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Evaluation of new mungbean varieties for the Macquarie Valley – Trangie Agricultural Research Centre, 2013–2016

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Key findings

- Mungbean yield potential ranged from a low of 0.81 t/ha up to a high of 2.70 t/ha in three years of irrigated variety evaluation experiments at Trangie in the Macquarie Valley.
- Jade_AU$^{\Phi}$ (released 2013) is the recommended variety for Macquarie Valley mungbean growers with the highest yield potential, largest seed size (an important quality attribute for marketing) and best disease tolerance package. Crystal$^{\Phi}$ would be an adequate second-best option based on yield and potential seed size.
- Niche mungbean varieties such as Regur (black gram type), and the two small-seeded lines Celera II$^{\Phi}$ and Green Diamond$^{\Phi}$, would have to command a substantial premium for their respective seed quality attributes to compensate for the poorer yield potential demonstrated in these experiments.

Introduction

The Northern Pulse Agronomy Initiative (NPAI) was established as a joint project between NSW DPI and GRDC in 2013. A key outcome from this project is developing management packages that lead to greater adoption, productivity and profitability of both winter and summer pulses in the northern grains region of NSW. Identifying and understanding the constraints that limit potential productivity will lead to more reliable pulse crops, allowing seasonal yield potential and quality characteristics are able to be achieved.

In recent years, mungbean has regained popularity in northern NSW as a short season, summer opportunity crop for three reasons:

1. reduced irrigation allocations (limiting cotton production)
2. the release of new mungbean varieties with improved yield and disease resistance
3. higher prices.

This has led to improved profitability of mungbean as a stand-alone crop, in addition to its rotational benefits as a pulse crop. However, adoption in the Macquarie Valley (central west NSW) has been limited by a lack of current agronomic information regarding best management practices for new varieties.

Through the support of the NPAI project, NSW DPI conducted mungbean variety evaluation experiments (in collaboration with more variety-specific agronomy experiments) at Trangie Agricultural Research Centre (Trangie ARC) for three consecutive summer seasons (2013–14, 2014–15 and 2015–16), to assess how effective new mungbean varieties for the Macquarie Valley were under irrigated conditions.

Site details

Location	All three experiments were conducted at Trangie ARC.
Soil type	Grey vertosol.
Irrigation	Full flood irrigation schedule, including pre-irrigation before planting and in-crop irrigation as required throughout the growing season.
Row spacing	These experiments were all planted on standard row spacing of 33 cm.
Plant population	Sowing rates were adjusted for each variety's individual seed size to achieve a consistent plant density of 35 plants/m^2.
Experiment design	Randomised complete block design with three replications.

Treatments

Table 1. Mungbean variety trial treatment list.

Treatment	2013–14 season	2014–15 season	2015–16 season
Varieties	Berken Crystal Green Diamond Jade_AU M09246 (Celera II) Regur Satin II	Berken Celera II Crystal Green Diamond Jade_AU M010047 M011057 Regur Satin II	Berken Celera II Crystal Green Diamond Jade_AU M010047 M011057 Regur Satin II
Sowing date	17 Dec 2013	16 Dec 2014	17 Dec 2015
Harvest date (days after sowing – DAS)	17 April 2014 (121 DAS)	15 April 2015 (120 DAS)	22 March 2016 (96 DAS)

Results

2013–14 season

- The mean yield in 2013–14 was 1.75 t/ha (1.19–2.19 t/ha).
- The three newly released varieties Jade_AU$^{\Phi}$ (2013), Crystal$^{\Phi}$ (2008) and Satin II$^{\Phi}$ (2008) all had yields >2.0 t/ha and were significantly higher yielding than the other four varieties.
- The experimental line M09246 was subsequently released in 2014 as Celera II$^{\Phi}$ as a replacement for Green Diamond$^{\Phi}$; both varieties target the small-seeded niche market, but did not achieve the yield potential of larger seeded varieties.
- Regur is a variety of black gram with dull grey-coloured seed targeting quality export markets in Japan; but in this experiment was the lowest yielding variety.
- The mean seed size (measured as 100-seed weight) was 5.77 g (3.54–7.23 g).
- Crystal$^{\Phi}$ (7.23 g) had a significantly larger seed size than all other varieties except its replacement Jade_AU$^{\Phi}$ (6.83 g).
- Both Green Diamond$^{\Phi}$ and its replacement line M09246 (now Celera II$^{\Phi}$) had significantly smaller seed size <4.0 g which, in part, contributed to their lower yield potential.

