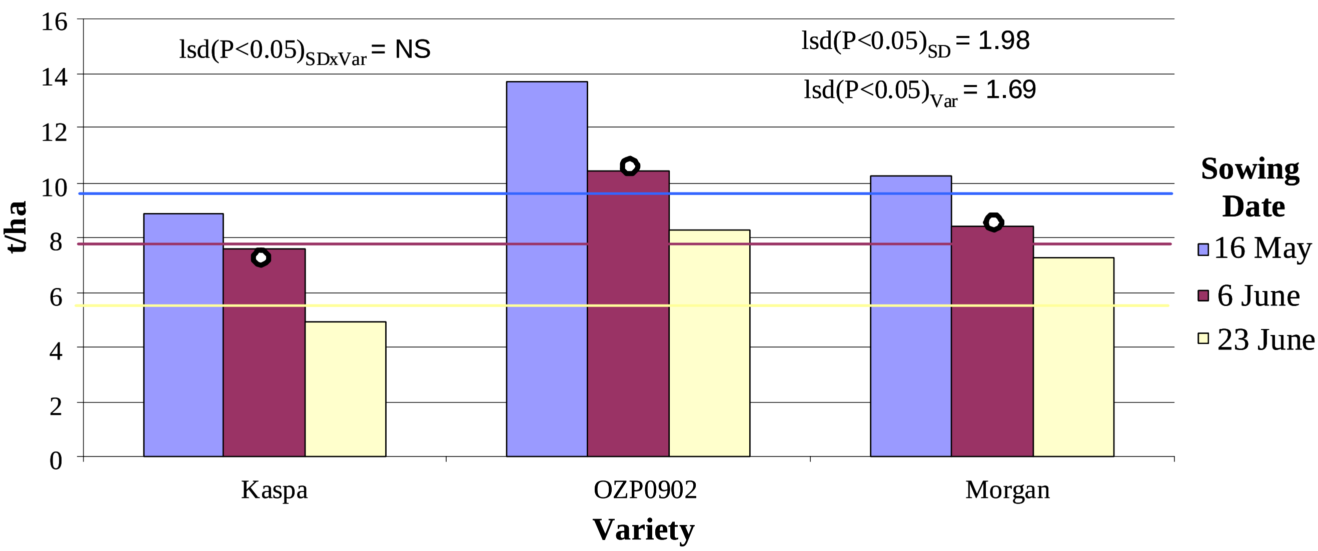


**Figure F8.1** The effect of the interaction between sowing date and field pea variety on biomass production at maturity at Rupanyup in 2011.

- Grain Yield – Grain yields were generally very good, ranging between 1.5t/ha for OZP0902 sown June 23 to 4.1t/ha for Sturt sown June 6 (Fig. F8.2). In this trial the June 23 sowing date generally resulted in lowest yield, although there was a slight interaction between sowing date and variety (Fig. F8.2). OZP0819 and PBA Percy, both showed significantly higher grain yields when sown May 16, while Sturt and PBA Gunyah had highest yields when sown June 6. Overall, OZP0805, OZP0819, Sturt and the Sturt:Kaspa mix had the highest grain yields (Fig. F9.2). The forage types Morgan and OZP0902, were lowest yielding. In the variety mix yields were between the two component varieties, but generally closer to the higher yielding variety Sturt. The proportion of Kaspa in the mix increased from 35% to 37% to 43% as sowing was delayed, respectively.

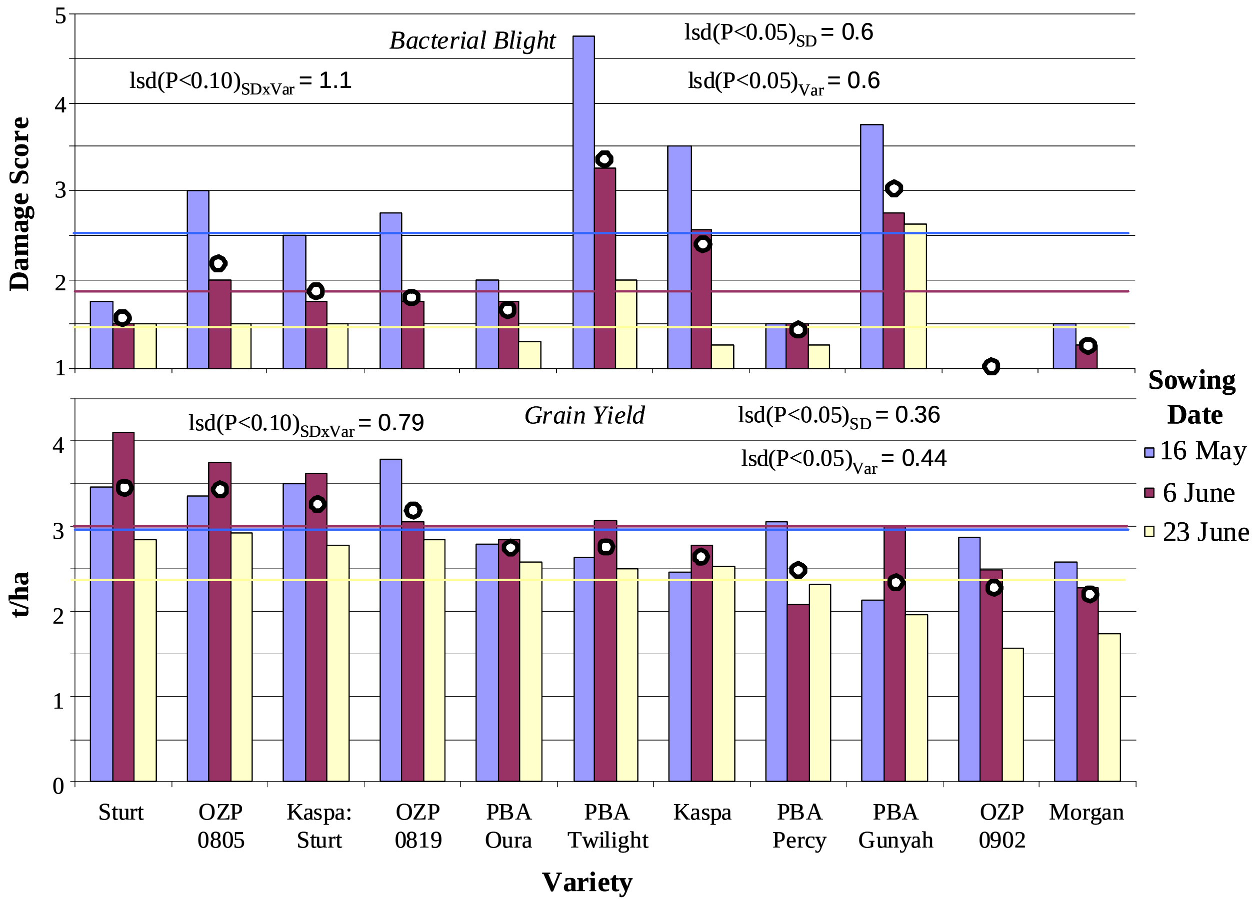


**Figure F8.2.** The effect of the interaction between sowing date and field pea variety on bacterial blight scores (1 – No damage, 9 – Dead) and grain yield at Rupanyup in 2011. Mean sowing date scores and grain yield indicated by horizontal lines; mean variety scores grain yield indicated by circles.

## Key Findings and Comments

Due to extreme rainfall events during the summer of 2010/11, soil profiles were at or near field capacity at sowing in 2011. Unlike Curyo, early growth at Rupanyup was not affected by the dyer period during May and June. Mild temperatures and sufficient rainfall during the main growth periods resulted in excellent grain yields (up to 4t/ha). Bacterial blight was present in this trial and potentially had a negative impact on grain yield in varieties such as Kaspa, PBA Gunyah and PBA Twilight. Overall grain yield results were similar to Curyo in that there was little difference between the first two sowing dates, with a significant reduction at the later sowing date. However, response of individual varieties to sowing date was different to Curyo. For example, at Curyo it appeared that OZP0805 was more responsive to early sowing than OZP0819, however at Rupanyup this response was reversed. The relative ranking of varieties, was similar between sites, with mid maturing varieties such as OZP0805, OZP0819 and Sturt highest and early varieties, such as PBA Gunyah, PBA Twilight and PBA Percy lowest. Primarily, the trial clearly indicates that significant yield and disease resistance gains are being achieved through the breeding program.

The performance of the forage type, OZP0902, was excellent producing the highest biomass of varieties assessed (up to 13.7 t/ha when sown early), with grain yields up to 2.9t/ha when sown early. Similar to Curyo these results indicate that the biomass production of this variety makes it suitable for forage and hay production, while its grain yields under suitable growing conditions are high enough to make is acceptable for grain harvest.

Similar to Curyo the variety mix (Kaspa:Sturt) was grown this year to asses whether we could improve yield stability by mixing different types of peas together. Overall yields were approximately between the two components, but closer to the higher yielding variety Sturt. In addition bacterial blight scores were significantly lower than the susceptible variety Kaspa and slightly higher than Sturt. The results appear to indicate that the mix can partially compensate for yield loss in one variety, but still does not achieve the grain yields of an individual line. Further work will occur in 2012 to further investigate these responses.

**F9 Sowing Time, Crop topping, Disease Management, Stubble HRZ Southern (Lake Bolac), Victoria**

**Aim**

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

**Treatments**

| | |
|---|---|
| Varieties: | Kaspa, PBA Oura, OZP0902, PBA Twilight. |
| Sowing dates: | 20 May (Early), 16 June (Mid), 9 August (Late). |
| Crop Topping: | Mid: Applied at rye grass milky dough |
| Disease Control | Fortnightly: chlorothalonil 500 @ 2 L/ha applied fortnightly starting 6 weeks after emergence. |
| Stubble: | Slashed<br>Burnt |

*Note: Stubble treatments were sown as independent trials. Crop topping and Disease management treatments were compared with an untreated control.*

**Other Details**

| | |
|---|---|
| Row Spacing: | 18 cm. |
| Fertiliser: | MAP + Zn @ 100 kg/ha at sowing. |
| Plant Density: | 35 plants/m$^2$. |

**Results and Interpretation**

- Key Message: Early sowing, concurrent with previous research, was significantly higher yielding in 2011. Varietal differences in this trial were minimal. Yield loss from disease, primarily black spot, was significant and economically viable control measures are important to develop.

