# Southern Pulse Agronomy 2019 trial overview (faba beans, lentils and chickpeas) — Dookie

**Michael Straight[1], Jason Brand[2], Joshua Fanning[2], Tim Nigussie[2], Mitchell Fromm[2], Sundara Mawalagedera[2], Kat Fuhrman[1] and Aaron Vague[1]**

[1] FAR Australia

[2] Agriculture Victoria, Department of Jobs, Precincts and Regions

## Background

Pulses are an important part of many productive, profitable and sustainable farming systems across southern Australia. During recent seasons, there has been rapid and successful uptake of new pulse varieties with improved adaptability and novel management traits. In addition, pulses are expanding into the low rainfall zone (LRZ) and high rainfall zone (HRZ) where they have traditionally been less adapted.

Building on previous projects, through targeted research and development activities, the project *'Understanding the implications of new traits on adaptation, crop physiology and management of pulses in the southern region'* will contribute to the broader understanding of pulse growth and performance under changing environmental and management conditions. This knowledge will lead to improved yield and yield stability of pulses, ultimately leading to increased profitability and increased adoption of new varieties by growers.

## Project objectives

This overarching project delivers research and development activities across South Australia and Victoria to assess new traits for modern farming systems including:

- herbicide tolerance and weed ecology
- disease management
- canopy management (biomass and architecture)
- harvest quality.

From these activities, the project will develop variety specific agronomy packages (VSAP), addressing major and expanding production zones in alignment with GRDC's agroecological zones including: SA Mid-North, Yorke Peninsula and Lower Eyre Peninsula; SA Bordertown and the Victorian Wimmera; SA and Victoria's Mallee, including Upper Eyre Peninsula and the Victorian high rainfall zone.

As part of this overarching project, four trials were sown at Dookie during 2019 — a faba bean variety x sowing rate trial, a faba bean disease management trial, and lentil and chickpea trials. The results of these trials are presented in this report.

Select trials were repeated during 2020, however the 2020 reports were not available in time for inclusion in this publication.

## Aim

To determine the best faba bean varieties, sowing rates and disease management strategies for north-east Victoria.

To identify the yield potential of chickpeas and lentils grown in north-east Victoria.

## Seasonal conditions

The Dookie Southern Pulse Agronomy trials were sown into a dry seedbed and emerged after a rainfall event on 3 May, 2019. Establishment was very good across all trials.

Monthly rainfall for 2019 was average-above average from May – July, however it was extremely low from August — November for north-east Victoria. Dookie experienced a decile 2 season (Figure 1). The late rainfall events during October ensured most crops were harvestable, while low temperatures though spring, and the ability of the crops to grow sufficient canopies through winter, improved grain yields. During the reproductive phase, conditions were generally cool, however there were some frosts, which affected pod set across all crop types. There were no major heat events through October, while maximum temperatures were 2 degrees higher than the long-term average.

Table 1 describes the results of soil testing carried out at the trial site.

*Faba beans were evaluated in the 2019 Dookie Southern Pulse Agronomy trial.*

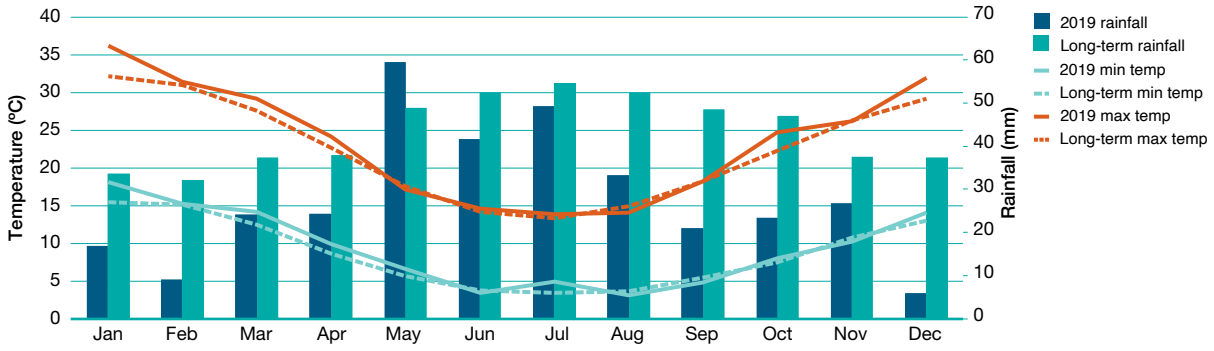


**FIGURE 1** Average monthly rainfall, average monthly maximum and minimum temperatures and absolute maximum or minimum at the at the Dookie trial site (MRZ, Victoria) in 2019 compared with the long-term average for Dookie