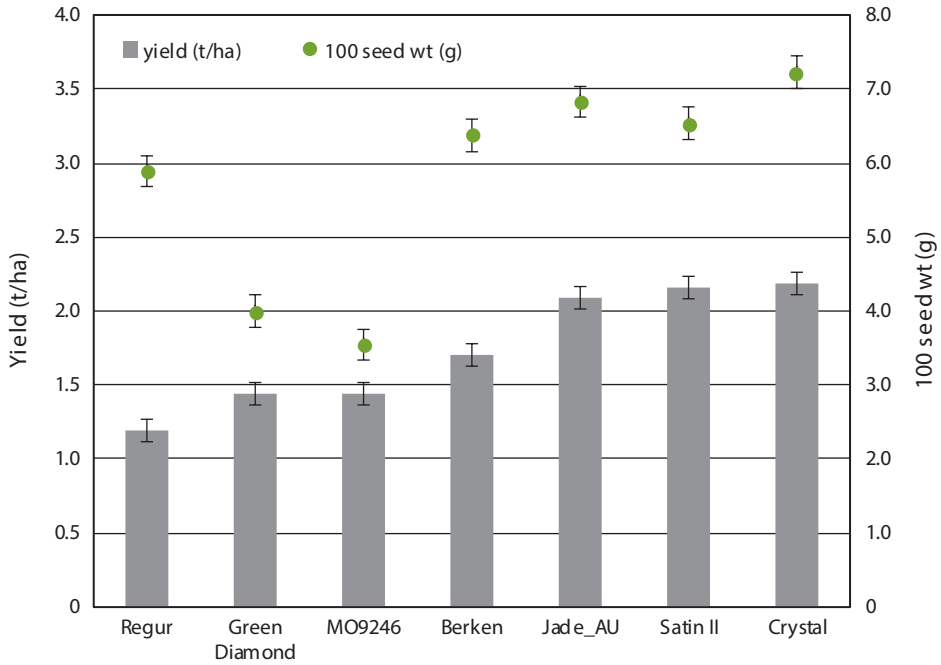

Figure 1. Grain yield (t/ha) and 100-seed weight (g) for seven varieties of mungbean at Trangie ARC, 2013–2014 season. l.s.d. yield (P<0.001) = 0.15 t/ha; l.s.d. 100-SW (P<0.001) = 0.42 g.

2014–15 season

- The mean yield in 2014–15 was 2.05 t/ha (0.97–2.70 t/ha).
- The three newly released varieties, Jade_AU$^{\phi}$ (2013), Crystal$^{\phi}$ (2008) and Satin II$^{\phi}$ (2008), all had yields >2.6 t/ha and were significantly higher yielding than the other six varieties.
- The small seeded variety Celera II$^{\phi}$ (Green Diamond$^{\phi}$ replacement) was significantly lower yielding than all other varieties in this experiment; whilst Green Diamond$^{\phi}$ was again in the lowest three rankings for yield.
- Regur (black gram variety) achieved a quite respectable yield of 2.1 t/ha in this season's experiment compared with the previous season. Note that Regur was harvested separately three weeks later than the other eight varieties (6 May) due to very late maturity.
- The mean seed size (measured as 100-seed weight) was 6.92 g (4.20–8.62 g), hence the higher yield potential for this season was matched by larger seed size compared with the previous 2013–14 season.
- The two experimental lines MO10047 and MO11057 had significantly larger seed than all other lines (>8.6 g); followed by Crystal$^{\phi}$ and Jade_AU$^{\phi}$ (>7.8 g), Satin II$^{\phi}$ and Berken (>7.2 g).
- Both Green Diamond$^{\phi}$ and its replacement line Celera II$^{\phi}$ had significantly smaller seed size < 4.3 g, which again contributed to lower yield potential as per the previous season.
- Flowering dates were recorded for the 2014–15 experiment with Celera II$^{\phi}$ at F50% on 28 January (43 DAS) and all eight other varieties at F50% on 2 February (48 DAS) (data not shown).
- Peak maturity biomass was measured by quadrant cuts on 30 March (two weeks pre-harvest) with a mean biomass of 2900 kg/ha for all varieties. Crystal$^{\phi}$ had the highest mean biomass (3755 kg/ha), Celera II$^{\phi}$ had lowest mean biomass (2130 kg/ha); hence there was a reasonable correlation (R^2 = 0.62) between peak maturity biomass and harvested yield (data not shown).

