

Chasing high yield in faba beans at Wittenoom Hills 2021



Department of
Primary Industries and
Regional Development

Mark Seymour (Senior Research Scientist)

Department of Primary Industries and Regional Development Western Australia

Key Messages

- PBA Amberley faba bean produced yields over 3 t/ha
- Faba bean did not respond to Phosphorus (> 10 kg P/ha) or Nitrogen inputs.
- Our 'Extra' treatment in late August during a dry period scorched the leaves which resulted in a reduction in seed yield of 250 kg/ha.

Background

Growers in higher rainfall zones are testing the value of higher inputs in cereals and canola. With faba bean being more readily adopted by high rainfall farmers we are interested in seeing if beans respond to higher inputs.

We aim to determine if faba beans in higher rainfall zone respond to high rates of phosphorus, in-crop nitrogen and/or a complete/intensive nutritional and disease management package

Table 1 Trial Details

| | |
|--------------------------------------|---|
| Trial Location | Mt Burdett, Wittenoom Hills |
| Soil type | clay loam |
| Sowing date | 20 April |
| Sowing rate | 228kg/ha PBA Amberley inoculated using TagTeam and Alosca Group EF rhizobia packed with the seed |
| Fertiliser | See treatment tables. |
| Herbicides & Insecticides | Pre-seeding: Sharpen WG 30 mL/ha + Roundup Ultra Max 1.2 L/ha + Hasten 1% At seeding: IBS - Sprayseed 3 L/ha, 1.2 kg/ha terbuthylazine (875g/kg) + 180g/ha flumioxazin (500g/kg) + Kerb 600 mL/ha 17 June: 250mL/ha clethodim (360g/L) + 120g/ha butroxydim (250g/kg) + Uptake 0.2% 26 Aug 200 mL/ha Lemat (omethoate) 9 Sept 200 mL/ha Lemat (omethoate) 24 Sept Trojan 30 mL/ha 27 Oct Sharpen WG 30 mL/ha + Roundup Ultra Max 2 L/ha + Hasten 1% |
| Harvest Date | 17 Nov |

Table 2 CSBP soil analysis of Wittenoom Hills 2021

| Depth | | 0-10 | 10-20 | 20-30 |
|-------------------------------|----------|-------|-------|-------|
| Colour | | GRBR | YWBR | YW |
| Gravel | % | 0 | 0 | 0 |
| Texture | | 2.5 | 3 | 3 |
| pH Level (CaCl ₂) | | 6.5 | 7.3 | 8.3 |
| pH Level (H ₂ O) | | 7 | 8 | 9.5 |
| Ammonium Nitrogen | mg/kg | 1 | < 1 | < 1 |
| Nitrate Nitrogen | mg/kg | 24 | 16 | 5 |
| Total Nitrogen | % | 0.11 | 0.06 | 0.04 |
| Phosphorus Colwell | mg/kg | 29 | 12 | 7 |
| DGTP | ug/L | 70.85 | 11.81 | 8.12 |
| PBI | | 37.4 | 87.7 | 194.7 |
| Potassium Colwell | mg/kg | 380 | 426 | 627 |
| Sulfur | mg/kg | 82.1 | 76.6 | 117.4 |
| Organic Carbon | % | 1.27 | 0.72 | 0.33 |
| Conductivity | dS/m | 0.278 | 0.321 | 0.522 |
| DTPA Copper | mg/kg | 0.89 | 0.57 | 0.5 |
| DTPA Iron | mg/kg | 25 | 15.9 | 16.9 |
| DTPA Manganese | mg/kg | 1.24 | 0.49 | 0.36 |
| DTPA Zinc | mg/kg | 1.18 | 0.47 | 0.17 |
| Exc. Aluminium | meq/100g | 0.1 | 0.21 | 0.18 |
| Exc. Calcium | meq/100g | 7.22 | 11.04 | 11.22 |
| Exc. Magnesium | meq/100g | 1.22 | 3.71 | 8.69 |
| Exc. Potassium | meq/100g | 0.86 | 1.05 | 1.71 |
| Exc. Sodium | meq/100g | 0.32 | 1.11 | 5 |
| Boron Hot CaCl ₂ | mg/kg | 1.53 | 4.77 | 13.76 |