**TABLE 1** Soil characteristics of the Dookie trial site in 2019

| Depth (cm) | $NH_4$-N | $NO_3$-N | P | K | S | EC (dS/ m) |
|---|---|---|---|---|---|---|
| | (mg/ kg) | | | | | |
| 0–10 | 5.00 | 41.5 | 81 | 302.5 | 21.68 | 0.14 |
| 10–20 | 1.75 | 12.0 | | | | 0.09 |
| 20–40 | 1.50 | 9.0 | | | | 0.10 |
| 40–60 | 1.50 | 4.5 | | | | 0.34 |
| 60–80 | 1.50 | 2.0 | | | | 0.32 |
| 80–100 | 1.25 | 2.0 | | | | 0.36 |
| 100–120 | 1.00 | 2.0 | | | | 0.45 |

| Depth (cm) | OC | Total N | Total C | pH | | Clay | Coarse sand | Fine sand | Sand | Silt |
|---|---|---|---|---|---|---|---|---|---|---|
| | (%) | | | ($CaCl_2$) | ($H_2O$) | (%) | | | | |
| 0–10 | 1.41 | 0.14 | 1.87 | 5.35 | 6.15 | 36 | 19 | 27 | 46 | 18 |
| 10–20 | | | | 5.80 | 7.02 | 62 | 6 | 24 | 30 | 8 |
| 20–40 | | | | 6.62 | 7.70 | 74 | 5 | 11 | 15 | 10 |
| 40–60 | | | | 7.40 | 8.47 | 66 | 6 | 15 | 21 | 13 |
| 60–80 | | | | 8.08 | 9.10 | 68 | 4 | 16 | 20 | 12 |
| 80–100 | | | | 8.05 | 9.15 | 65 | 5 | 13 | 18 | 18 |
| 100–120 | | | | 8.10 | 9.12 | 61 | 6 | 22 | 28 | 11 |

# Trial 1: Dookie faba bean fungicide strategy x plant density and fungicide strategy trials (2019)

**Michael Straight, Kat Fuhrman and Aaron Vague**
FAR Australia

## Sowing information

**Sowing date:** 29 April, 2019
**Stubble height:** 30cm
**Row spacing:** 22.5cm
**Fertiliser:** 50kg/ha as MAP

## Key points

- In a season with little disease pressure, there were small varietal differences in chocolate spot symptoms throughout the season, although they did not manifest into yield differences.
- Sowing rate was critical to maximising yield during 2019. Lower sowing rates produced significantly lower yields when compared with higher rates.
- Sowing rate had a major effect on crop architecture, with lower sowing rate treatments podding over a larger portion of the stem, with a higher pod number, but lower overall dry matter (DM) harvest than the higher sowing rates.
- During 2019, grain yields were high (3.36 and 2.96t/ha) considering the dry finish to the season.
- Slower-maturing varieties held a green canopy for longer, but could not convert the green leaf area into yield due to the dry spring conditions.
- Varietal selection is the key to minimising disease, however, in low disease-pressure situations less disease doesn't automatically mean higher yields.

## Aim

To investigate the adaptability of a range of faba bean varieties and breeding lines to different plant densities and fungicide programs.

