Chickpea, Nutrition to promote early vigour, MRZ Eyre Peninsula (Tooligie), South Australia
Chickpea, Nutrition to promote early vigour, MRZ Mid North (Warnertown), South Australia

Authors
Sarah Day, Penny Roberts

Aim
To promote early vigour to improve biomass and yield partitioning in chickpea.

Treatments

Table 1. Treatment and trial site details of early vigour chickpea trials on the Eyre Peninsula, 2019.

Treatments	1. Nil 2. Nil inoculum + MAP 3. Standard rate inoculum + MAP 4. Double rate inoculum + MAP 5. Standard rate inoculum + MAP + phosphorus 6. Double rate inoculum + MAP + phosphorus 7. Standard rate inoculum + MAP + sulphur 8. Double rate inoculum + MAP + sulphur 9. Standard rate inoculum + MAP + calcium 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: 21 May
Variety and seeding rate	PBA Slasher sown at 50 plant/m^2

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

Table 2. Treatment and trial site details of early vigour chickpea trials in the Mid North, 2019.

Treatments	1. Nil 2. Nil inoculum + MAP 3. Standard rate inoculum + MAP 4. Double rate inoculum + MAP 5. Standard rate inoculum + MAP + phosphorus 6. Double rate inoculum + MAP + phosphorus 7. Standard rate inoculum + MAP + sulphur 8. Double rate inoculum + MAP + sulphur 9. Standard rate inoculum + MAP + gibberellic acid 10. Double rate inoculum + MAP + gibberellic acid
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
Gibberellic acid rate	40 ml/ha GALA + BS1000 applied at 6 node growth stage
Sowing date	Warnertown: 17 May
Variety and seeding rate	PBA Slasher sown at 50 plant/m^2

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

Results and Interpretation

- Key Messages: Inoculant and MAP fertiliser increased plant height and biomass production. Further, inoculant and MAP fertiliser increased the height of the lowest pod, which increased their harvestability at Tooligie, 2019.
  Doubled rate of inoculant did not increase chickpea production compared to applying the standard rate at an economically viable level.
  Gibberellic acid did not influence plant height or biomass but decreased the grain yield of chickpea at Warnertown 2019.

- Plant height: Inoculant and MAP fertiliser is vital for promoting early vigour and production in pulse crops. At early vegetative growth stage, applying MAP fertiliser increased chickpea plant height by 2 cm compared to the nil plants at Tooligie, 2019 (Figure 1). As the crop reached reproductive stage the increase in plant height was greater where flowering and mature plants that received MAP fertiliser were 3.5 cm taller than those that were not fertilised.
  The height at which the lowest pod is formed was measured prior to harvest to identify the effects of fertiliser and inoculant on harvestability of the crop. Increase in height at which the lowest pod is formed enhances the harvestability as pods are not closer to the ground. Height at which the lowest pod is formed increased in response to inoculant and MAP fertiliser, at Tooligie 2019 (Figure 2). Applying inoculant increased height of the lowest pod by 1.8 cm compared to the nil, while a double rate of inoculant increased the height of the lowest pod slightly over the standard rate of inoculant (Figure 2a). Applying MAP fertiliser at sowing also increased height of the lowest pod by 2.7 cm compared to nil MAP (Figure 2b).
  There were positive plant height responses at flowering for MAP fertiliser and inoculant rate at Warnertown, 2019 (Figure 3). Plant height was increased by 3 cm where MAP fertiliser was applied compared to the nil. Further, application of inoculant standard and a double rates increased plant height by at least 2.5 cm compared to the nil. However, heights of plants that received doubled rates were not different from those that received standard rates.

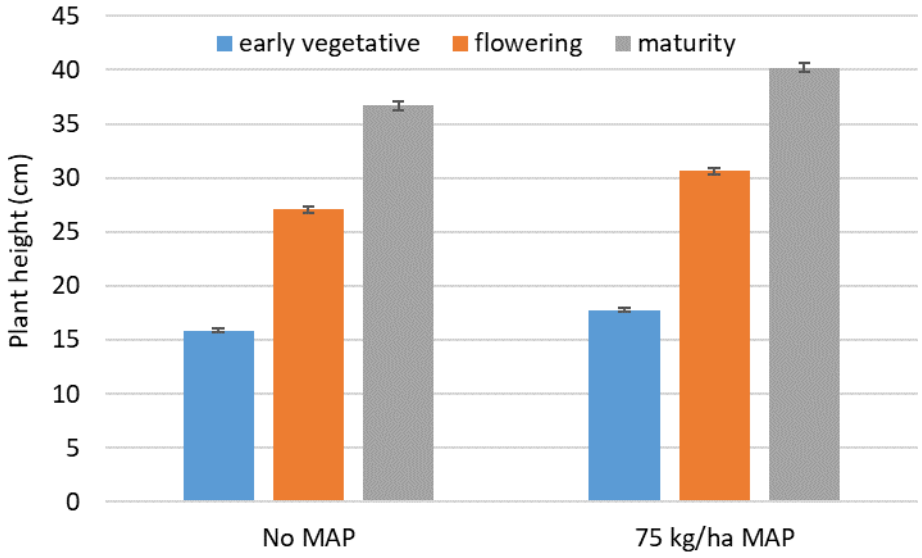

Figure 1. Effect of MAP fertiliser on height of plants measured at early vegetative, flowering and mature stages, at Tooligie 2019. Error bars represent standard error (P<0.05).

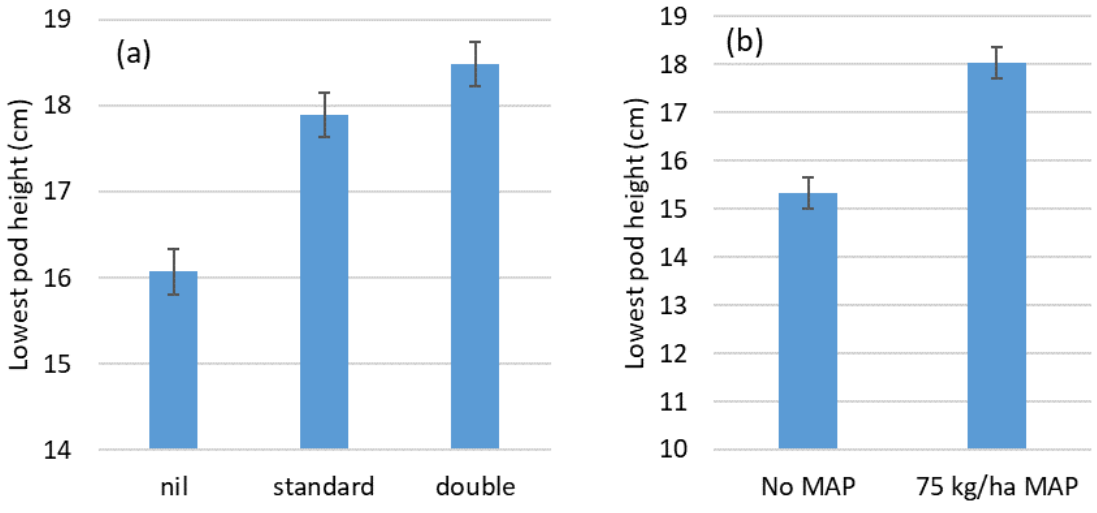

Figure 2. Height at which the lowest pod is formed in response to the application of (a) inoculant and (b) MAP fertiliser at Tooligie, 2019. Error bars represent standard error (P<0.05).

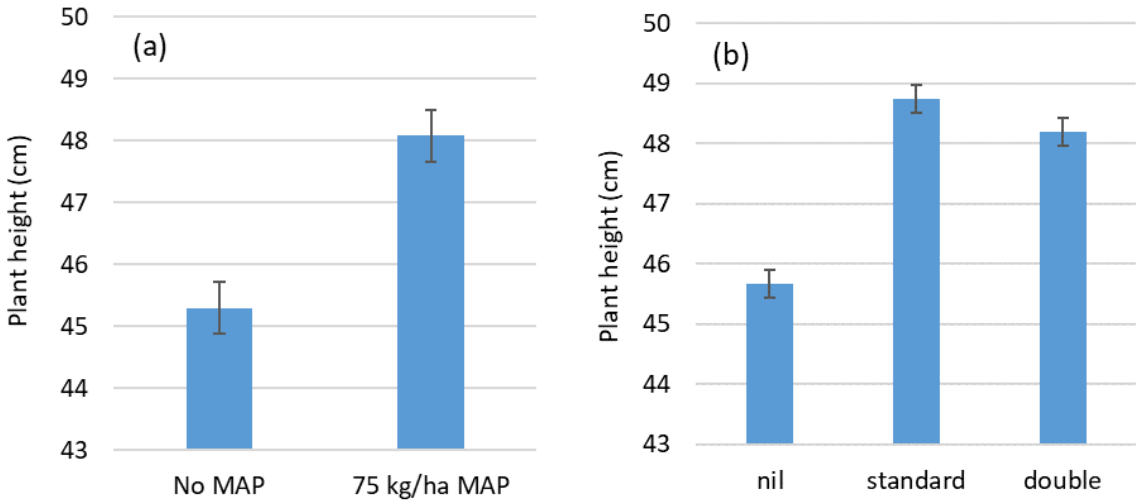

Figure 3. Height of plants at flowering in response to (a) MAP fertiliser and (b) inoculant rate, at Warnertown 2019. Error bars represent standard error (P<0.05).

- Biomass: MAP fertiliser increased biomass of chickpea at early vegetative stage, at flowering and at crop maturity at Tooligie, 2019 (Figure 4a). Plants that received MAP fertiliser at sowing increased biomass by 27% (460 kg/ha) at maturity compared to those sown without fertiliser.
  Inoculant treatments had minimal effect on biomass at early vegetative growth stage at Tooligie, 2019 (Figure 4b). However, at flowering stage plants inoculated with standard rate produced 54% (380 kg/ha) more biomass than nil plants. However, in mature plants biomass production was similar between those that received inoculant at standard rate at sowing and those that did not.
  Doubling the rate of inoculant increased biomass by 240 kg/ha compared to the standard rate in mature plants at Tooligie, 2019 (Figure 4b). However, at flowering and vegetative stages biomass of plants receiving doubled and standard rates were similar (Figure 4b).
  Chickpea biomass production at flowering increased by 740 kg/ha in response to standard rate of inoculant compared to the nil, at Warnertown 2019 (Figure 5). Further, doubling the rate of inoculant increased biomass by 280 kg/ha compared to the nil. However, doubling the rate of inoculant decreased biomass by 460 kg/ha compared to the standard rate. Therefore, additional cost of inoculant for a double rate would not be economically viable.