Table 3 2021 monthly rainfall (mm) from DPIRD Mt Burdett weather station

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | April-Oct | Annual |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----------|--------|
| 2021 | 36 | 25 | 23 | 26 | 48 | 67 | 46 | 31 | 31 | 50 | 23 | 1 | 299 | 405 |
| Average | 25 | 26 | 29 | 32 | 45 | 42 | 48 | 48 | 38 | 35 | 33 | 19 | 289 | 418 |

Table 4 Trial treatments

| Treatment | Phosphorus (kg/ha) | Nitrogen (kg/ha) |
|-----------|--------------------|------------------|
| 1 | 10P | 0N |
| 2 | 10P | 75N [#] |
| 3 | 20P | 0N |
| 4 | 20P | 75N |
| 5 | 40P | 0N |
| 6 | 40P | 75N |
| 7 | 40P+Extra* | 0N |
| 8 | 40P+Extra | 75N |

*Extra plots received five extra fungicide applications and extra nutrition amounting to 81 kg N/ha, 9 kg P/ha and 48 kg K/ha plus micronutrients and seaweed extract

[#] Nitrogen topdressed as urea in 3 separate applications of 25 kgN/ha.

Table 5 Dates that fertiliser and fungicide treatments were applied at Wittenoom Hills in 2021

| Date | Normal | Extra fertiliser | Extra fungicide |
|-----------|---|---|------------------------|
| May 19 | 25 kg N/ha as Urea on +N treatments | | |
| June 11 | | | Procymidone 500 mL/ha |
| June 15 | 25 kg N/ha as Urea on +N treatments | | |
| June 14 | 4 kg MnSO ₄ /ha + 2 kg ZnSO ₄ /ha | | |
| June 18 | | | Spin Flo 500mL/ha |
| June 24 | 25 kg N/ha as Urea on +N treatments | | |
| July 12 | | | Aviator Xpro 600 mL/ha |
| July 13 | | Foliar Fertiliser Mix – see Tables 5 to 7 | |
| August 3 | Veritas 1 L/ha | | |
| August 6 | | Foliar Fertiliser Mix – see Tables 5 to 7 | |
| August 19 | | | Miravis Star 1000mL/ha |
| August 31 | | Foliar Fertiliser Mix – see Tables 5 to 7 | |
| Sept 3 | Procymidone 500 mL/ha | | |
| Sept 21 | | | Miravis Star 1000mL/ha |

Table 6 Fertiliser products used in ‘Extra’ Treatments at Wittenoom Hills in 2021

| | Cost per kg or L | Rate | \$/ha per application | \$/ha for 3 applications |
|-------------------------------|------------------|----------|-----------------------|--------------------------|
| Manutec Trace elements | \$ 23.00 | 50 kg/ha | \$ 1,150 | \$3,450 |
| Eco seaweed | \$ 52.00 | 0.7 g/ha | \$ 36.40 | \$109 |
| Powerfeed | \$ 7.87 | 225 L/ha | \$ 1,771 | \$5,313 |

Table 7 Analysis of fertiliser products used in ‘Extra’ Treatments at Wittenoom Hills in 2021

| Product | Element | Element % | Rate (kg/ha) | kg Nutrient/ha |
|-------------------------------|------------|-----------|--------------|----------------|
| Manutec Trace elements | S | 6.29 | 50 | 3 |
| | Ca | 10 | 50 | 5 |
| | Mg | 3.62 | 50 | 2 |
| | Mn | 2.88 | 50 | 1.4 |
| | Fe | 2.73 | 50 | 1.4 |
| | Cu | 1.25 | 50 | 0.6 |
| | Zn | 1 | 50 | 0.5 |
| | B | 0.09 | 50 | 0.05 |
| | Mo | 0.0038 | 50 | 0.002 |
| Eco seaweed | N | 1 | 0.7 | 0.01 |
| | P | 0.1 | 0.7 | 0.001 |
| | K | 12 | 0.7 | 0.08 |
| | Aminoacids | 6 | 0.7 | 0.04 |
| | PGR's | 600ppm | 0.7 | 0.0004 |
| Powerfeed | N | 12 | 225 | 27 |
| | P | 1.4 | 225 | 3 |
| | K | 7 | 225 | 16 |