- Grain Yield – Seasonal conditions at Lake Bolac were excellent for pulse production, with adequate rainfall and few high or low temperature events that impacted on yield. Grain yields ranged from 0.9 t/ha for OZP0902 sown Aug 9 to 3.9t//ha for Kaspa sown 20 May, both in the slashed stubble block (Table F9.1 & F9.2). A summary for each of the agronomic treatments is outlined below.
  - Stubble treatment: Overall grain yield in the slashed stubble block was slightly higher, 2.26t/ha compared with 2.13t/ha in the burnt stubble (Table F9.1 & F9.2). However, this may not be indicative of the full response as OZP0902 appeared to be 20% lower yielding on slashed, while all other varieties had 10-15% higher yields in slashed stubble.
  - Crop Topping – Data has been averaged across the three sowing dates as trends were similar. Overall there was no effect of crop topping on grain yield in either slashed or burnt stubble (Table F9.1 & F9.2). However, there appeared to be differences among varieties with OZP0902 showing a significant yield loss in the slashed stubble, while PBA Oura had a significant yield loss in the burnt stubble which occurred at the May 20 sowing date.
  - Disease management - Data has been averaged across the three sowing dates as trends were similar. In the trial sown on burnt stubble there was a 20% increase in grain yield (Table F9.2), while on the slashed stubble the yield improvement was insignificant, but still showed an increasing trend (Table F9.1). All varieties, showed increased yields with the fortnightly disease management strategy.
  - Sowing Dates – In both trials the early sowing date (20 May) had 20% higher grain yield than the mid sowing date (16 June) and 70% higher grain yield than the late sowing date (Aug 9) (Tables F9.1 & F9.2). Varieties generally responded similarly, except OZP0902 on the slashed stubble which was similar at the early and mid sowing dates.

**Table F9.1.** Effect of the agronomic treatments, crop topping and complete disease control, and various sowing dates on grain yield (t/ha) of field pea varieties grown on slashed stubble at Lake Bolac in 2011.

| Treatment | Kaspa | OZP0902 | PBA Oura | PBA Twilight | *Average* |
|---|---|---|---|---|---|
| Agronomic Treatments | | | | | |
| **Nil** | 2.58 | 1.72 | 2.30 | 2.45 | *2.26* |
| **Crop Topped** | 2.42 | 1.30 | 2.36 | 2.41 | *2.12* |
| **Fortnightly Fungicide** | 2.63 | 1.96 | 2.55 | 2.47 | *2.40* |
| Sowing Dates | | | | | |
| **20th May** | 3.87 | 1.98 | 3.43 | 3.40 | *3.17* |
| **16th June** | 2.83 | 2.10 | 2.52 | 2.87 | *2.58* |
| **9th August** | 0.94 | 0.91 | 1.27 | 1.06 | *1.04* |
| *Average* | *2.55* | *1.66* | *2.40* | *2.44* | *2.26* |

To compare interactions lsd(P<0.05)CTx Var = 0.3, DMxVar = ns, SDxVar = 0.57.
To compare main effects (ie. average) lsd(P<0.05)CT = ns, DM = ns TOS = 0.35, Var = 0.12.

**Table F9.2.** Effect of the agronomic treatments, crop topping and complete disease control, and various sowing dates on grain yield (t/ha) of field pea varieties grown on burnt stubble at Lake Bolac in 2011.

| Treatment | Kaspa | OZP0902 | PBA Oura | PBA Twilight | *Average* |
|---|---|---|---|---|---|
| Agronomic Treatments | | | | | |
| **Nil** | 2.11 | 1.94 | 2.27 | 1.75 | *2.02* |
| **Crop Topped** | 2.04 | 2.02 | 1.60 | 2.18 | *1.96* |
| **Fortnightly Fungicide** | 2.38 | 2.33 | 2.67 | 2.29 | *2.42* |
| Sowing Dates | | | | | |
| **20th May** | 3.27 | 2.87 | 2.91 | 2.86 | *2.98* |
| **16th June** | 2.28 | 2.40 | 2.56 | 2.30 | *2.38* |
| **9th August** | 0.99 | 1.03 | 1.06 | 1.06 | *1.03* |
| *Average* | *2.18* | *2.10* | *2.18* | *2.07* | *2.13* |

To compare interactions lsd(P<0.05)CTx Var = 0.47, DMxVar = ns, SDxVar = ns.
To compare main effects (ie. average) lsd(P<0.05)CT = ns, DM = 0.24, TOS = 0.23, Var = ns.

## Key Findings and Comments

- Stubble – Similar to Rupanyup, there appeared to be an improvement in yield in the slashed stubble compared with burnt stubble. It is unclear why OZP0902, responded differently to other varieties in this trial.
- Crop Topping – The response of OZP0902 in the slashed stubble was expected as this variety is very late maturing and has primarily developed for forage or hay production. A similar response was not observed in the burnt stubble block and reasons for this are unclear. Further work will continue in 2012. The grain yield loss of PBA Oura in response to crop topping in burnt stubble was inconsistent with previous research and likely to be experimental error.
- Disease Management – This treatment was implemented to assess the effect disease is having on grain yields of field peas in a high rainfall zone. These trials indicate that peas are suffering yield loss from disease, primarily black spot in these trials. The strategy of a fortnightly fungicide regime is unlikely to be economically viable, unless yields are above 2t/ha and differences are in excess of 20% when using a fungicide. In response to these trials further work is now occurring to develop an economically viable strategy to manage the risk of disease in field peas.
- Sowing Dates – Early sowing, concurrent with previous research, was significantly higher yielding in 2011. It was particularly beneficial for Kaspa which achieved yields of almost 3.9 t/ha on the slashed stubble when sown early. Early sowing can also maximise the benefits from crop topping as the crop will mature earlier, minimising risks of yield loss in the peas when targeting to optimum stage in the ryegrass. With appropriate rotations and disease management strategies (under development) the risks of disease can be minimised.

# 4. Faba Beans

## B1 Sowing Date 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 and PBA Rana |
| Sowing dates: | 29 April (Early), 26 May (Mid) |
| Row Spacing: | Narrow = 22.5cm (9 inch), Wide = 45cm (18 inch) |
| Fertiliser: | Map + Zn @ 90kg/ha at sowing |

### Results and Interpretation

- Disease – disease infection was generally low in 2011, and controlled using management practices representative of grower practice.
- Lodging – In contrast to previous seasons only low levels of lodging were observed in 2011. However differences in lodging were still apparent between varieties and treatments with Farah showing a higher incidence of lodging than other varieties, which all behaved similarly (Table B1.1). Wider row spacings were also shown to contribute to higher lodging levels in 2011 (Table B1.2).
- Necking – (where the top part of the stem collapses and bends over sharply, but does not break completely) was not observed in the 2011 trials.
- Grain Yield – Faba bean yields at Tarlee were high in 2011 due to favourable growing conditions and minimal disease and averaged 4.8t/ha. While only average growing season rainfall was achieved, yields were buoyed by the high 2010/11 summer rainfall events. Fiord was the highest yielding variety across both sowing dates (Table B1.3), but not significantly higher than Farah and Nura. PBA Rana showed lower yield than Fiord and Nura across both sowing dates.

  Grain yield showed a significant interaction between sowing date and row spacing (Table B1.4). Wide row spacing (45cm) resulted in lower yield than narrow rows (22.5cm) at both sowing dates. The extent of this yield penalty was similar at both sowing dates (22% early and 18% late sown). There was also a 6% yield penalty from delayed sowing at the narrow row spacing, while wider rows showed no sowing date response.

**Table B1.1.** Plant lodging (1-9) at maturity of four faba bean varieties, Tarlee 2011. 1= prostrate, 9 = erect

| Variety | PBARana | Farah | Fiord | Nura |
|---|---|---|---|---|
| Lodging Score (1-9) | 7.75 [a] | 6.8 [b] | 7.3 [a] | 7.6 [a] |

lsd ($P<0.05$) = 0.48

**Table B1.2.** Plant lodging (1-9) at maturity of faba beans at two sowing dates and two row spacings, Tarlee 2011. 1= prostrate, 9 = erect

| Treatment | Narrow | Wide |
|---|---|---|
| Lodging Score (1-9) | 7.5 [a] | 7.25 [b] |

lsd ($P<0.05$) = 0.20

**Table B1.3.** Grain yield (t/ha) of four faba bean varieties, Tarlee 2011.

| Variety | PBA Rana | Farah | Fiord | Nura |
|---|---|---|---|---|
| Yield (t/ha) | 4.6 [a] | 4.82 [ab] | 5.03 [b] | 4.89 [b] |

lsd ($P<0.05$) = 0.228

**Table B1.4.** Grain yield (t/ha) of faba beans at two sowing dates and two row spacings, Tarlee 2011.

| Sowing Date | Narrow | Wide |
|---|---|---|
| **Early** | 5.55 [a] | 4.31 [c] |
| **Late** | 5.21 [b] | 4.27 [c] |

lsd ($P<0.05$) SD x RS = 0.236 (0.211 same RS)

## Key Findings and Comments

- Faba bean yields at Tarlee were again high in 2011 despite below average growing season rainfall, being buoyed by high summer rainfall and minimal disease.
- Disease levels were generally low in 2011, and there was very little disease pressure in this trial. Although rust outbreaks were observed across the state no rust was evident in this trial. The favourable season, together with minimal disease and minimal lower pod abortion, meant that yield was close to reaching maximum potential.
- Increasing row spacing from 22.5cm (9 inch) to 45cm (18 inch) has resulted in consistent yield losses over the last three years, from 10% average across all varieties in 2009 to 20% in 2011. However it must be noted that wider row spacings form part of a farming systems package that may generate other benefits.
- The 2011 released faba bean PBA Rana was slightly lower yielding than other varieties in these 2011 trials, but yielded similarly to Farah across all NVT sites in SA.
- The incidence of lower pod abortion, which was evident in the 2008 and 2010 seasons, was not noted in this trial in 2011. Work is ongoing to discover the cause of this issue and determine whether this can be minimised through variety choice or agronomic practice.

**B2 Sowing Date x Plant Density, HRZ South East (Moyhall), South Australia**

Co-authored by Trent Potter, South Australian Research & Development Institute – Struan

**Aim**

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

**Treatments**

| | |
|---|---|
| Varieties: | Nura, Farah, Fiord and PBA Rana |
| Sowing dates: | 10 May (Early), 7 June (Late) |
| Densities: | 16, 24 and 32 plants/$m^2$ |
| Fertiliser: | Map + Zn @ 100kg/ha at sowing |

**Results and Interpretation**

- Plant lodging at maturity – Farah showed the highest levels of lodging in 2011, followed by Fiord (Table B2.1). PBA Rana was least affected by lodging, but not significantly different to Nura. Later sown plants (7th June) were more erect than early sown plants. There was no difference in lodging across plant densities at the late sowing date, but at the early sowing date lodging increased as plant density increased from 16 to 32 plants/$m^2$ (Table B2.2).

**Table B2.1.** Plant lodging (1-9) at maturity of four faba bean varieties, Bool Lagoon 2011. 1= prostrate, 9 = erect

| Variety | PBA Rana | Farah | Fiord | Nura |
|---|---|---|---|---|
| **Lodging** | 8.17 | 6.67 | 7.39 | 7.72 |

lsd (P<0.05) = 0.621

**Table B2.2.** effect of plant density on lodging (1-9) at maturity of faba bean, Bool Lagoon 2011.
1= prostrate, 9 = erect

| Sowing Date | Plant Density (#/m2) | | |
|---|---|---|---|
| | 16 | 24 | 32 |
| May 10 | 7.5 | 6.42 | 5.33 |
| Jun 07 | 8.67 | 8.5 | 8.5 |

lsd (P<0.05) SD x PD = 1.129

- Grain Yield – Faba bean yields at Bool Lagoon were high in 2011 as in 2010, averaging 4.3t/ha across all varieties and treatments in 2011compared to 4.9t/ha in 2010. Yield of early sown faba beans was either equal or higher than the late sowing date (Figure B2.1). PBA Rana, and Nura showed higher yield from earlier sowing at the low plant density (16 plants/$m^2$), while Farah and Fiord showed yield improvement from sowing early at the medium plant density (24 plants/$m^2$). Fiord also showed a yield improvement from sowing early at the high plants density (32 plants/$m^2$).
  Plant density was more important than variety choice in 2011, since all varieties generally performed similarly at the same sowing dates and plant density (except that Nura outyielded Fiord sown early at 16 plants/$m^2$). Early sown Fiord showed a yield penalty from sowing at 16plants/$m^2$ compared to 24 and 32plants/$m^2$. At the later sowing date Fiord was the only variety not to show a response from increasing plant density.

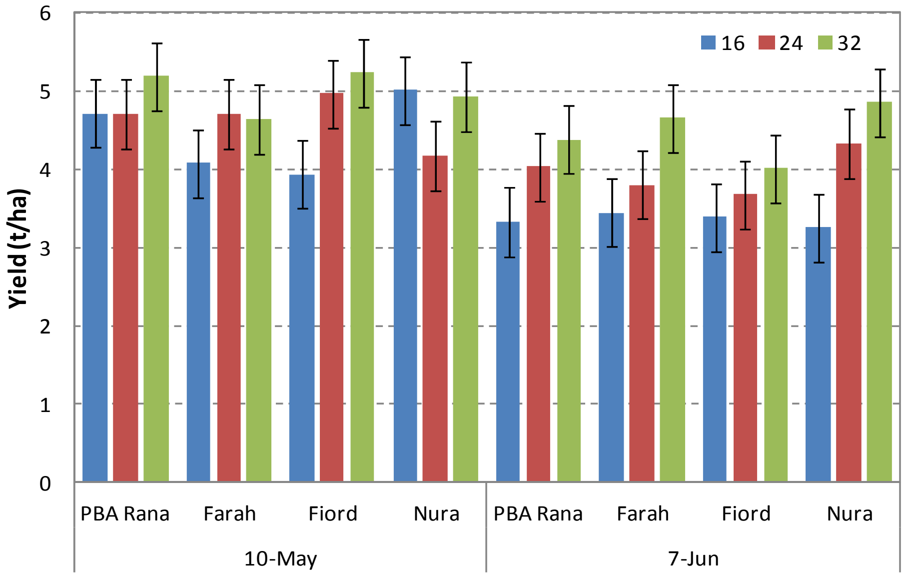


**Figure B2.1.** Grain yield (t/ha) of four faba bean varieties at two sowing dates and three plant densities (plants/$m^2$), Bool Lagoon 2011.

## Key Findings and Comments

- Faba bean yields at Bool Lagoon were again high in 2011 despite below average growing season rainfall, being buoyed by high summer rainfall and minimal disease.
- Varieties performed similarly at Bool Lagoon in 2011, and plant density generally had a greater influence on yield than variety choice.
- There was a general yield response to increasing sowing density from 16 to 32 plants/$m^2$ in 2011, particularly at the later sowing date, however previous research has shown a link to increased disease pressure which may negate any potential yield advantage from this higher seeding rate. The recommended seeding rate for beans (24 plants/$m^2$) performed similarly to the high seeding density for all varieties

## B3 Sowing Date, HRZ South East (Conmurra), South Australia

Co-authored by Trent Potter, South Australian Research & Development Institute – Struan

### Aim

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

### Treatments

Varieties: Nura, Farah, PBA Rana, PBA Kareema, Aquadulce and Aquadulce_Gilb (grower selection)
Sowing dates: 16 May (Early), 15 June (Late)
Fertiliser: Map + Zn @ 100kg/ha at sowing

### Results and Interpretation

- Plant lodging at maturity – Lodging scores showed that Farah and PBA Rana were the most prone to lodging, and Aquadulce was the least (Table B3.1). The broad beans generally showed less lodging than the faba bean varieties.
- Grain Weight – PBA Rana has larger seed size and grain weight than the other faba beans, Farah and Nura (Table B3.2). PBA Kareema had the highest grain weight of the three broad beans, while the grower selection Aquadulce_Gilb appears to be a larger seeded selection from Aquadulce.
- Grain Yield – Bean yields in 2011 were less than half of those achieved in 2010 at the same site, averaging only 2.8t/ha across all varieties compared to 6.4 t/ha in 2010. There was very little disease or weed pressure to cause this, but drier than average conditions and several frost events during September and October may have contributed to this result.
  A sowing time by variety response was observed for grain yield (Figure B3.1). All varieties performed similarly at both sowing dates except Nura and Aquadulce_Gilb. Nura showed 43% higher yield at the later sowing date, while Aquadulce_Gilb showed nearly 40% higher yield at the early sowing date. Aquadulce_Gilb outyielded all of the faba bean varieties at the early sowing date, but performed similarly to the other broad bean varieties PBA Kareema and Aquadulce. There was no difference between varieties at the later sowing date.

**Table B3.1.** Plant lodging (1-9) at maturity of three faba bean and three broad bean varieties, Conmurra 2011. 1= prostrate, 9 = erect

| Variety | Farah | Nura | PBA Rana | Aquadulce | Aquadulce_Gilb | PBA Kareema |
|---|---|---|---|---|---|---|
| **Lodging** | 3.33 | 5.33 | 2.33 | 7.23 | 5 | 5 |

lsd (P<0.05) = 1.86

**Table B3.2.** Grain weight (g/100 seeds) of three faba bean (left) and three broad bean varieties (right), Conmurra 2011.

| Variety | Farah | Nura | PBA Rana | Aquadulce | Aquadulce_Gilb | PBA Kareema |
|---|---|---|---|---|---|---|
| **100gwt** | 75.2 | 75.0 | 84.2 | 133.3 | 143.5 | 149.2 |

lsd (P<0.05) = 4.4

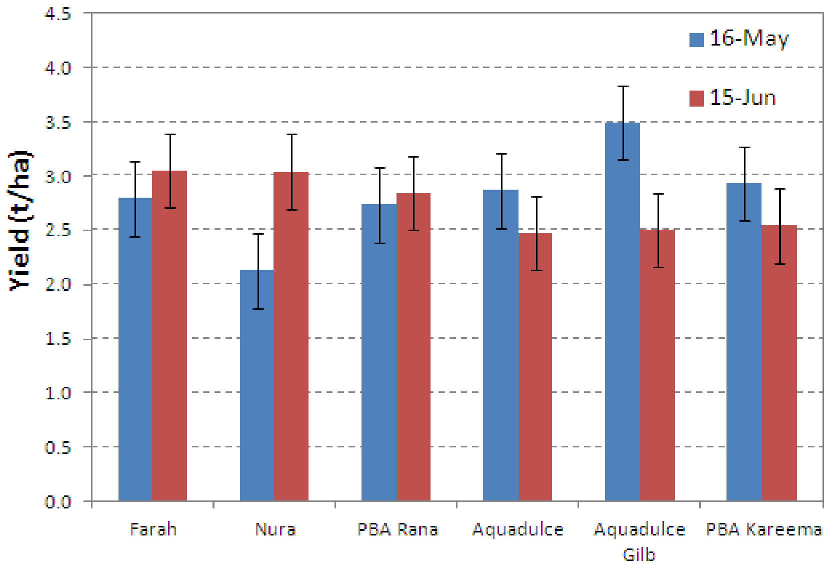


**Figure B3.1.** The effect of sowing date on the grain yield (t/ha) of three faba bean (left) and three broad bean varieties (right), Conmurra 2011.

**Key Findings and Comments**

- Bean yields at Conmurra were significantly lower in 2011 than in 2010. This trial was located in much shallower soil in 2011 than 2010, and yield was suppressed by dry conditions and several frost events during September and October.
- There was no difference in yield between the broad bean cultivars Aquadulce and PBA Kareema at Conmurra in 2011. PBA Kareema has improved resistance to ascochyta blight and rust compared to Aquadulce, although neither of these diseases were observed in this trial. The characteristics of the farmer selection Aquadulce_Gilb and reasons for its higher yield at the early sowing date are not known.
- Nura showed a penalty from early sowing, and was the only variety to show this response. Previous research has shown that it is generally better suited to early sowing than other varieties, due to its favourable disease resistance profile, mid flowering and short plant height. These characteristics favour this variety in shorter seasons with a dry finish.

## B4 Sowing Time x Plant Population, HMRZ (Wagga Wagga), NSW

Aim: To investigate effects of sowing date on the grain yield of four faba bean cultivars.
To investigate effects of fungicides on yield, both fertilizer augmented and foliar applied.

**Treatments**

| | |
|---|---|
| Varieties: | Farah, PBA Rana, AF3001 and AF3063 |
| Sowing dates: | 7th May and 10th June 2011. |
| Fungicides: | 1. Impact®In-Furrow (on Fert)<br>2. Standard fungicide sprays throughout season<br>3. Impact®In-Furrow PLUS 1 or 2 Strategic crop sprays |
| Plant populations: | Targeted 30 plants/m$^2$. |
| Plot Size: | 12m x 1.8m |
| Row Spacing/Stubble: | 30 cm into standing light stubble. |
| Fertiliser: | Legume Starter @ 115 kg/ha at sowing |
| Fungicide Product | Penncozeb and Bravo® foliar fungicides to prevent chocolate spot 22nd July (early sowing only); 13th September and 6th October 2011 (All) |

Fungicides are more effectively used as protectants rather than as a cure to infection. The "Control" fungicide treatments in this experiment was the industry "standard" designed to prevent chocolate spot infection from establishing by routinely spraying with foliar fungicides. This was compared with Impact®In-Furrow, designed to protect the seedlings from these diseases. In the third regime, Impact®In-Furrow was used in conjunction with two strategic foliar applications.

**Results and Interpretations**:
The major yield affect on in this trial was sowing time – see Figure B4.1. On average, yield declined by 29kg/day when sowing was delayed from 7 May to 10 June (34 days). Average yield for 7 May sowing was 3.5 t/ha; the 10 June 2.5 t/ha.

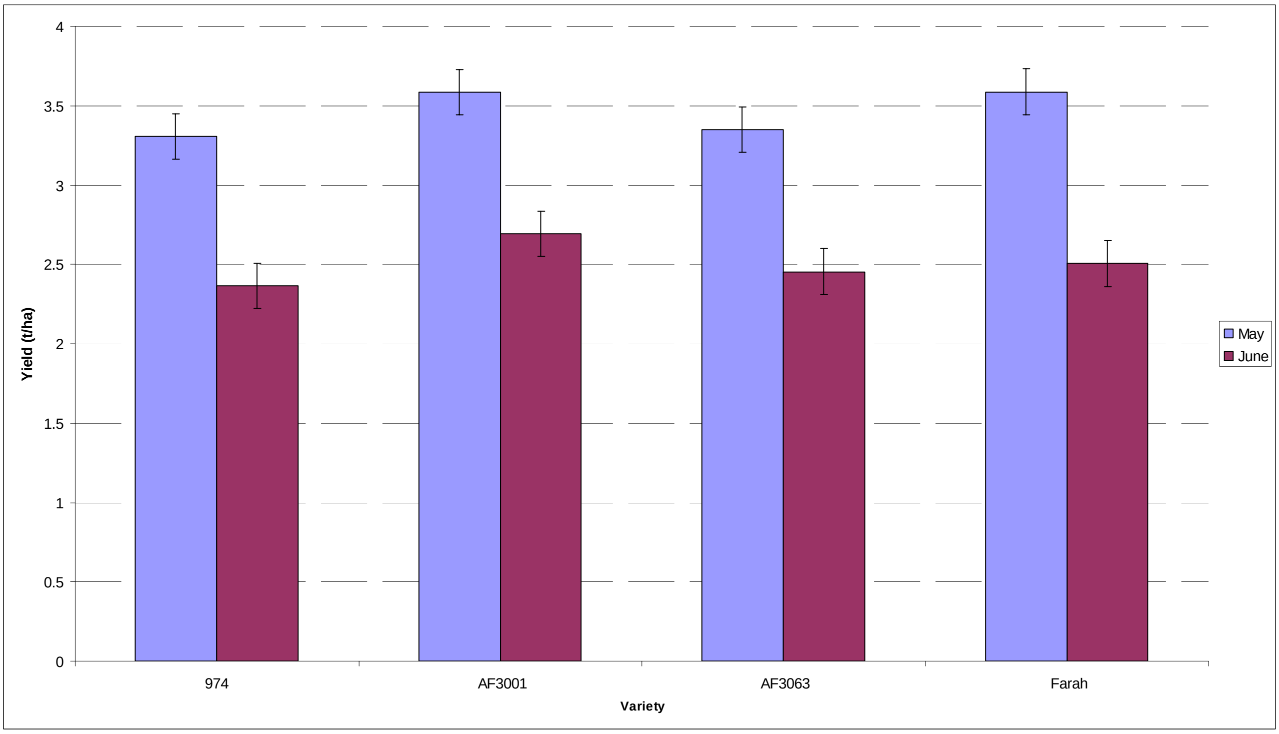


**Figure B4.1**. Effect of sowing time and variety on grain yield of faba bean at Wagga in 2011

The three fungicide regimes had little or no affect on faba bean yield at any sowing date this season. This is a direct reflection of the dry growing conditions which limited disease incidence. There was one significant yield reduction at the May sowing time – the "control" treatment with AF3063. This result was unexpected and reasons unclear.

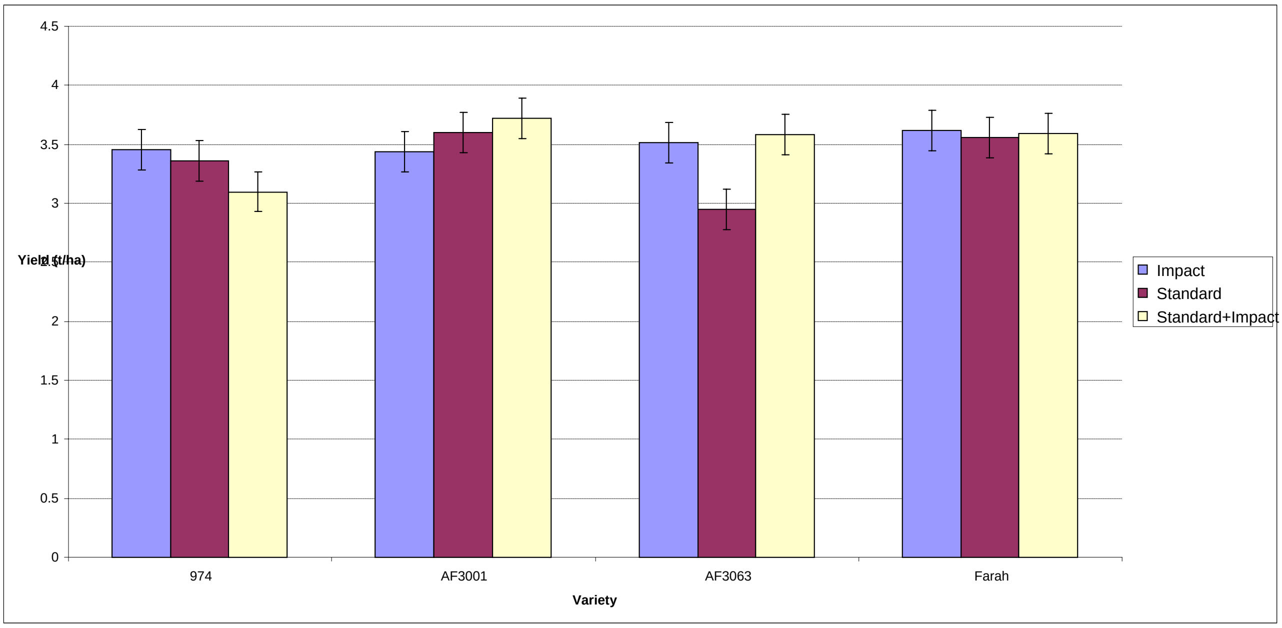


**Figure B4.2.** Fungicide effects on faba bean varieties from 7 May sowing at Wagga in 2011

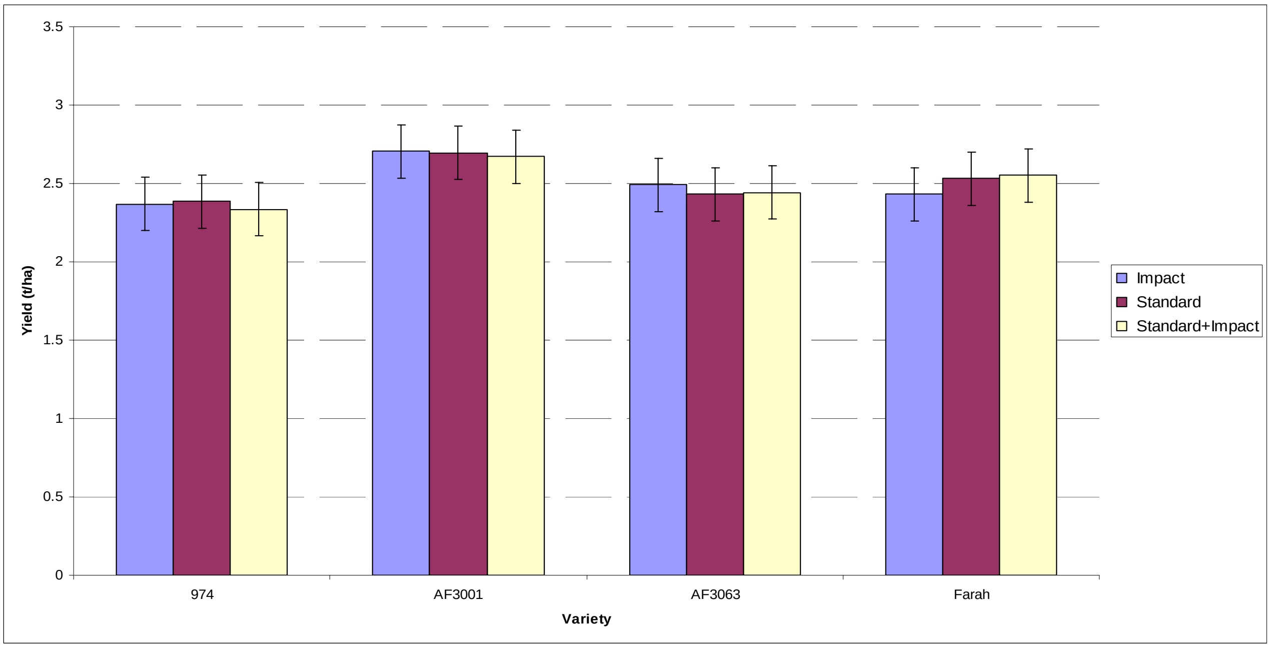


**Figure B4.3.** Fungicide effects on faba bean varieties from 10 June sowing at Wagga in 2011

## Key Findings and Comments

- Large yield reductions occurred from delaying sowing from 7 May to 10 June (34 days).
- There was no significant yield difference between varieties.
- There was little disease pressure.
- The merit of protecting faba seedlings with in furrow fungicide application requires further evaluation over a wider range of season, particularly wetter winters