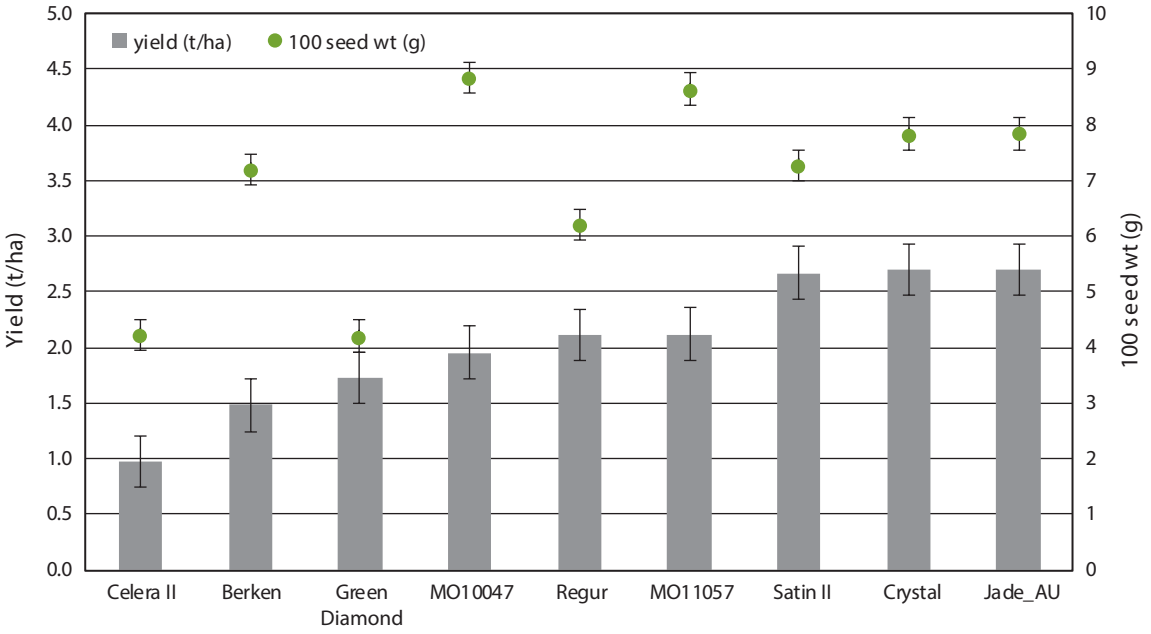

Figure 2. Grain yield (t/ha) and 100-seed weight (g) for nine varieties of mungbean at Trangie ARC, 2014–2015 season. l.s.d. yield (P<0.001) = 0.47 t/ha; l.s.d. 100-SW (P<0.001) = 0.57 g

2015–16 season

- The mean yield in 2015–16 was 1.01 t/ha (0.81–1.26 t/ha).
- Jade_AU$^{\phi}$ and Berken had the highest mean yields at 1.26 t/ha and 1.20 t/ha respectively, followed by Satin II$^{\phi}$. All six other varieties, including Crystal$^{\phi}$ and Regur, yielded <1.0 t/ha and were not significantly different from each other, except for the experimental line MO11057, which produced significantly lower yields.
- The mean seed size (measured as 100-seed weight) was 5.59 g (3.30–6.78 g).
- Jade_AU$^{\phi}$ had the largest seed size (6.78 g), but was not significantly different from the experimental lines MO10047 or MO11057, plus Crystal$^{\phi}$, which all had a seed size of >6.5 g. Satin II$^{\phi}$ had a seed size >6.0 g.
- Celera II$^{\phi}$ and Green Diamond$^{\phi}$ had significantly smaller seed (<3.5 g) than all other varieties.
- Flowering dates were recorded for the 2015–16 experiment with Celera II$^{\phi}$ at F50% on 3 February (48 DAS); Berken, Jade_AU$^{\phi}$ and Satin II$^{\phi}$ on 9 February (54 DAS); Crystal$^{\phi}$ on 10 February (55 DAS); and Green Diamond$^{\phi}$ and Regur on 12 February (57 DAS).
- Peak maturity biomass was measured by quadrant cuts on 9 March (two weeks pre-harvest) with a mean biomass of 6360 kg/ha for all varieties. Jade_AU$^{\phi}$ and Crystal$^{\phi}$ had the highest mean biomass of the named varieties (both >7000 kg/ha), but otherwise in this experiment there was a very poor correlation (data not shown) between peak maturity biomass and harvested yield.