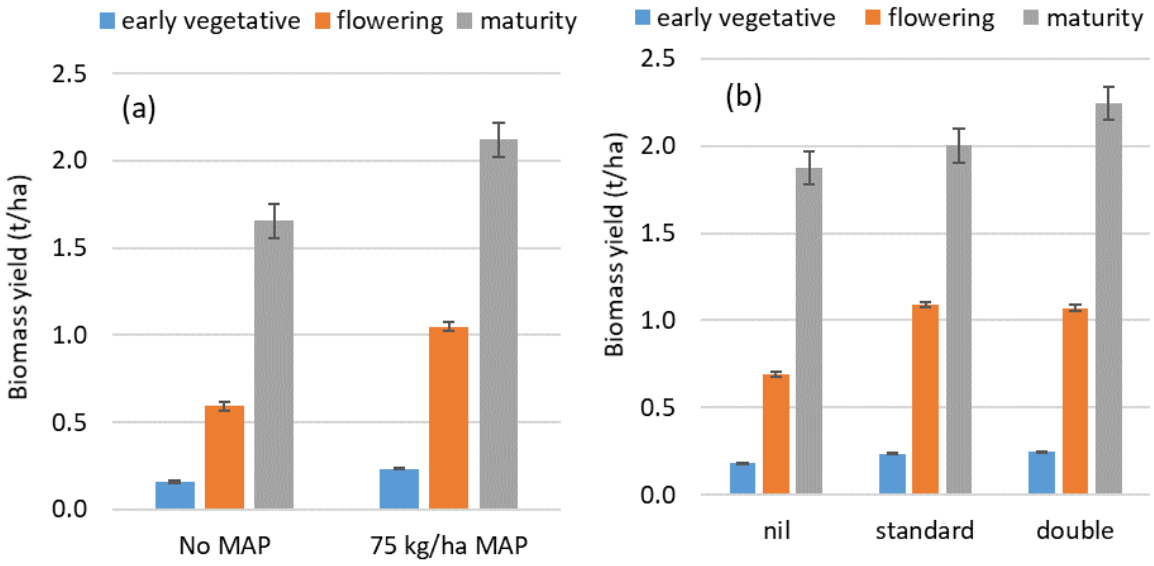

Figure 4. Chickpea biomass production in response to (a) MAP fertiliser and (b) inoculant applied at sowing, at Tooligie 2019. Error bars represent standard error (P<0.05).

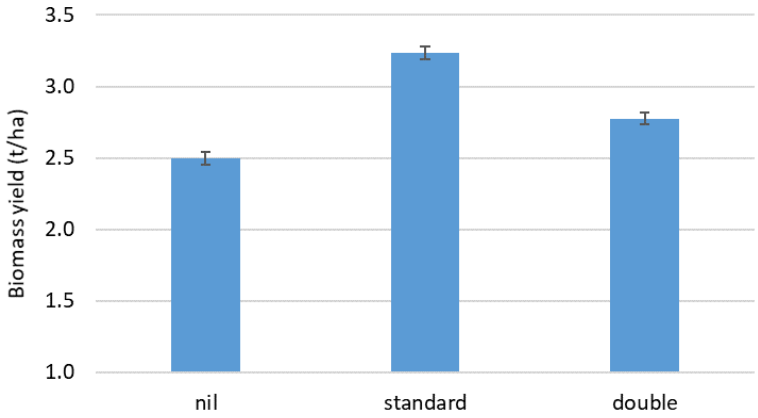

Figure 5. Chickpea biomass yield at flowering in response to inoculant applied at sowing, at Warnertown 2019. Error bars represent standard error (P<0.05).

- Grain yield: Average grain yield of PBA Slasher chickpea was 800 kg/ha at Tooligie, 2019 (data not shown). No grain yield responses were observed for inoculant or MAP fertiliser. Application of gibberellic acid at 6 node stage decreased grain yield of chickpea by 50 kg/ha compared to the nil at Warnertown, 2019 (Figure 6). Gibberellic acid is a plant growth regulator, which stimulates winter growth and thus promote biomass gain in pastures. However, at Warnertown there was no production benefit of applying gibberellic acid in chickpea.

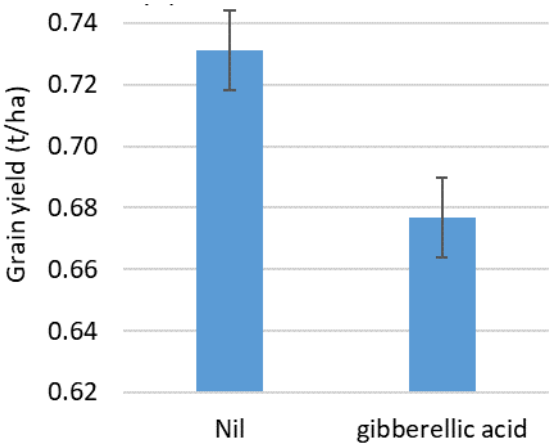

Figure 6. Application of gibberellic acid on grain yield of chickpea at Warnertown 2019. Error bars represent standard error (P<0.05).

Acknowledgements

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 and the authors would like to thank them for their continued support. The continued assistance in trial management from SARDI Agronomy groups at Clare, Minnipa, Struan and Port Lincoln is gratefully acknowledged and appreciated. 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.