## B5 Row Spacing x Disease Management x Stubble, MRZ Wimmera (Rupanyup), Victoria

**Aim**

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

### Experimental Treatments

Varieties: Farah, Nura, PBARana, AF03063, AF03109, AF04053, AF05069, AF05073.

Fungicide Regimes:

| Regime | Chemical & Application Rate[1] | Timing |
|---|---|---|
| Complete (Fort) | chlorothalonil 720 @ 2L/ha<br>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: 30 cm row spacing, standing stubble (ST30),
30 cm row spacing, burnt stubble (B30),
60 cm row spacing, inter-row, standing stubble (ST60),
60 cm row spacing, inter-row, burnt stubble (B60).

*Note: Stubble treatments were sown as independent trials.*

### Other Details

Sowing date: 10 May (burnt stubble); 17 May (standing stubble).
Fertiliser: MAP + Zn @ 60 kg/ha at sowing.
Plant Density: 20 plants/$m^2$.

### Results and Interpretation

- Key Message: Grain yield in the standing stubble trial averaged 20% more than the burnt stubble trial. Disease, predominately rust resulted in grain yield losses of >20%. While there were varieties with less susceptibility to the disease present, it did not confer a grain yield advantage in the unsprayed treatment.

- Disease Symptoms – Due to suitable winter and spring time conditions, disease pressure was moderate to high in the faba beans. Aschochyta blight and chocolate spot were noticed in mid August and rust at the end of August. During September and October, rust became the predominant disease, probably because environmental conditions were conducive for rust development and the trial was designed to assess management options for chocolate spot and chemicals used only have limited efficacy on rust. The level of disease was assessed October 25, just prior to the beginning of leaf drop. Across all varieties there appeared to be a slight, but insignificant trend toward lower disease levels in the wider row spacing, particularly in standing stubble (data not shown). However there were large differences between stubble treatments. In the standing stubble trial disease scores were less for all varieties and fungicide regimes (Fig's. B5.1 and B5.2). This was particularly evident in the more susceptible varieties, Farah and AF03063 which, in the 'nil' fungicide regime had scores of approximately '7' in the burnt stubble trial and '5' in the standing stubble trial. The general response of varieties across the fungicide regimes was relatively consistent in the two trials. As the number of fungicide applications increased, the level of disease decreased. While among varieties PBA Rana and AF05069 showed the lowest level of disease, while Farah and AF03063 had the highest levels of disease (Fig's. B5.1 and B5.2).

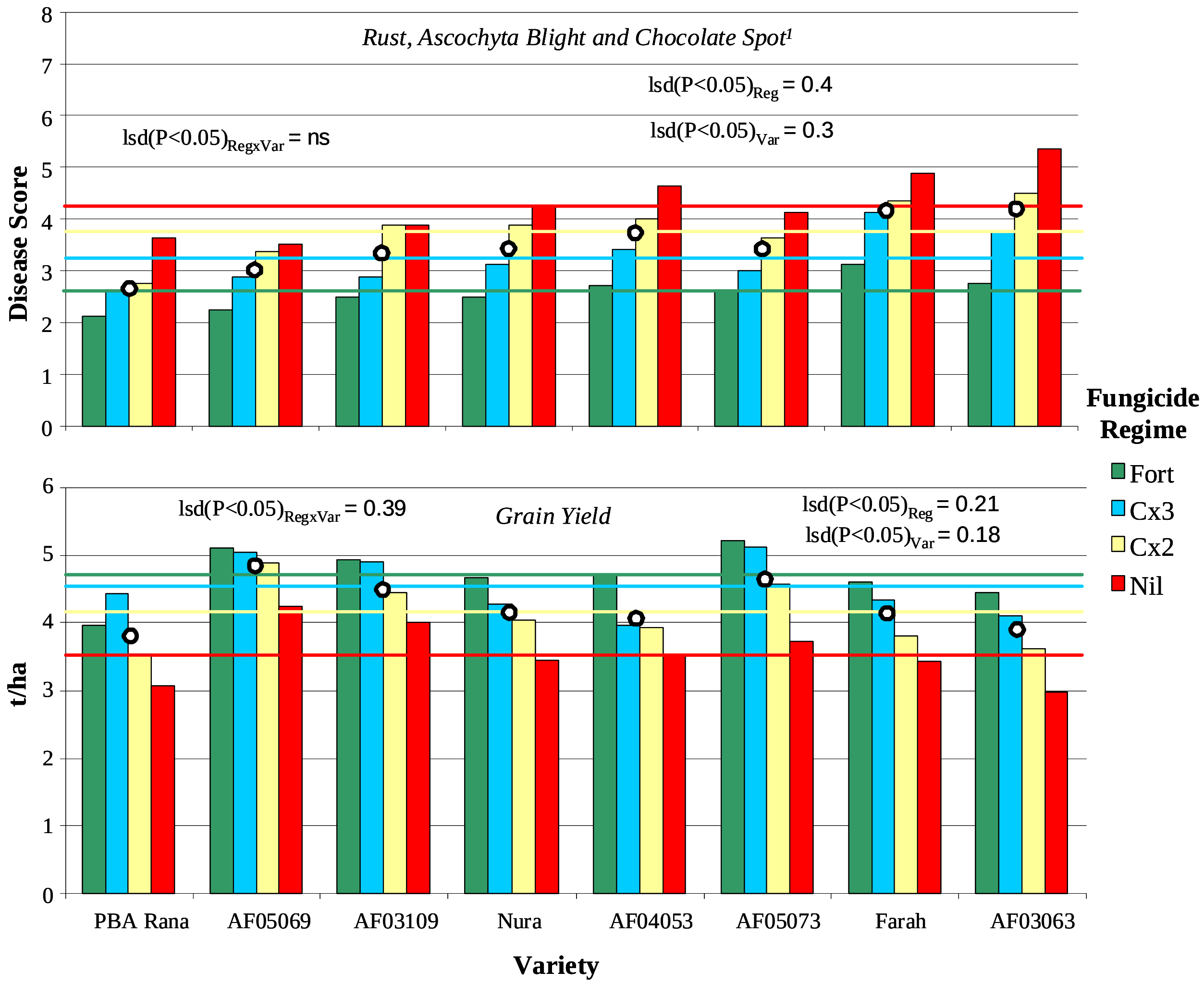


**Figure B5.1.** The interaction effect of fungicide regime and variety on disease damage score recorded October 25 (1 – no symptoms present, 9 – complete plot death) and grain yield of faba beans in standing stubble at Rupanyup in 2011. [1]*Disease damage was a combination of Rust, Ascochyta Blight and Chocolate Spot. Rust was the predominant disease present.*

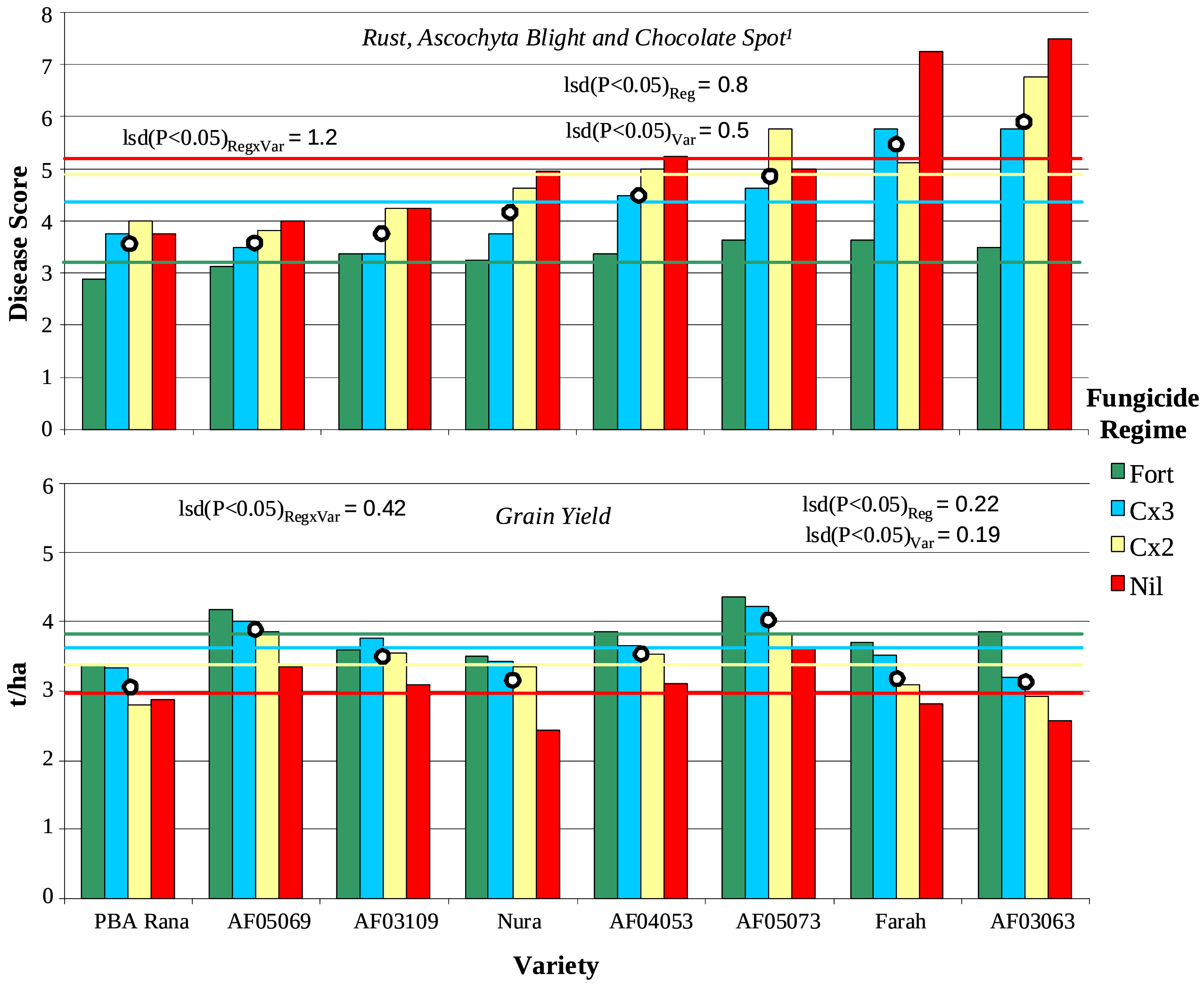


**Figure B5.2.** The interaction effect of fungicide regime and variety on disease damage score recorded October 25 (1 – no symptoms present, 9 – complete plot death) and grain yield of faba beans in burnt stubble at Rupanyup in 2011. [1]*Disease damage was a combination of Rust, Ascochyta Blight and Chocolate Spot. Rust was the predominant disease present.*

- Pod Height – Height to the lowest pods in the standing stubble were 10-25% higher than in the burnt stubble (Table B6.1). In the standing stubble trial, all varieties had a similar bottom pod height, except Nura and AF03063, which were significantly lower than the best variety AF05069. In the burnt stubble trial PBA Rana had the highest bottom pod height and Nura and AF03063 the lowest (Table B5.1).

- Grain Yield - Grain yields in 2011 were relatively high, ranging from 4.0 to 5.2t/ha on the standing stubble and 3.4 to 4.4t/ha on the burnt stubble, both in the fortnightly fungicide regime (Fig's. B5.1 and B5.2). No difference was noted between row spacings, so data presented is based on the interaction between fungicide regime and variety only. Overall grain yield in the standing stubble trial averaged 20% more than the burnt stubble trial. The maturity of the plots in the standing stubble was up to 2 weeks later than the burnt stubble. The response to fungicide regimes across varieties was relatively similar in both trials. In comparison to the fortnightly regime the average yield loss for the 'Cx3' regime was approximately 5%, for the 'Cx2' regime 12% and the 'nil' treatment 23% (Fig's. B5.1 and B5.2). The relative response of varieties did not appear to be related to the disease score, in that, the varieties with highest disease scores, did not show significantly greater yield loss in the 'nil' treatment than the varieties with lowest disease scores. When comparing the overall grain yield of varieties, AF05069 and AF05073 were 15-20% greater than Farah in all stubble treatments and fungicide regimes (Fig's. B5.1 and B5.2). While disease was relatively severe in this trial there appeared to be no effect on seed quality.

**Table B5.1.** The height (cm) to bottom pod of Faba Bean varieties grown in the disease management trials on standing and burnt stubble at Rupanyup in 2011.

| Trial | AF03063 | Nura | AF03109 | AF05073 | AF04053 | Farah | AF05069 | PBA Rana | Average |
|---|---|---|---|---|---|---|---|---|---|
| **Standing** | 29.9 | 30.1 | 32.4 | 32.9 | 32.4 | 33.0 | 34.6 | 32.8 | 32.3 |
| **Burnt** | 24.2 | 24.2 | 24.8 | 24.9 | 26.5 | 27.1 | 28.2 | 29.2 | 26.1 |

Standing stubble trial: lsd(P<0.05)Var = 3.0
Burnt stubble trial: lsd(P<0.05)Var = 3.3.

## Key Findings and Comments

Similar to other pulse crops growing conditions in 2011 were excellent for faba beans, due to extreme rainfall events during the summer of 2010/11 which resulted in soil profiles at or near field capacity at sowing. In addition, temperatures were mild in the in the flowering and podding periods with few frosts or high temperatures, so yield potential was high. Similar to chickpeas, row spacing had no major effect on grain yields in 2011 in either standing or burnt stubble. The importance of residue when seasonal conditions are dry to maintain stored moisture was again highlighted with grain yield in the standing stubble trial averaging 20% more than the burnt stubble trial. The main reason for reduced yields was likely to be greater evaporation from the soil surface as similar to lentils the maturity of plots on the burnt stubble was significantly earlier than the standing stubble.

There were no major difference in the response of varieties to fungicide regimes between the two stubble trials. Disease, predominately rust, resulted in grain yield losses of >20% (generally between 0.5-1t/ha). There were clear differences in the susceptibility of varieties to the disease present, however the varieties with greater tolerance, did not appear to have a grain yield advantage in the unsprayed treatment. It is unclear why there were no differences and further work will occur in 2012 to more clearly understand the impacts of rust in faba beans. Also despite severe disease in this trial there appeared to be no effect on seed quality. This is indicative of the relatively dry finish to the season meaning that it is less likely for disease to be transferred from the plant or pods onto seed.

A particular highlight of this trial was the yield gains of two new varieties, AF05069 and AF05073 compared with Farah. This confirms results of 2010 at Vectis in the Wimmera where AF05073 had similar yield gains compared with Farah (AF05069 was not tested in 2010).

## B6 Row Spacing x Disease Management x Stubble, HRZ Southern (Lake Bolac), Victoria

**Aim**

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

**Experimental Treatments**

Varieties: Farah, Nura, PBARana, AF03063.

Fungicide Regimes:

| Regime | Chemical & Application Rate[1] | Timing |
|---|---|---|
| Complete (Fort) | chlorothalonil 720 @ 2L/ha<br>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: 18 cm row spacing, slashed stubble (sl18),
18 cm row spacing, burnt stubble (B18),
36 cm row spacing, inter-row, slashed stubble (sl36),
36 cm row spacing, inter-row, burnt stubble (B36).

*Note: Stubble treatments were sown as independent trials.*

**Other Details**

Sowing date: 20 May.
Fertiliser: MAP + Zn @ 100 kg/ha at sowing.
Plant Density: 20 plants/m$^2$.

**Results and Interpretation**

- Key Message: Yield loss from disease in PBA Rana was significantly less than other varieties compared in this trial.

- Disease Damage – Due to suitable winter and spring time conditions, disease pressure was high in the faba beans. Aschochyta blight and chocolate spot were noticed in late August and rust early September. During September and October, rust became the predominant disease, probably because the trial was designed to assess management options for chocolate spot and chemicals used only have limited efficacy on rust. The level of disease was assessed November 15, just prior to the beginning of leaf drop and maturity.

  In the slashed stubble trial disease scores were less for all varieties and fungicide regimes than observed in the burnt stubble (Fig. B6.1). However, the general response of varieties across the fungicide regimes was relatively consistent in the two trials. The 'Nil' treatment was significantly worse than the 'Cx2' and 'Cx3' treatments, which were worse than the 'Fortnightly treatment'. Among varieties PBA Rana showed the lowest level of disease, while Farah and AF03063 had the highest levels of disease (Fig. B6.1).