## Treatments

**Varieties:** See tables 2 and 3
**Plant densities:** See tables 2 and 3
**Fungicide strategies:** See tables 4 and 5

**TABLE 2** Seed weight and estimated sowing rate to achieve target plant densities for each of the varieties sown in the fungicide strategy x plant density trial at Dookie, Victoria, 2019

| Variety | Seed weight (g/100 seeds) | Target plant density (plants/m²) | | |
|---|---|---|---|---|
| | | 15 | 25 | 35 |
| | | Estimated sowing rates (kg/ha) | | |
| PBA Samira | 77 | 138 | 223 | 315 |
| PBA Zahra | 72 | 109 | 181 | 253 |
| Farah | 55 | 82 | 137 | 191 |
| PBA Amberley (AF11023) | 60 | 107 | 173 | 245 |

**TABLE 3** Seed weight and estimated sowing rate to achieve the target plant density sown in the fungicide strategy trial at Dookie, Victoria, 2019

| Variety | Seed weight (g/100 seeds) | Target plant density (plants/m²) |
|---|---|---|
| | | 20 |
| | | Estimated sowing rates (kg/ha) |
| PBA Samira | 77 | 177 |
| PBA Bendoc | 59 | 135 |
| PBA Zahra | 72 | 145 |
| Farah | 55 | 109 |
| Fiesta VF | 64 | 128 |
| PBA Amberley (AF11023) | 60 | 137 |

## Results and discussion — fungicide strategy x plant density trial

### i. Establishment

Average faba bean establishment was slightly below target for the 25 and 35 plants/m² treatments, at 21 and 28 plants/m² respectively. There was no interaction between sowing rate and variety. PBA Samira had the lowest average establishment (19 plants/m²) across the sowing rate treatments, while Farah had the highest (22 plants/m²) (Table 6).

### ii. Disease

Interactions between disease and variety or fungicide strategy were insignificant (Table 7).

PBA Amberley, Farah and PBA Zahra had significantly less leaf area infected with chocolate spot in the top part of the canopy than PBA Samira at both 10 and 25 September (Table 8). Green leaf retention (GLR) on 25 September was at least 9.6 per cent higher in Amberley (61.7 per cent) than any other variety.

**TABLE 4** Treatments and rates in the fungicide strategy x plant density trial at Dookie, Victoria, 2019

| | Early (6/8 node) | Early flowering | Mid-late flowering | Post flower |
|---|---|---|---|---|
| Nil fungicide | Nil | Nil | Nil | Nil |
| Best practice | Tebuconazole 150 ml | Carbendazim 500ml | Carbendazim 500ml | Carbendazim 500ml |
| Complete control | Veritas 1L | Aviator 600ml | Carbendazim 500ml | |

**TABLE 5** Treatments and rates in the fungicide strategy trial at Dookie, Victoria, 2019

| | Early (6/8 node) | Early flowering | Mid-late flowering | Post flower |
|---|---|---|---|---|
| Nil fungicide | Nil | Nil | Nil | Nil |
| Best practice | Tebuconazole 150 ml | Carbendazim 500ml | Carbendazim 500ml | Carbendazim 500ml |
| Complete control | Veritas 1L | Aviator 600ml | Carbendazim 500ml | |
| Old chemistry | Mancozeb 1.5kg | Mancozeb 1.5kg | Mancozeb 1.5kg | Mancozeb 1.5kg |
| New chemistry | Veritas 1L | Aviator 600ml | Aviator 600ml | |

**TABLE 6** Establishment of faba bean varieties sown at different rates on 22 May, 2019 in the fungicide strategy x plant density trial at Dookie, Victoria, 2019

| Target plant density (plants/m$^2$) | Actual plant density (plants/m$^2$) | | | | |
|---|---|---|---|---|---|
| | PBA Samira | PBA Zahra | Farah | PBA Amberley | Average |
| 15 | 13 | 14 | 15 | 14 | 14 |
| 25 | 18 | 21 | 23 | 20 | 21 |
| 35 | 26 | 27 | 28 | 29 | 28 |
| **Average** | **19** | **21** | **22** | **21** | |

LSD (P<0.05) sowing rate x variety = ns; sowing rate = 2; variety = 2.

