Department of Primary Industries
Department of Regional NSW

NSW research results

RESEARCH & DEVELOPMENT – INDEPENDENT RESEARCH FOR INDUSTRY

The following paper is from an edition of the Northern or Southern New South Wales research results book.

Published annually since 2012, these books contain a collection of papers that provide an insight into selected research and development activities undertaken by NSW DPI in northern and southern NSW.

Not all papers will be accessible to readers with limited vision.
For help, please contact: Carey Martin at carey.martin@dpi.nsw.gov.au

Published by NSW Department of Primary Industries,
a part of the Department of Regional New South Wales.

Soybean variety comparison – Liverpool Plains 2013–14

Kathi Hertel[1], Craig Chapman[1] and Steven Harden[2]
[1] NSW DPI, Narrabri [2] NSW DPI, Tamworth

Key findings

Moonbi(ф) and Richmond(ф), two varieties released from the Australian Soybean Breeding Program have both shown improvement over the now outclassed Soya791 in the areas of yield, seed size and seed quality in this experiment.

Overall site yield was 2.01 t /ha. Richmond(ф), released in 2014 yielded 133% of the site average. There was no significant yield difference between Moonbi(ф) and Richmond(ф). The lowest yielding variety was Hale at 1.16 t/ha or just 58% of the site average.

Soya791 results should be treated with caution. Seed quality was poor and despite adjustments to seeding rates, poor establishment and subsequent growth compromised performance throughout the season.

Introduction

Improving the yield potential and reliability of pulses in Northern Grains Region farming systems is a major focus of the Northern Pulse Agronomy Initiative project. Benefits of pulse crops include:

- improving the productivity of subsequent crops
- reducing the impacts of disease and weeds
- increasing soil fertility
- enhancing farm income
- increasing crop diversity and economic risk
- producing a protein food source, increasingly in demand by a global population.

This experiment is one of a number of research studies into summer pulses, specifically soybean and mungbean, conducted by NSW DPI researchers at Grafton, the Australian Cotton Research Institute (Narrabri) and the Trangie Agricultural Institute. Additional sites are also located on farms located throughout Northern Grains Region.

One of the aims of the project is to investigate agronomic constraints to achieving yield potential of summer pulses. Data from experiments will be used to develop variety specific agronomy recommendations for newer varieties as well as general pulse agronomy recommendations. This experiment includes older varieties as well as newer varieties to assess gains in yields and improvements in desirable agronomic traits of recently released varieties.

Site details

Location:	**'Windy Station' Pine Ridge**
Co-operator:	**Romani Pastoral Company Peter Winton (Crop Manager)**
Planting date:	**12 December 2013**
Harvest date:	**29 May (167 DAS)**
Comments:	**The experiment was sown into marginal seedbed moisture, however 18. 4 mm of rainfall fell** **5 days after sowing. In-crop rainfall totalled 265.1 mm** **The season was characterised by little in-crop rainfall and above average daily maximum temperatures during the vegetative growth phase. This was in sharp contrast to the reproductive phase where lower, close to optimum temperatures and frequent rainfall events favouring grain development occurred**

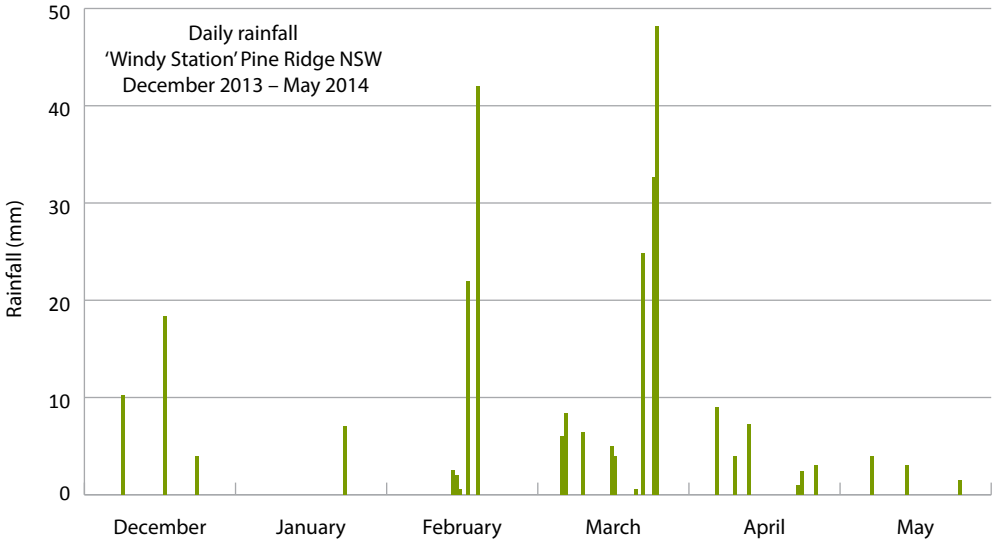

***Figure 1**. Daily rainfall events at "Windy Station" Pine Ridge in 2013–14*

***Table 1**. Site temperature (°C)*

	December	January	February	March	April	May
Minimum	11.7	8.8	9.3	5.3	-0.4	-3.6
Minimum (mean)	*16*	*15.2*	*15.4*	*13.1*	*9.4*	*4.2*
Maximum	39.6	45.1	37.8	31.7	29.4	25.9
Maximum (mean)	*34.1*	*35.1*	*31.3*	*27.3*	*24.8*	*21.4*
Overall mean	25.1	25.1	23.4	20.3	17.1	12.8

Treatments

- Six varieties were evaluated.
- Moonbi$^{\Phi}$ is a clear hilum variety released in 2010. A short season variety, it is resistant to powdery mildew and has better weathering tolerance than Soya 791.
- Richmond$^{\Phi}$ is a clear hilum variety released in 2013 with the highest weathering tolerance of any current clear hilum varieties. Moonbi$^{\Phi}$ and Richmond$^{\Phi}$ are suited to production on the Liverpool Plains.
- Soya791, now outclassed has a brown hilum and is suited to soy flour production. It is susceptible to race 15 of Phytophthora.
- Hale has been a popular soybean variety grown on the Liverpool Plains but is now outclassed. It is the quickest maturing of the varieties tested in this trial.
- Bunya$^{\Phi}$ is no longer recommended due to its 'Very susceptible' rating to powdery mildew.
- PR443 is an experimental line under evaluation from the Australian Soybean Breeding Program.

Results

Establishment

- