**Faba Bean, Nutrition to promote early vigour, MRZ Eyre Peninsula (Tooligie), South Australia**
**Faba Bean, Nutrition to promote early vigour, HRZ Eyre Peninsula (Strawberry Hill), South Australia**

**Authors**
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**Aim**
To promote early vigour to improve biomass and yield partitioning in faba bean.

**Treatments**
**Table 1.** Treatment and trial site details of early vigour faba bean trials on the Eyre Peninsula, 2019.

| | |
|---|---|
| **Treatments** | 1. Nil<br>2. Nil inoculum + MAP<br>3. Standard rate inoculum + MAP<br>4. Double rate inoculum + MAP<br>5. Standard rate inoculum + MAP + phosphorus<br>6. Double rate inoculum + MAP + phosphorus<br>7. Standard rate inoculum + MAP + sulphur<br>8. Double rate inoculum + MAP + sulphur<br>9. Standard rate inoculum + MAP + calcium<br>10. Double rate inoculum + MAP + calcium |
| **Fertilizer (kg/ha)[1]** | 75 |
| **Phosphorus rate** | 10 units of P applied as MAP |
| **Sulphur rate** | 5 units of S applied as sulphate of ammonia |
| **Calcium rate** | 4 units of Ca applied as lime |
| **Sowing date** | Tooligie: 20 May<br>Strawberry Hill: 3 June |
| **Variety and seeding rate** | PBA Zahra sown at 24 plants/$m^2$ |

[1]MAP (9.2, 20.2, 0, 2.7) + Zn (2.5)

**Results and Interpretation**
- Key Messages: Applying inoculant at sowing has proven to be beneficial to early season crop vigour in faba bean production. Adequate phosphorus fertiliser increased early season crop vigour, biomass and grain yields. Applying 75 kg/ha MAP to faba bean at sowing doubled biomass production compared to faba bean being sown with no fertiliser, at Strawberry Hill in 2019.

- Plant height: Applying inoculant at standard and double rates increased plant height by 2 cm and 3.3 cm compared to the nil plants at early vegetative stage (Figure 1a). However, doubling the rate of inoculant did not increase early vegetative plant height more than the standard inoculant rate. Applying 75 kg/ha MAP fertiliser at sowing increased early vegetative plant height by 3.6 cm compared to the nil (Figure 1b).
At flowering, plants that received inoculant at the standard and double rates were 2 cm and 3 cm taller than the plants that did not receive inoculant (Figure 2a). Unlike at the early vegetative growth stage, doubling the inoculant rate increased plant height by 1 cm compared to the standard rate. However, it is unlikely that 1 cm increase in plant height is a significant enough to warrant the additional cost of doubling the inoculant rate, particularly where nitrogen fixation or grain yield is not increased. Application of 75 kg/ha MAP at sowing increased height of flowering plants by 2.3 cm while 120 kg/ha MAP increased height by 4.8 cm compared to then nil (Figure 2b).
Inoculants were not significant on height of plants at maturity. This suggests that inoculant is of greater importance to early crop vigour but will not necessarily improve crop vigour or production when the crop reaches physiological maturity.
However, when MAP fertiliser was applied at 75 kg/ha the height of plants at maturity increased by 3 cm and by 5.1 cm when MAP fertiliser was applied at 120 kg/ha compared to the nil (Figure 3).

There was a difference in plant height during early vegetative growth stage in response to inoculant rate at Strawberry Hill, 2019 (data not shown). Applying a standard rate and a double rate of inoculant increased plant height by 4 and 5 cm, respectively, compared to the nil. Doubling the rate of inoculant did not increase early vegetative plant height over the standard rate. However, at flowering and at crop maturity

plant height increased response to inoculant and MAP fertiliser at Strawberry Hill, 2019 (Figure 4). A standard and double rate of inoculant increased faba bean plant height at flowering and crop maturity by at least 9 cm and 5 cm, respectively. There was no plant height advantage from using a double rate of inoculant compared to the standard rate. Applying 75 kg/ha MAP fertiliser at sowing increased faba bean plant height by 16 cm at flowering and 7 cm at crop maturity. For both the inoculant and MAP responses, the differences between treatments were reduced at crop maturity compared to flowering, showing the important of inoculation and MAP fertiliser for early crop growth more so than later crop production.