**TABLE 7** Chocolate spot disease score* and green leaf retention of various fungicide strategies in the fungicide strategy x plant density trial at Dookie, Victoria, September 2019

| | Chocolate spot (% LAI) | | | GLR (%) |
|---|---|---|---|---|
| | 10 September | | 25 September | 25 September |
| Fungicide strategy | Top | Bottom | Top | Bottom |
| Untreated | 0.4 | 1.1 | 2.5 | 60 |
| Best practice | 0.1 | 0.9 | 2.1 | 48 |
| Complete control | 0.5 | 0.9 | 2.4 | 50 |
| **LSD (P<0.05)** | **ns** | **ns** | **ns** | **ns** |

* 0 – no disease; 100 – dead.

**TABLE 8** Chocolate spot disease score* and green leaf retention of different varieties in the fungicide strategy x plant density trial at Dookie, Victoria, September 2019

| | Chocolate spot (% LAI) | | | GLR (%) |
|---|---|---|---|---|
| | 10 September | | 25 September | 25 September |
| Variety | Top | Bottom | Top | Bottom |
| PBA Samira | 0.5 | 1.2 | 2.9 | 50 |
| PBA Zahra | 0.3 | 1.0 | 2.1 | 52 |
| Farah | 0.3 | 1.1 | 2.4 | 47 |
| PBA Amberley (AF11023) | 0.2 | 0.6 | 2.0 | 62 |
| **LSD (P<0.05)** | **0.2** | **0.25** | **0.48** | **6.73** |

* 0 – no disease; 100 – dead.

### iii. Crop architecture

Plant height increased with sowing rate. The tallest variety was PBA Samira (94.5cm), in the 35 plants/m$^2$ treatment (Table 9). For both PBA Samira and PBA Amberley, the height of the bottom-most pod was lowest in the 15 plants/m$^2$ treatment. Although pod number and seed weight were highest in the 15 plants/m$^2$ treatment for both PBA Amberley and PBA Samira, harvested DM was lowest in these treatments. This suggests harvest index (HI) in treatments with lower plant populations (15 plants/m$^2$) was significantly higher (around 55 per cent) than the HI observed in the treatments with higher plant populations (around 40 per cent).

### iv. Grain yield and quality

Grain yields were very good, averaging 2.79t/ha across the trial despite the dry spring. Farah had the lowest seed weight (65g per 100 seeds) but produced the highest yield (3t/ha) (Figures 2 and 3).

There were significant differences in yield between plant density treatments, with the 15 plants/m$^2$ treatment (2.58t/ha) yielding significantly less than the 25 plants/m$^2$ treatment (2.85t/ha) and 35 plants/m$^2$ (2.94t/ha) treatments. Plant densities lower than 25 plants/m$^2$ resulted in a yield penalty (Figure 3).

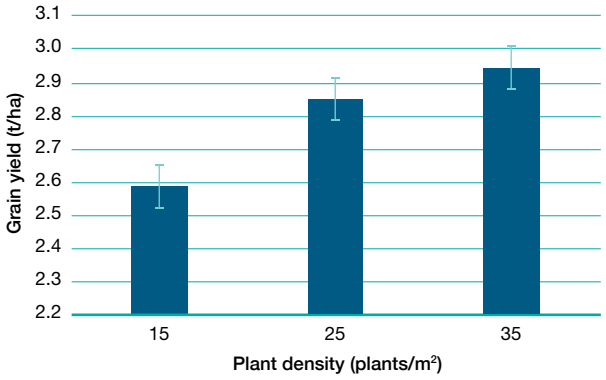


**FIGURE 3** Grain yield of faba beans in the fungicide strategy x plant density trial at Dookie, Victoria, 2019

Error bars are a measure of LSD. LSD = 0.13.

Farah had the highest average yield (2.97t/ha), yielding significantly more than PBA Zahra (2.85t/ha), PBA Samira (2.75t/ha) and PBA Amberley (AF11023) (2.6t/ha) (Figure 4).