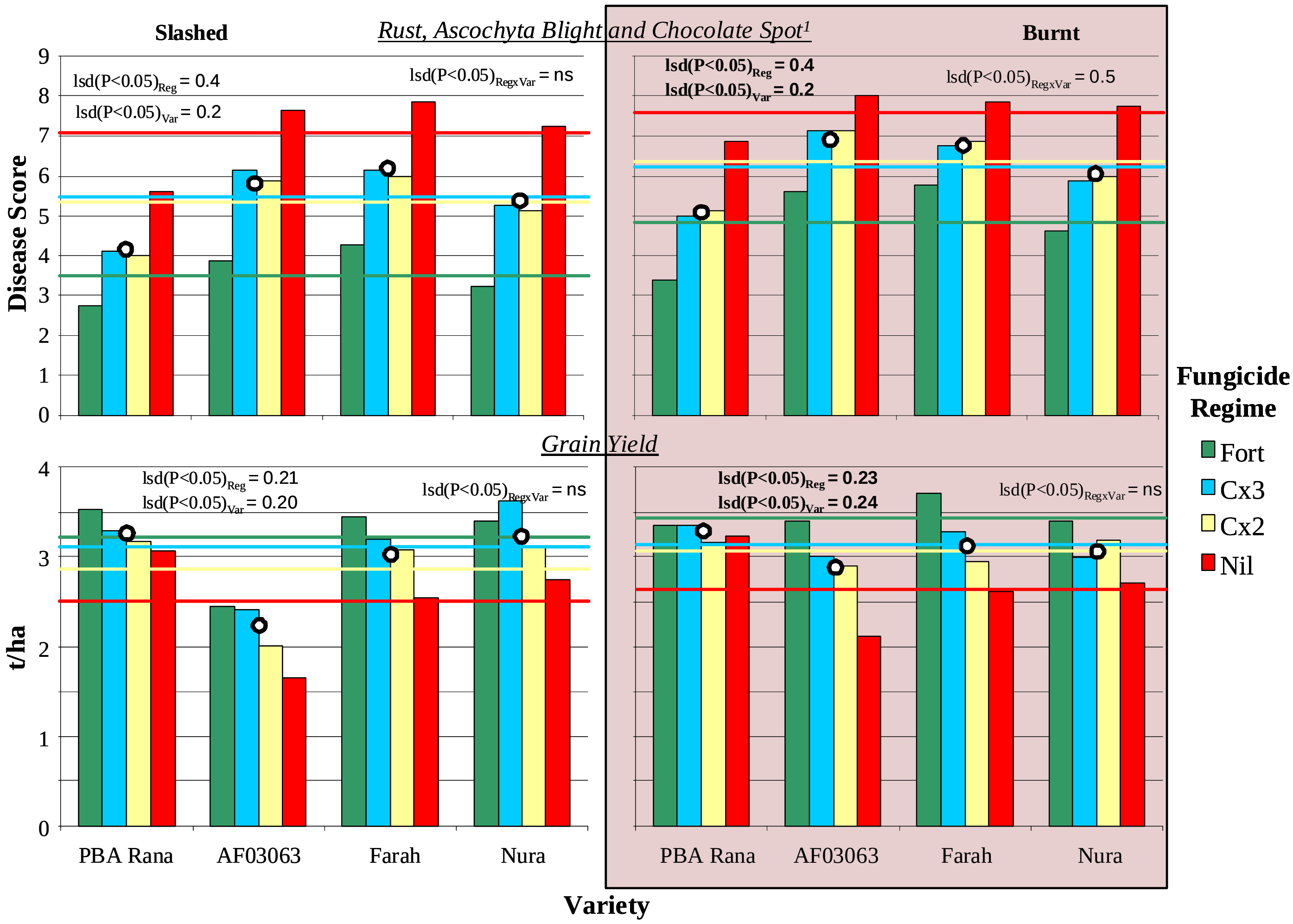


**Figure B6.1.** The interaction effect of fungicide regime and variety on disease damage score recorded October 25 (1 – no symptoms present, 9 – complete plot death) and grain yield of faba beans in slashed and burnt stubble at Lake Bolac 2011. [1]*Disease damage was a combination of Rust, Ascohyta Blight and Chocolate Spot. Rust was the predominant disease present.*

- Grain Yield – Grain yields in 2011 ranged from 3.4 to 3.7t/ha on the burnt stubble and 2.4 to 3.5t/ha on the slashed stubble, both in the fortnightly fungicide regime (Fig. B6.1). Grain yield in the burnt standing stubble and slashed stubble trials were similar for all varieties except AF03063, which was 25% lower in the slashed stubble. The response to fungicide regimes across varieties was relatively similar in both trials. Generally, PBA Rana showed the lowest yield loss and AF03063, was greatest, consistent with visual disease scores. For example, in comparison to the fortnightly regime the yield loss in the 'Nil' treatment for PBA Rana was 13% and 4% in the slashed and burnt stubble, respectively, for Nura, 19% and 20%, for Farah, 26% and 30%, and for AF03063, 32% and 37% (Fig. B6.1). While disease was relatively severe in this trial there appeared to be no effect on seed quality.

## Key Findings and Comments

Similar to other pulse crops growing conditions in 2011 were excellent for faba beans, due to extreme rainfall events during the summer of 2010/11 which resulted in soil profiles at or near field capacity at sowing. In addition, temperatures were mild in the in the flowering and podding periods with few frost or high temperatures, so yield potential was high. Stubble retention appeared to have no major effect on grain yield which was inconsistent with results from a similar trial at Rupanyup, where there was a 20% yield loss in burnt stubble. It is unclear, why there were significant differences between the two trial sites. Disease, predominately rust, resulted in grain yield losses of between 5 and 35% . There were clear differences in the susceptibility of varieties to the disease present, and this negatively correlated with grain yield. The variety with the lowest disease scores, had the lowest grain yield loss in the 'Nil' fungicide treatment. Further work will occur in 2012 on a broader range of varieties and fungicide regimes to control rust. Also despite severe disease in this trial there appeared to be no effect on seed quality. This is indicative of the relatively dry finish to the season meaning that it is less likely for disease to be transferred from the plant or pods onto seed.

## 4. Lupin

**U1 Sowing Date x Row Spacing, MRZ Lower Eyre Peninsula (Wanilla), South Australia**

Co-authored by Andrew Ware, South Australian Research & Development Institute – Port Lincoln

### 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 and potential release 01A012R67
Sowing dates: 4 May (Early), 26 May (Mid), 15 June (Late)
Row Spacing: Narrow = 24cm (10 inch), Wide = 48cm (20 inch)
Fertiliser: Map + Zn @ 100kg/ha at sowing

### Results and Interpretation

- Grain Yield – a full moisture profile at sowing, followed by high rainfall throughout June and July resulted in waterlogging at this site, and poor and variable yields, all a common occurrence in commercial lupin crops across the Lower Eyre Peninsula in 2011. The use of various scores as covariates during analysis failed to reduce the variability across the trial site (cv =18.8) and caution is required in interpreting results.
  Variety and row spacing had no effect on grain yield of lupins in 2011. However, sowing date had a significant effect on grain yield (Table U1.1). Mid sown (May 26$^{th}$) lupins yielded higher than early sown (May 4$^{th}$), which was higher yielding than late sown lupins (June 15$^{th}$).
- Podding Height – Sowing date was the only variable influencing top pod height of lupins in 2011 (Table U1.2). Top pod height decreased with delayed sowing, likely due to shorter plant height in later sown plants. Row spacing and variety had no influence on top pod height in 2011.
  A two way (Sowing Date x Variety) effect was seen for bottom pod height of lupins in 2011 (Table U1.3). All varieties except Mandellup showed lower bottom pod height with each delay in sowing. Mandellup showed similar bottom pod heights at the two earlier sowing dates, but lower at the later sowing date. Jindalee, the latest maturing variety, had the highest or equal highest bottom pod height of the four varieties.

**Table U1.1.** Grain yield (t/ha) of lupins at three sowing dates, Wanilla 2011.

| Sowing Date | 4-May | 26-May | 15-Jun |
|---|---|---|---|
| **Yield (t/ha)** | 1.83 $^{b}$ | 2.12 $^{a}$ | 1.27 $^{c}$ |

lsd (P<0.05) = 0.28

**Table U1.2.** Top pod height (cm) of lupins sown at three sowing dates, Wanilla 2011.

| Sowing Date | 4-May | 26-May | 15-Jun |
|---|---|---|---|
| **Height (cm)** | 67 $^{a}$ | 53 $^{b}$ | 46 $^{c}$ |

lsd (P<0.05) = 6.5

**Table U1.3.** Bottom pod height (cm) of four lupin varieties sown at three sowing dates, Wanilla 2011.

| Sowing Date | 01A012R67 | Jenabillup | Jindalee | Mandelup |
|---|---|---|---|---|
| **4-May** | 35 $^{ef}$ | 39 $^{f}$ | 47 $^{g}$ | 39 $^{f}$ |
| **26-May** | 27 $^{cd}$ | 31 $^{de}$ | 35 $^{ef}$ | 35 $^{ef}$ |
| **15-Jun** | 18 $^{a}$ | 24 $^{bc}$ | 24 $^{bc}$ | 21 $^{b}$ |

lsd (P<0.05) SD x Var = 4.4 (4.5 same SD)

**Key Findings and Comments**

Due to early season waterlogging grain yields of lupin on Lower Eyre Peninsula were variable and generally poor in 2011 and no effect of variety choice and row spacing on grain yield was observed. However a sowing date response did occur with the mid sown lupins outyielding early and late sown lupins.

The potential release 01A012R67 performed similarly to other varieties in this trial, however it has shown high yield potential in other trials across the Eyre Peninsula. This line was chosen as a potential release for its earlier flowering and high yield potential, particularly in eastern states, however it has now been surpassed by other advanced breeding lines and will no longer be released.

Previous results have shown a significant variety and row spacing response for grain yield of lupins, so that while there was a general decrease in yield of all varieties at the late sowing date, late sowings of Jenabillup at wide row spacing were able to recover some of the yield lost from delayed sowing. This demonstrates that these varieties have the potential to act differently to sowing time and row spacing in the higher rainfall environment, and row spacing may be a tool for improving the conversion of high biomass into grain yield in some varieties.

## U2 Herbicide tolerance, Wanilla (Lower Eyre Peninsula), Tooligie (Upper Eyre Peninsula, South Australia

Co-authored by Andrew Ware, South Australian Research & Development Institute – Port Lincoln

### Aim

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

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

### Treatments

| | |
|---|---|
| Varieties: | Jenabillup, Jindalee, Mandelup, Wonga and potential release 01A012R67 |
| Treatments: | Nil herbicides |
| | Low Metribuzin (100g/ha – label rate for light soil type) |
| | High Metribuzin (200g/ha) |
| | Low Metribuzin (100g/ha) plus Diflufenican (100ml/ha) |
| | High Metribuzin (200g/ha) plus Diflufenican (100ml/ha) |
| Timing: | 27th July (8-10 leaf) |
| Fertiliser: | Map + Zn @ 100kg/ha at sowing |
| Sites: | Wanilla (high rainfall Lower Eyre Peninsula, sand over light clay) |
| | Tooligie (medium rainfall Upper Eyre Peninsula, sand over medium clay) |

### Results and Interpretation

- Early season growth – As for the Wanilla sowing date trial, waterlogging throughout June and July resulted in variable growth and generally poor and variable yields in the Wanilla lupin metribuzin trial. The trial at Tooligie escaped early damage from waterlogging, but sustained extensive hail damage immediately after metribuzin treatment. The site recovered well, however post-treatment visual damage scores were not measured at this site due to hail damage.
- Visual Damage Score – Early damage scores taken at Wanilla showed a treatment effect (Table U2.1), but no variety effect indicating all varieties performed similarly to metribuzin and brodal treatments.
  All herbicide treatments showed visual damage symptoms compared to the untreated control. High Metribuzin + Diflufenican showed the highest level of herbicide damage, while Low Metribuzin, High Metribuzin and Low Metribuzin + Diflufenican showed similar levels of damage.
  No damage scores were taken at Tooligie due to severe post-treatment hail damage.
- Grain Yield – A significant Treatment x Variety interaction was seen for grain yield at Wanilla (Figure U2.1). The potential release 01A012R67 was the highest or equal highest yielding variety for all treatments. Untreated plots of the advanced breeding line 01A012R67 were higher yielding than all other varieties except for the Wonga Nil.
  While yield losses ranged from 0-38% across all treatments, the addition of diflufenican with either rate of metribuzin showed no further yield loss in any of the five varieties.
  Jindalee and Mandelup showed no significant difference in grain yield between the five herbicide treatments. Wonga was the most sensitive variety to the four herbicide treatments, showing the highest yield loss from herbicide treatments of all varieties tested. A 27% yield loss was observed from the two low metribuzin treatments and a 38% yield loss from the High Metribuzin treatment.
  Jenabilup displayed no yield loss from the two Low treatments, however a significant yield loss (averaging 26%) occurred from the high metribuzin treatments.
  The breeding line 01A012R67 showed a significant yield loss from all treatments except Low Metribuzin + Diflufenican. An 18% yield loss was observed from Low Metribuzin, while the two high metribuzin treatments averaged 23% yield loss.