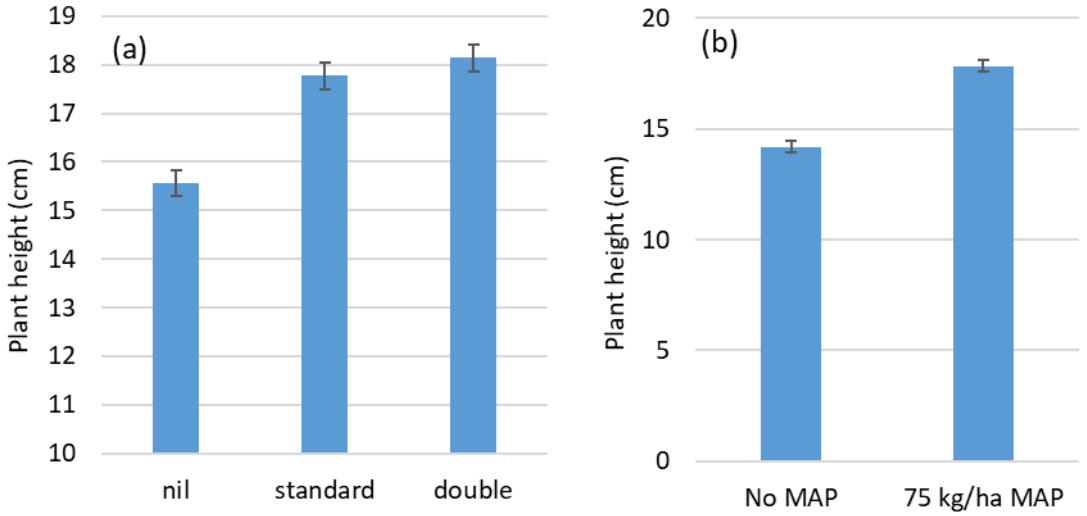


**Figure 1**. Early vegetative plant height response to (a) inoculant rate and (b) MAP fertiliser observed in faba bean at Tooligie, 2019. Error bars represent standard error (P<0.05).