**TABLE 9** Faba bean phenology of new and existing faba bean varieties, and plant population in the fungicide strategy x plant density trial at Dookie, Victoria, 2019

| Variety | Plant density (plants/m$^2$) | Plant height (cm) | Bottom pod height (cm) | Stem length between bottom and top pod (cm) | Pod number | Branches per plant | Dry matter harvest (t/ha) | Seed weight (g/100 seeds) |
|---|---|---|---|---|---|---|---|---|
| PBA Samira | **15** | 92.4 | 36.3 | 25.8 | 6.8 | 3.8 | 4.26 | 62 |
| | **25** | 90.2 | 48.2 | 16.9 | 3.9 | 3.0 | 6.73 | 62 |
| | **35** | 94.5 | 51.5 | 17.8 | 4.7 | 3.3 | 6.88 | 61 |
| PBA Amberley (AF11023) | **15** | 83.8 | 37.3 | 21.5 | 6.3 | 4.3 | 4.53 | 60 |
| | **25** | 91.8 | 45.6 | 17.8 | 4.5 | 3.8 | 5.19 | 62 |
| | **35** | 94.3 | 53.7 | 13.7 | 3.9 | 3.1 | 6.03 | 61 |
| **LSD (P<0.05)** | | **6.1** | **8.2** | **7.2** | **1.8** | **0.6** | **1.74** | **ns** |

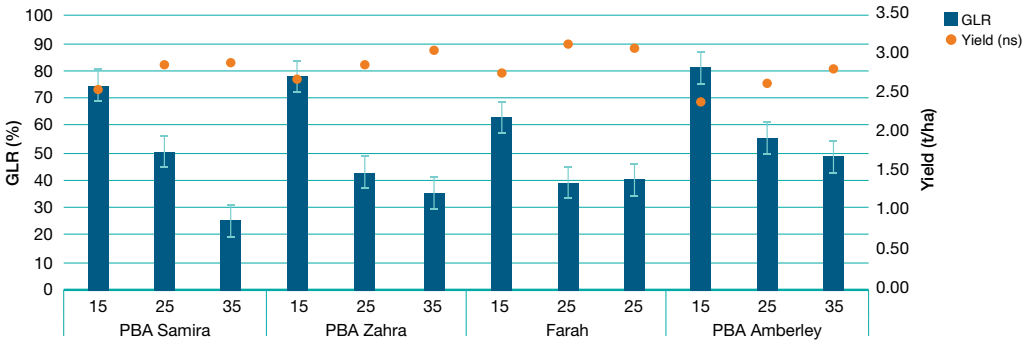


**FIGURE 2** Effect of variety* and plant population on green leaf retention (assessed 25 September) and grain yield in the fungicide strategy x plant density trial at Dookie, Victoria, 2019

Error bars are a measure of LSD. LSD GLR = 11.65.

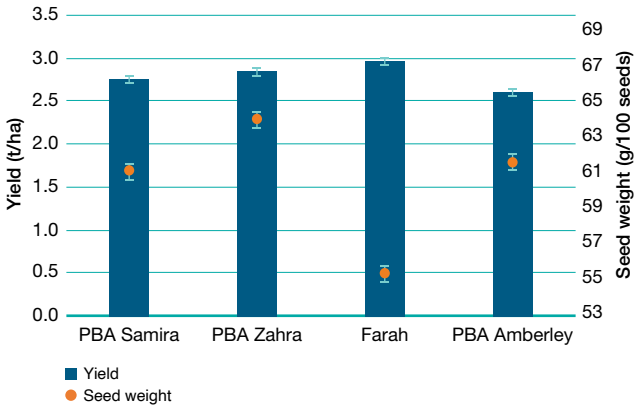


**FIGURE 4** Grain yield and seed weight of faba bean varieties* in the fungicide strategy x plant density trial at Dookie, Victoria, 2019

Error bars are a measure of LSD. LSD Yield= 0.08: LSD seed weight = 8.7.

### v. Green leaf retention (GLR)

Green leaf retention was closely linked with plant population. Lower plant populations had higher GLR due to lower plant biomass and delayed water use (Figure 2).

There were differences in GLR between varieties, however this did not affect yield. Amberley had the highest GLR, but due to the dry spring, could not convert the late green leaf into yield.

## Results and discussion — fungicide strategy trial

### i. Establishment

Establishment was reasonably even and reached the target plant densities (Table 10). Although differences between varieties were small, Fiesta (21.7 plants/m$^2$) had significantly higher plant establishment than PBA Amberley (18.3 plants/m$^2$) and PBA Samira (17.9 plants/m$^2$)

### ii. Disease

Diseases levels were very low in the trial (Tables 11 and 12) and fungicide strategy had no effect.