Grain yields at Tooligie show a herbicide treatment effect (Table U2.2), but no variety interaction. This means that all varieties behaved similarly for each treatment at this site. All treatments reduced grain yield except for Low Metribuzin. The High Metribuzin plus Diflufenican treatment incurred the highest level of grain yield loss, yielding 21% lower than the Nil, but was not significantly different to the High Metribuzin treatment.

**Table U2.1.** Effect of various herbicide treatment combinations on visual damage score (0-5) of lupins at Wanilla, Lower Eyre Peninsula 2011. 0= no leaf burn, 1= 20% leaf burn, 5= 100% death.

| Treatment | Nil | Low Met | High Met | Low Met + Diflufenican | High Met + Diflufenican |
|---|---|---|---|---|---|
| Visual Damage Scores (0-5) | 0.1 [c] | 0.7 [b] | 0.9 [b] | 0.7 [b] | 1.3 [a] |

lsd (P<0.05) = 0.38

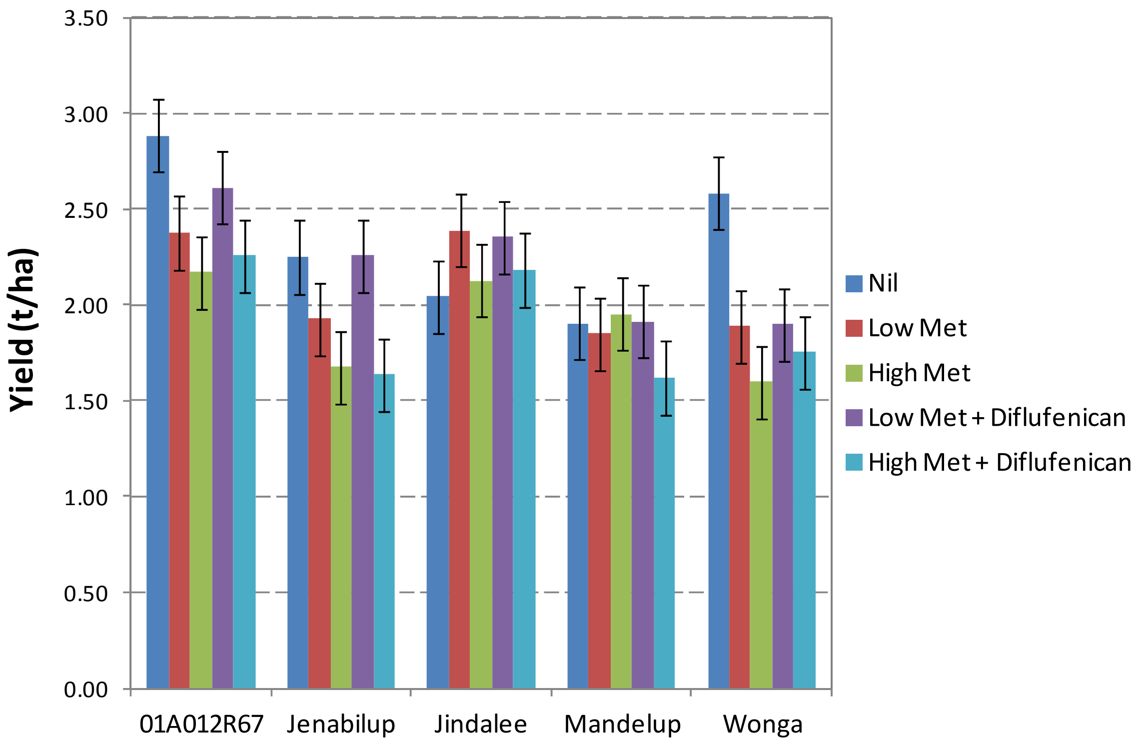


**Figure U2.1.** Effect of various herbicide treatment combinations on grain yield (t/ha) of five lupin varieties at Wanilla, Lower Eyre Peninsula 2011.

**Table U2.2.** Effect of various herbicide treatment combinations on grain yield (t/ha) of lupins at Toologie, Lower Eyre Peninsula 2011.

| Treatment | Nil | Low Met | High Met | Low Met + Diflufenican | High Met + Diflufenican |
|---|---|---|---|---|---|
| Yield (t/ha) | 1.69 [a] | 1.61 [ab] | 1.44 [cd] | 1.54 [bc] | 1.33 [d] |

lsd (P<0.05) = 0.12

## Key Findings and Comments

The early season climatic events of waterlogging (Wanilla) and hail damage (Tooligie) were not conducive for small scale field trial studies, but reflected wide scale industry issues from these regions. Although this meant that some measurements could not be taken, reasonable results were still gained from these trials.

The potential release 01A012R67 performed well across all herbicide treatments, and shows high yield potential. This line was chosen as a potential release for its earlier flowering and high yield potential, particularly in eastern states, however it has now been surpassed by other advanced breeding lines and will no longer be released.

Metribuzin applied post emergence (PE) (8-10 leaf) resulted in significant yield losses at both sites at the high rate and yield loss in some varieties at Wanilla at the low rate. Yield losses from use of metribuzin, particularly at high rates, were seen in Wonga, Jenabilup and the advanced breeding line 01A012R67 at Wanilla. The highest yield losses at this site were seen in the sensitive variety Wonga, with up to 38% yield loss compared to the control. Mandelup and Jindalee showed no yield loss from any of the herbicide treatments in 2011, and may have sufficient tolerance at this site. However, results at Tooligie were similar to results from 2010 trials, demonstrating that all varieties performed similarly and show yield losses from PE use of metribuzin, particularly at the higher rate. It is likely that the response from PE use of metribuzin in lupins is similar to the response observed in lentils, and hinges on the climatic conditions around the time of application. Varietal differences in tolerance to post emergent metribuzin exist and any potential registration is likely to be only for specific varieties.

In all four of the trials that have been conducted (2010 and 2011), the addition of Diflufenican did not significantly decrease grain yield further than the corresponding rate of metribuzin alone. This result appears promising, and would allow additional broadleaf weed control in specific lupin varieties if registration for use of PE metribuzin could be sought in the eastern states as it has been for Western Australia. Further work will be required to support these results.

## U3 Row Spacing, HRZ Southern (Lake Bolac), Victoria

### Aim

To investigate the impact of row spacing and stubble management on a range of lupin varieties.

### Experimental Treatments

| | |
|---|---|
| Varieties: | 01A012R-67, Jenabillup, Jindalee, Mandelup. |
| Row Spacings/Stubble: | 18 cm row spacing, slashed stubble (sl18),<br>18 cm row spacing, burnt stubble (B18),<br>36 cm row spacing, inter-row, slashed stubble (sl36),<br>36 cm row spacing, inter-row, burnt stubble (B36). |

*Note: Stubble treatments were sown as independent trials.*

### Other Details

Stubble

| | |
|---|---|
| Sowing date: | 20 May. |
| Fertiliser: | MAP + Zn @ 100 kg/ha at sowing. |
| Plant Density: | 60 plants/$m^2$. |

### Results and Interpretation

- Key Message: The new line 01A012R-67 had grain yields equivalent or higher than all other varieties compared.

**Figure U3.1.** The interaction effect of row spacing and variety on grain yield (t/ha) of lupins in slashed and burnt stubble at Rupanyup in 2011.

| Row Spacing (m) | **01A012R-67** | **Jenabillup** | **Jindalee** | **Mandelup** | *Average* |
|---|---|---|---|---|---|
| | | *BURNT* | | | |
| **0.18** | 3.82 | 3.20 | 3.26 | 3.91 | *3.55* |
| **0.36** | 3.73 | 3.36 | 3.20 | 3.59 | *3.47* |
| *Average* | *3.77* | *3.28* | *3.23* | *3.75* | *3.51* |
| | | *SLASHED* | | | |
| **0.18** | 3.22 | 2.19 | 2.47 | 2.88 | *2.69* |
| **0.36** | 3.24 | 2.40 | 2.81 | 3.39 | *2.96* |
| *Average* | *3.23* | *2.29* | *2.64* | *3.14* | *2.82* |

Slashed stubble trial: lsd(P<0.05)rsxvar = 0.52; lsd(P<0.05)gen = 0.15; lsd(P<0.05)rowspace = ns.
Burnt stubble trial: lsd(P<0.10) rsxvar = 0.76; lsd(P<0.05)gen = 0.19; lsd(P<0.05)rowspace = ns.

- Grain Yield – Grain yields in 2011 were relatively high, ranging from 3.2 to 3.9t/ha on the burnt stubble and 2.2 to 3.4t/ha on the slashed stubble (Table U3.1). Overall grain yield in the burnt stubble trial averaged 20% more than the slashed stubble trial. There were no major effects of row spacing on grain yield. Mandelup and 01A012R-67 had the highest yields, 15-30% greater than Jenabillup and Jindalee (Table U3.1).

### Key Findings and Comments

Similar to other pulse crops growing conditions in 2011 were excellent for lupins, due to extreme rainfall events during the summer of 2010/11 which resulted in soil profiles at or near field capacity at sowing. In addition, temperatures were mild in the in the flowering and podding periods with few frost or high temperatures, so yield potential was high. Stubble retention appeared to reduce grain yields in lupins, which is inconsistent with other pulses. It is unclear why this may have occurred. The new line 01A012R-67 had grain yields equivalent or higher than all other varieties compared.