Results

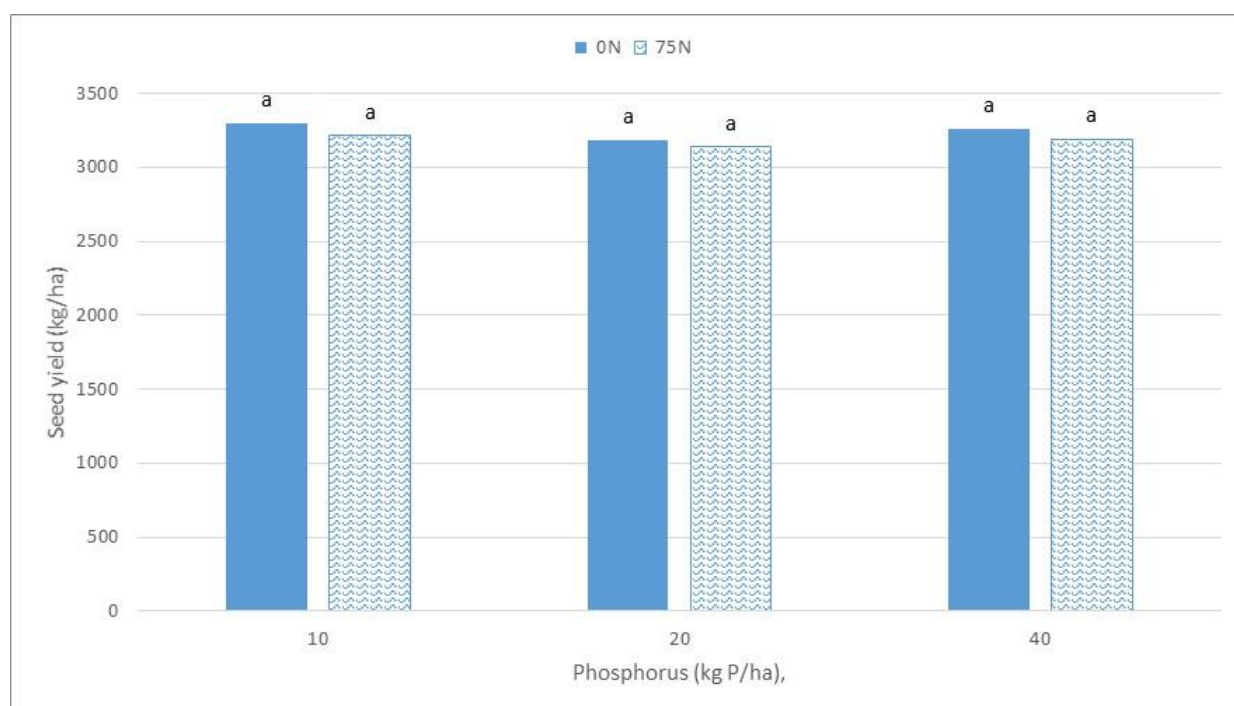


Figure 1 Seed yield response of PBA Amberley faba bean to phosphorus and nitrogen at Wittenoom Hills in 2021 (21ES06)