**TABLE 10** Faba bean establishment on 22 May 2019 in the fungicide strategy trial at Dookie, Victoria

| Variety | Establishment (plants/m$^2$)[1] |
|---|---|
| PBA Samira | 18 |
| PBA Bendoc | 20 |
| PBA Zahra | 20 |
| Farah | 20 |
| Fiesta VF | 22 |
| PBA Amberley | 18 |
| **LSD (P<0.05)** | **2.1** |

[1] Target plant population was 20 plants/m$^2$

**TABLE 11** Chocolate spot disease scores* for different faba bean varieties in the fungicide strategy trial at Dookie, Victoria, during September 2019

| | Chocolate spot (% LAI) | | | |
|---|---|---|---|---|
| | 10 September | | 25 September | |
| Variety | Top | Bottom | Top | Bottom |
| PBA Samira | 0.5 | 1.2 | 0.8 | 2.1 |
| PBA Bendoc | 0.4 | 1.4 | 0.7 | 1.9 |
| PBA Zahra | 0.4 | 1.3 | 0.3 | 2.0 |
| Farah | 0.3 | 1.7 | 0.4 | 1.8 |
| Fiesta VF | 0.6 | 1.8 | 0.6 | 2.4 |
| PBA Amberley | 0.1 | 0.9 | 0.3 | 1.3 |
| **LSD (P<0.05)** | **0.3** | **0.4** | **0.4** | **0.4** |

* 0 – no disease; 100 – dead.

**TABLE 12** Cercospora disease scores* for different faba bean varieties in the fungicide strategy trial at Dookie, Victoria, during September 2019

| | Cercospora (% LAI) | | |
|---|---|---|---|
| | 10 September | 25 September | |
| Variety | Bottom | Top | Bottom |
| PBA Samira | 1.4 | 0.2 | 1.8 |
| PBA Bendoc | 1.3 | 0.1 | 1.2 |
| PBA Zahra | 1.1 | 0 | 0.9 |
| Farah | 1.6 | 0.2 | 1.6 |
| Fiesta VF | 2 | 0.2 | 1.9 |
| PBA Amberley | 0.4 | 0.1 | 1.0 |
| **LSD (P<0.05)** | **0.5** | **0.25** | **0.68** |

* 0 – no disease; 100 – dead.

### iii. Yield and quality

Fiesta VF yielded significantly more (3.36t/ha) than PBA Samira (3.13t/ha), PBA Zahra (3.08t/ha) and Amberley (2.96t/ha), yielding 0.4t/ha more than PBA Amberley, while having around twice the disease levels.

Seed weight was highest in varieties where yield was lowest. This was because varieties such as PBA Samira, PBA Zahra and PBA Amberley produced significantly less grain, but the grain was significantly heavier — by up to 10g per 100 seeds (Figure 5).

## Conclusion

Grain yield in faba beans at Dookie during 2019 averaged around 3t/ha, which was very good given the reasonable start to the season was followed by a harsh, dry finish. The dry seasonal conditions meant fungicide management strategies had no impact on final yields.