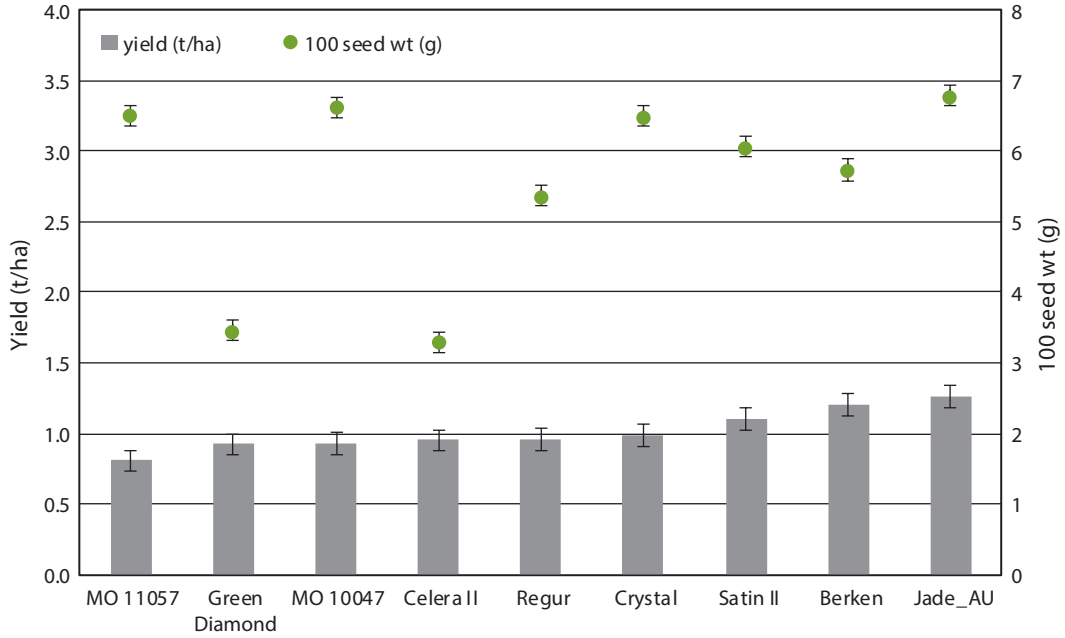

Figure 3. Grain yield (t/ha) and 100-seed weight (g) for nine varieties of mungbean at Trangie ARC, 2015–2016 season. l.s.d. yield (P<0.001) = 0.15 t/ha; l.s.d. 100-SW (P<0.001) = 0.30 g.

Conclusions

- Under fully irrigated conditions on a grey vertosol in the Macquarie Valley, mungbean yield potential ranged from a low of 0.81 t/ha up to a high of 2.70 t/ha across three years of variety evaluation experiments.
- The new mungbean variety Jade_AU$^{\phi}$ (released 2013), remains the preferred variety for Macquarie Valley mungbean growers with the highest yield potential, largest seed size (an important quality attribute for marketing) and best disease tolerance package.
- Crystal$^{\phi}$ (released 2008), would be an adequate second-best option, based on yield and seed size potential, if Jade_AU$^{\phi}$ seed cannot be sourced.

- Satin II$^{\phi}$ (released 2008), achieved a yield potential in the top three rankings (with Jade_AU$^{\phi}$ and Crystal$^{\phi}$) through three years of experiments; however, growers should note there is a limited market size for this dull-seeded variety.
- Niche mungbean varieties such as Regur (black gram type), and the two small-seeded lines Celera II$^{\phi}$ and Green Diamond$^{\phi}$, would have to command a substantial premium for their respective seed quality attributes to compensate for the poorer yield potential demonstrated in these three experiments.

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