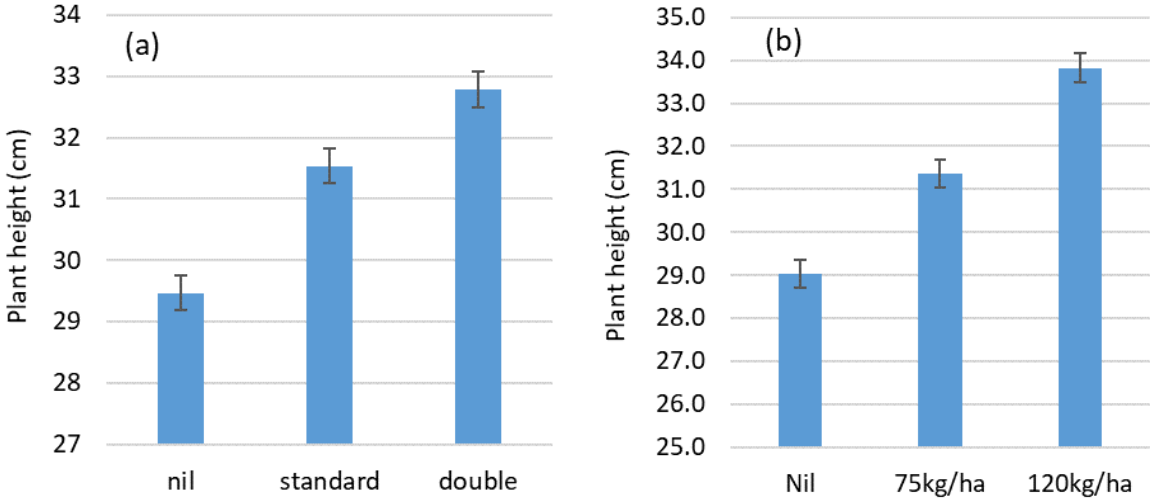


**Figure 2**. Plant height response at flowering to (a) inoculant rate and (b) MAP fertiliser observed in faba bean at Tooligie, 2019. Error bars represent standard error (P<0.05).

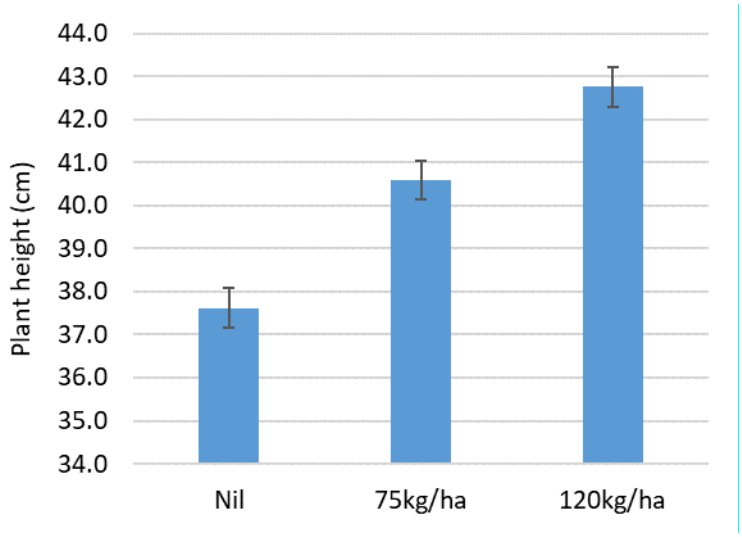


**Figure 3.** Plant height response at crop maturity to MAP fertiliser rate observed in faba bean at Tooligie, 2019. Error bars represent standard error (P<0.05).

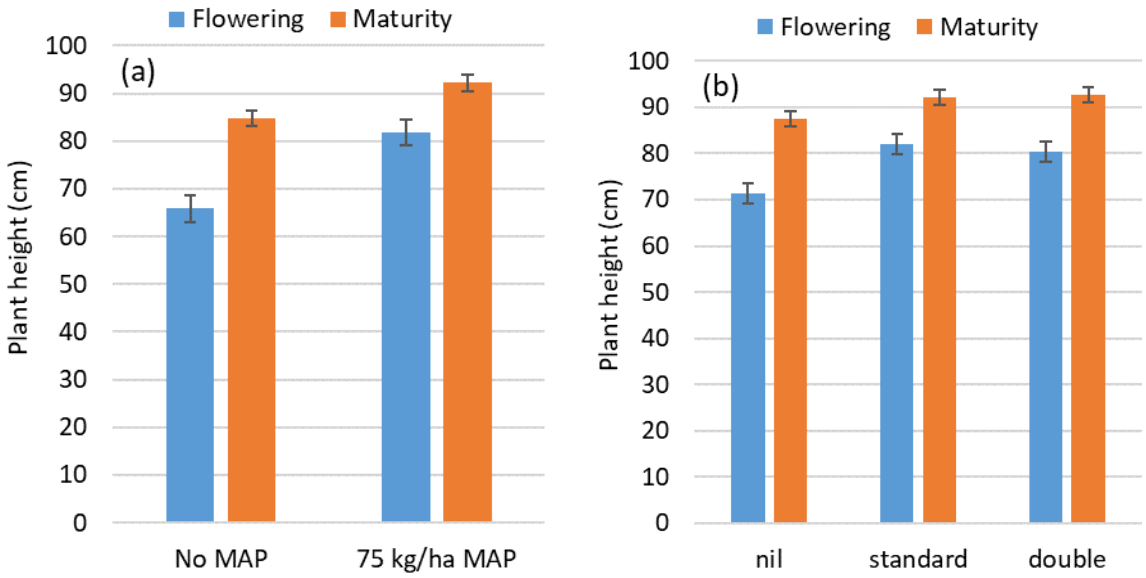


**Figure 4.** Height of faba bean plants at flowering and at maturity in response to (a) inoculant and (b) MAP fertiliser at Strawberry Hill, 2019. Error bars represent standard error (P<0.05).

• Biomass production: Application of inoculant at standard and double rates at sowing increased biomass yield by 56% (220 kg/ha) and 38% (150 kg/ha) compared to the nil plants at early vegetative stage (Figure 5a). This shows the benefit of using standard rate of inoculant for promoting early crop vigour. There were not additional benefit of doubling the rate of inoculant compared to the standard rate on biomass yield improvements at early vegetative stage.

At Strawberry Hill early vegetative biomass production increased by at least 340 kg/ha when the inoculant was applied compared to the nil (data not shown). Doubling the rate of inoculant did not increase early vegetative biomass production compared to the standard rate of inoculant.

Applying 75 kg/ha and 120 kg/ha of MAP fertiliser at sowing increased early vegetative biomass production by 36% (130 kg/ha) and 105% (380 kg/ha) compared to the nil (Figure 5b). This indicates the importance of applying adequate fertiliser to maximise early season biomass production.

Flowering biomass too increased when a standard rate of inoculant and additional phosphorus fertiliser were applied at sowing (Figure 6). Applying inoculant at the standard and double rates increased biomass yield at flowering by 35% (475 kg/ha) and 19% (250 kg/ha) compared to the nil (Figure 6a). Thus, a double rate of inoculant produced less biomass than the standard rate of inoculant.

Applying 75 kg/ha MAP fertiliser at sowing increased flowering biomass yield by 69% (240 kg/ha), while applying 120 kg/ha MAP fertiliser increased biomass by 188% (660 kg/ha) at flowering, compared to the nil (Figure 6b).

Applying 75 kg/ha MAP at sowing increased biomass yield at maturity by 24% (0.66 t/ha), while applying 120 kg/ha increased biomass production by 56% (1.4 t/ha), compared to the nil (Figure 7). These positive responses reiterate the importance of adequate phosphorus availability for crop production.