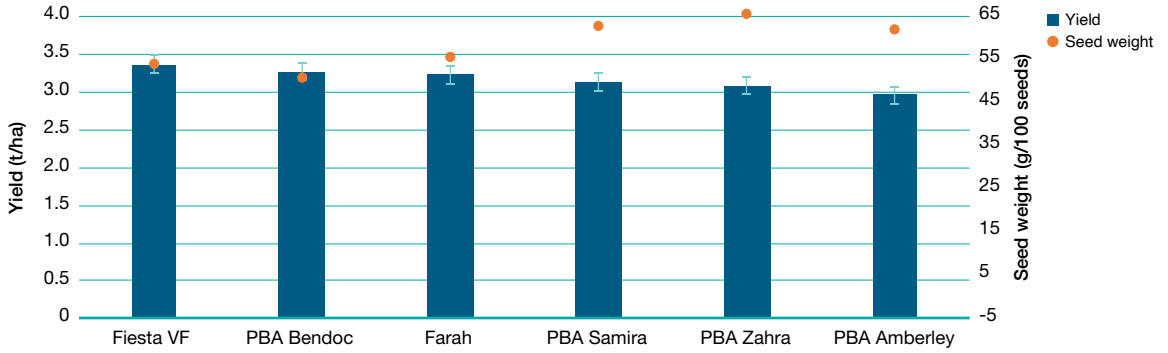


**FIGURE 5** Grain yield and seed weight of different faba bean varieties in the fungicide strategy trial at Dookie, Victoria, 2019

Error bars are a measure of LSD. LSD yield = 0.12: LSD seed weight = 1.18.

## Trial 2: Dookie lentil germplasm trials (2019)

**Michael Straight, Kat Fuhrman and Aaron Vague**

FAR Australia

### Key points

- Older lentil varieties, such as PBA Jumbo and PBA Jumbo2, were the top yielding varieties in a region where lentils are not traditionally grown.
- Yields were high (1.21–1.97t/ha), considering the dry finish at Dookie during 2019.

### Aim

To investigate the adaptability of a range of lentil varieties and breeding lines, specifically on the more acidic soils of the north-east high rainfall zone (HRZ) at Dookie.

### Treatments

Varieties: See Table 13.

### Sowing information

Sowing date: 29 April, 2019

Stubble height: 30cm

Row spacing: 22.5cm

Fertiliser: 50kg/ha MAP

All varieties were sown at 120 seeds/m$^2$. Treflan was applied as a pre-emergent herbicide and clethodim was applied as a post-emergent herbicide.

**TABLE 13** Disease scores on 10 September, harvest index, seed weight, and grain yield of lentils at Dookie, Victoria, 2019

| Variety | (% LAI) | Seed weight (g/100 seeds) | Harvest index (%) | Yield (t/ha) |
|---|---|---|---|---|
| PBA Jumbo | | 4.5 | 37 | 1.97 |
| PBA Jumbo2 | 2.3 | 4.9 | 42 | 1.96 |
| CIPAL1801 | 4.7 | 3.8 | 42 | 1.89 |
| PBA Flash | 3.7 | 4.4 | 35 | 1.85 |
| PBA Bolt | 2.3 | 4.1 | 32 | 1.81 |
| CIPAL1721 | 2.3 | 4.2 | 38 | 1.80 |
| PBA Hallmark XT | 1.7 | 3.5 | 37 | 1.60 |
| PBA Greenfield | 1.3 | 4.8 | 30 | 1.47 |
| CIPAL1504 | 1.3 | 3.9 | 26 | 1.42 |
| PBA Hurricane XT | 1.7 | 3.3 | 29 | 1.38 |
| PBA Ace | 2.0 | 4.2 | 30 | 1.37 |
| PBA Giant | 1.3 | 5.8 | 22 | 1.21 |
| **LSD (P<0.05)** | **1.8** | **0.3** | **10** | **0.41** |

## Results and discussion

### i. Disease

The percentage of leaf area infected (LAI) by disease were scored on 10 September, with overall disease levels being low (Table 13).

### ii. Grain yield and quality

The average seed weight was consistent with market classes for each of the varieties (Table 13).

PBA Jumbo, PBA Jumbo2, CIPAL1801, PBA Flash, PBA Bolt and CIPAL1721 yielded the highest, ranging between 1.80–1.97t/ha (Table 13).

### iii. Harvest index

Harvest index decreased with yield across all varieties. This highlights the superior ability of the higher yielding varieties to convert their winter biomass into grain. These factors, combined with a mild spring with few frost events, resulted in high yields across the trial.

## Conclusion

Lentils can yield well, despite seasonal factors, in north-east Victoria. Vigorous growth through winter combined with low background disease levels, showed that even in dry conditions lentils are a viable option for growers across the region if prices and rotations are favourable. It is worth noting waterlogging could be a significant issue during wetter seasons. In low a disease-pressure situation, such as was experienced during 2019, PBA Jumbo and PBA Jumbo2 yielded the highest.