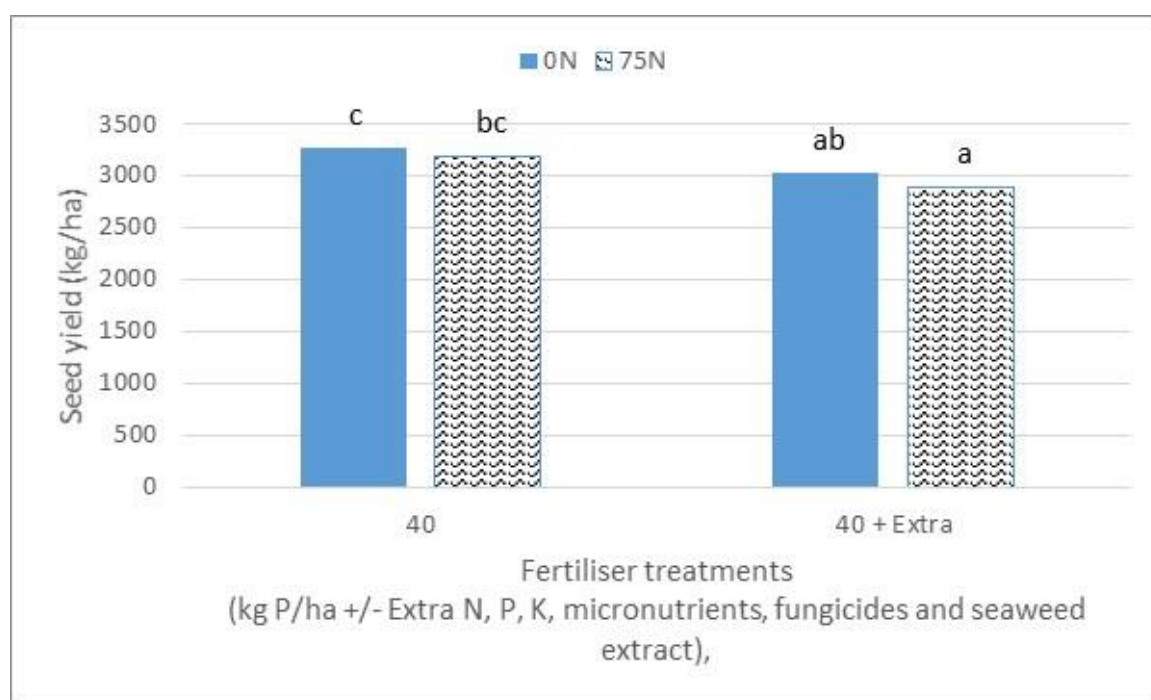


Figure 2 Seed yield response of PBA Amberley faba bean to nitrogen and Extra applications of N, P, K, micronutrients, fungicides and seaweed extract at Wittenoom Hills in 2021 (21ES06)

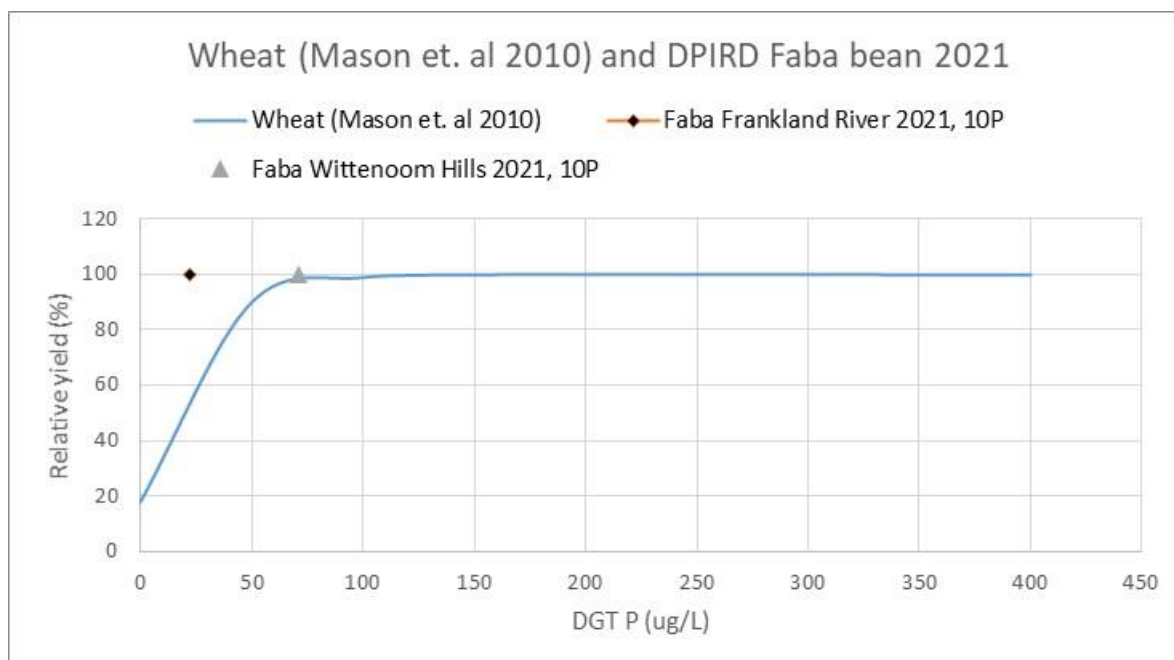


Figure 3 Relative yield of wheat (Mason et. al 2010) and faba bean in relation to soil P (DGT)

Comments

The site at Wittenoom Hills was very favourable for faba beans. Soil pH was good (>6.5), and boron only became elevated at 20cm. Conditions in 2021 were quite good apart from a warm dry spell at the end of August. 2021 had 11mm on March 15 and then dribs and drabs until April 12 when 12mm fell allowing for seeding to be into soil moisture on April 20. 17mm fell on May 5 and follow up rains in late May and early June gave us one of the best starts for many years. The site did get quite wet in June, but the crop was growing so well that very little waterlogging occurred. August and September were lower than average rainfall months and the plants were looking water stressed during late August – this minimised disease issues but as we note later the dry conditions may have exacerbated leaf damage from our ‘Extra’ foliar sprays.

PBA Amberley seed used had a seed size of 656mg and a germination rate of 90%. We assumed a field establishment would have been 80% for beans and sowed the trial at a seeding rate of 228 kg/ha. However, in 2021 conditions were so kind that we achieved higher field establishment than expected. We targeted 25 plants/ m^2 and 3 weeks after sowing we counted 31 plants/ m^2 . No treatment had any effect on plant establishment – note we banded the superphosphate treatments around 3-5cm below the seed to avoid fertiliser toxicity issues.

Visually all plots looked excellent from the outset, and it was difficult to see any visual responses to P or N treatments during the year. Our first NDVI on June 30 indicated higher rates of applied P had slightly higher NDVI than the lowest rate of 10P. Later NDVI readings indicated no difference.

The main Nitrogen treats of 75 kg N/ha were applied in 3 split applications of 25N on 19-May, 15-June and 24-June and a few weeks later we evaluated nodulation. The beans had nodulated well in 2021 and there were no treatment effects.

For the ‘Extra’ treatments we applied a mix of 3 products purchased from the local Bunnings store– Manutec Trace elements, Ecos seaweed and Powerfeed. Each time this mix supplied nutrients outlined in (**Error! Reference source not found.**).

This extra mix was applied 3 times – on July 13, August 6 and August 31 supplying in total an extra 81 kg N/ha, 9 kg P/ha and 48 kg K/ha (**Error! Reference source not found.**). The inclusion of Powerfeed which has ‘Charlie Carp’ as its main ingredient led to the canopy looking quite dark and smelling quite a bit. For the first two times of application there was no noticeable long term effect, however the last spray on August 31 during a

dry period led to leaf scorching and we believe that set the crop back which was reflected in the seed yield data – hence for the analysis of P and N treatments we removed the ‘Extra treatments’.

Disease levels at Wittenoom Hills were very low in 2021, which is thought to be due to the low humidity in a relatively dry spring. Hence our rigorous fungicide regime was not required.

Bean yields of 3.2 t/ha were quite good for 2021 given the lower-than-average August and September rainfall. Cool conditions in spring are likely to have allowed the beans to set and fill pods. Water use efficiency was around 15 kg/ha/mm – which is considered high for faba bean.

Soil phosphorus and potassium levels were adequate; hence we did not expect a large response to fertiliser. This proved to be the case as we found no response to increasing P above 10 kg P/ha. Similarly, there was no grain yield response to applied nitrogen at this site.

Recent research has suggested a new soil test for phosphorus (DGTP) may provide better predictions of likely response to P (Mason *et. al* 2010). We compared the response of beans to 10P (as we did not have a nil treatment) at Wittenoom Hills and Frankland River in 2021 to that presented for wheat by Mason *et. al* 2010 (Figure 3), which indicated a P response was unlikely for wheat, and based on our observations in 2021 it appears unlikely for beans. It would be useful to gather more P response data of beans and soil tests to see if this observation holds true in other circumstances.

References

Mason, S., McNeill, A., McLaughlin, M. J., & Zhang, H. (2010). Prediction of wheat response to an application of phosphorus under field conditions using diffusive gradients in thin-films (DGT) and extraction methods. *Plant and soil*, 337(1), 243-258.

Acknowledgements

This trial is part of the DPIRD/GRDC co-investment “DAW1903-004RTX: High Value Pulses - Raising awareness, optimising yield and expanding the area of lentil, chickpea and faba bean in Western Australia”. Thanks to Pam Burgess and Joel Kidd for excellent technical assistance, Chris Matthews (DPIRD TSU) for trial management, and Mt Burdett staff for the trial site and ongoing interest in faba beans.

Contact: Mark Seymour, mark.seymour@dpird.wa.gov.au, 0428 925 002