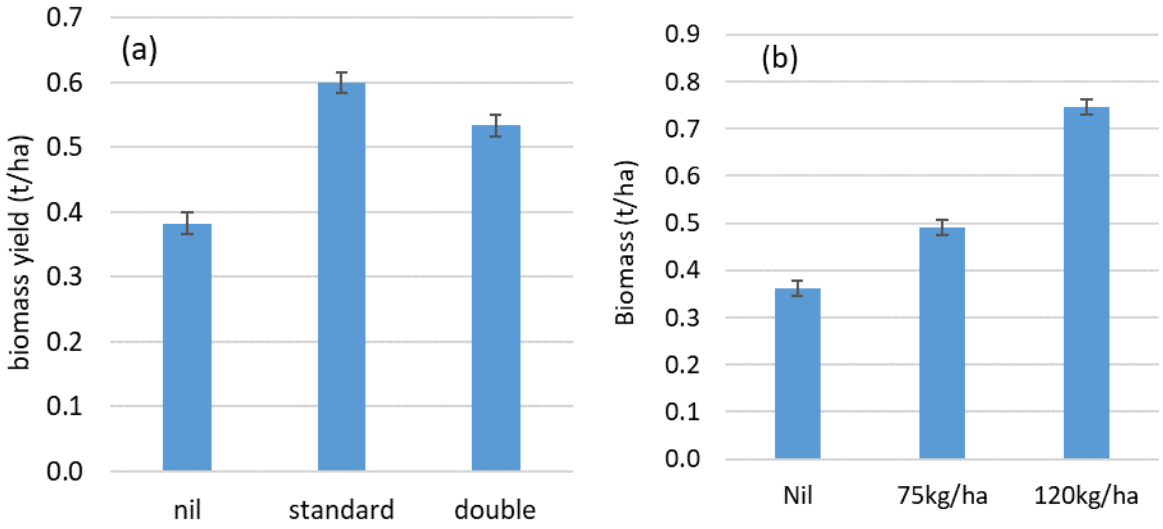


**Figure 5**. Early season biomass in response to (a) inoculant rate and (b) phosphorus fertiliser in faba bean at Tooligie, 2019. Error bars represent standard error (P<0.05).

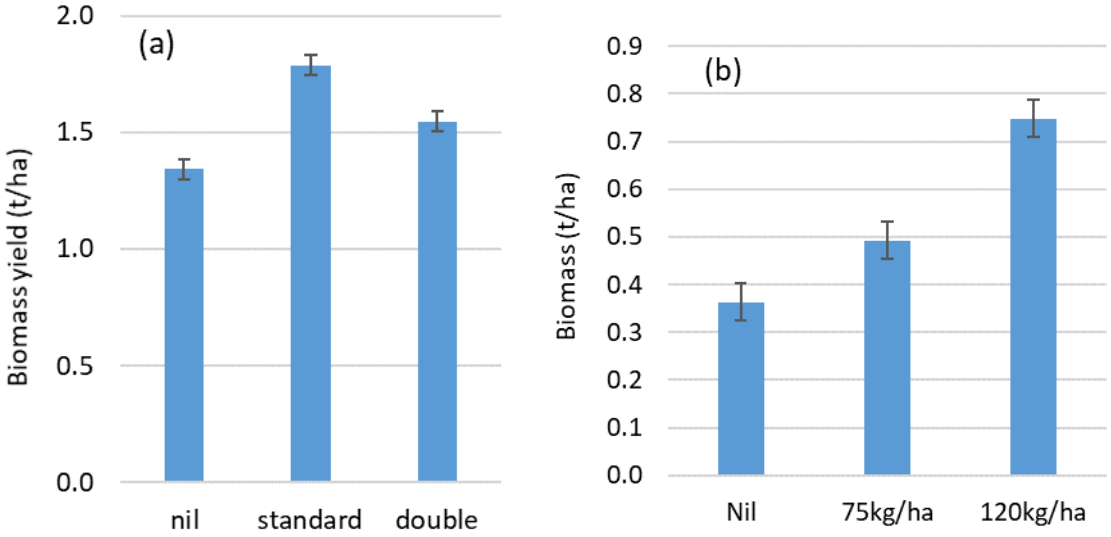


**Figure 6.** Biomass of flowering plants in response to (a) inoculant rate and (b) phosphorus fertiliser in faba bean at Tooligie, 2019. Error bars represent standard error (P<0.05).

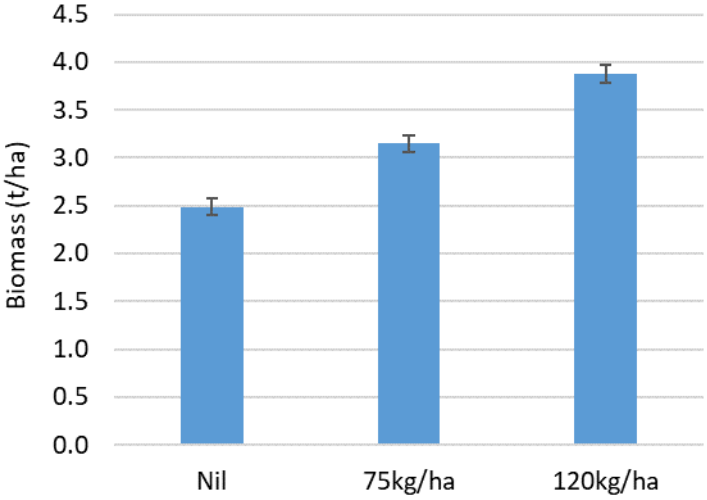

**Figure 7.** Maturity biomass response to MAP fertiliser rate in faba bean at Tooligie, 2019. Error bars represent standard error (P<0.05).

• Grain yield: Faba bean expressed a positive grain yield response to phosphorus fertiliser at Tooligie, 2019 (Figure 8). Applying MAP fertiliser at 75 kg/ha and 120 kg/ha at sowing increased grain yield by 35% (280 kg/ha) and by 58% (460 kg/ha), compared to the nil. As MAP contains 22% phosphorus, this highlights the importance of phosphorus for grain production in faba bean.
There was a positive grain yield response to inoculant rate at Strawberry Hill (Figure 9). Effects of the inoculant are more pronounced during crop establishment on improving early crop vigour, root nodulation and crop nitrogen fixation. The standard and double rate of inoculant used at sowing increased grain yield by 13% (330 kg/ha) and 12% (290 kg/ha) compared to not applying any inoculant. Thus, doubling the rate of inoculant was not highly beneficial in terms of grain yield production compared to the standard rate of inoculant.

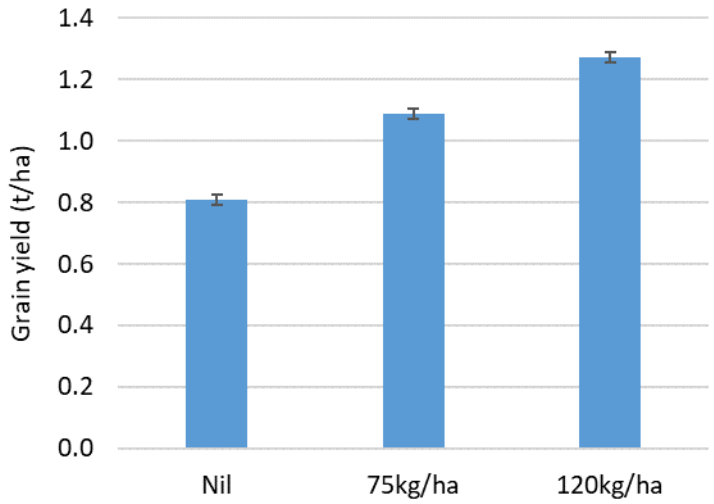


**Figure 8**. Faba bean expressed a positive response in grain yield to MAP fertiliser rate at Tooligie, 2019. Error bars represent standard error (P<0.05).

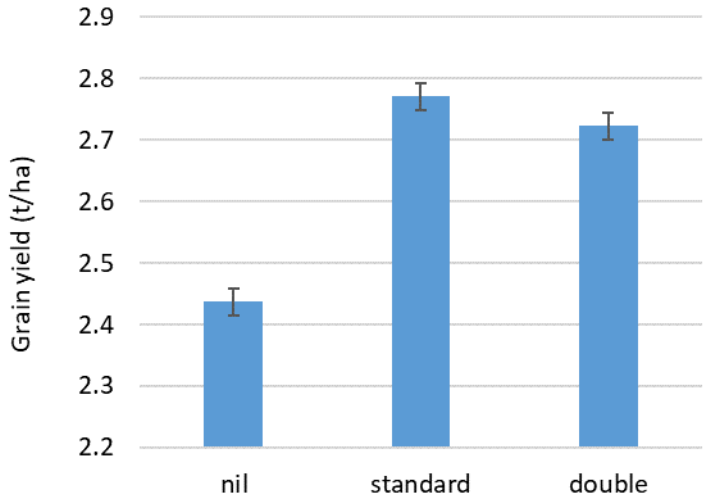


**Figure 9.** Faba bean expressed a positive response in grain yield to inoculant rate at Strawberry Hill, 2019. Error bars represent standard error (P<0.05).

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