# Trial 3: Dookie chickpea germplasm trial (2019)

**Michael Straight, Kat Fuhrman and Aaron Vague**
FAR Australia

## Key points

- Desi varieties were among top three highest yielding varieties at Dookie during 2019.
- Grain yields were high (0.90–1.53t/ha) considering the dry finish at Dookie during 2019.

## Aim

To investigate the adaptability of a range of chickpea varieties and breeding lines to the acidic soils of the high rainfall zone (HRZ) in north-east Victoria (Dookie).

## Treatments

Varieties: See Table 14.

## Sowing information

Sowing date: 29 April, 2019
Stubble height: 30cm
Row spacing: 22.5 cm
Fertiliser: 50kg/ha MAP

All varieties were sown at a rate of 35 seeds/m$^2$. Pre-emergent treflan and post emergent clethodim was applied for grass weed control.

**TABLE 14** Dry matter production at maturity, seed weight, grain yield and harvest index of chickpeas at Dookie, Victoria, 2019

| Variety | Type | DM production (t/ha) | Seed weight (g/100 seeds) | Yield (t/ha) | HI (%) |
|---|---|---|---|---|---|
| CICA1454 | Kabuli | 6.04 | 23 | 1.53 | 25 |
| Neelam | Desi | 3.61 | 15 | 1.41 | 40 |
| Howzat | Desi | 3.58 | 15 | 1.40 | 38 |
| CICA1521 | Desi | 5.32 | 17 | 1.36 | 25 |
| Genesis Kalkee | Kabuli | 4.79 | 29 | 1.29 | 27 |
| CICA1352 | Kabuli | 4.78 | 27 | 1.18 | 28 |
| D11022>F101>13F3TMWR2005 | Desi | 4.56 | 16 | 1.16 | 23 |
| PBA Striker | Desi | 5.10 | 17 | 1.14 | 22 |
| Genesis090 | Kabuli | 3.96 | 21 | 1.13 | 23 |
| PBA Monarch | Kabuli | 4.17 | 27 | 1.05 | 29 |
| PBA Maiden | Desi | 4.12 | 16 | 0.92 | 23 |
| D12084>14F3TMWR2AB008 | Desi | 3.77 | 15 | 0.90 | 25 |
| **LSD (P<0.05)** | | **1.42** | **1.6** | **0.22** | **8.3** |

## Results and discussion

### i. Dry matter production at harvest

Dry matter production (t DM/ha) varied across seed types and varieties. The Kabuli variety CICA1454 produced almost twice as much DM (6.04t DM/ha) at harvest than the highest-yielding Desi variety, Neelam (3.61t DM/ha) (Table 14). Despite large differences in biomass production, both varieties achieved similar grain yields and were the highest yielding for each chickpea type.

### ii. Grain yield and grain quality

Neelam, Howzat and CICA1521 were the highest yielding Desi varieties, with yields ranging from 1.40–1.36/ha. Of the Kabuli varieties, CICA1454 (1.53t/ha) yielded 18% more than Genesis Kalkee (1.29t/ha) (Table 14). As expected, Kabuli varieties had higher seed weights than Desi varieties. Genesis Kalkee had the highest seed weight 29g/100 seeds whereas the Desi variety Howzat had a seed weight of 15g/100 seeds.

### iii. Harvest Index

Harvest indices were higher in the Desi varieties, Neelam and Howzat than all other varieties. There is a correlation between HI and yield in Desi chickpea varieties.

## Conclusions

Chickpeas were a viable crop for the north-east region of Victoria during 2019, despite the dry spring. Low background disease pressure and the dry finish meant little-to-no yield penalty occurred as a result of disease. The large canopies produced by some Kabuli types caused some of these varieties to experience water stress from flowering until maturity; resulting in yield loss.

## Acknowledgments

The research undertaken as part of the GRDC-funded Southern Pulse Agronomy project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC. The authors would like to thank these growers for their continued support. The authors would also like to gratefully acknowledge SARDI Plant Pathology and Soil Biology groups for their scientific input and assistance, as well as advisors and grower groups involved in the project.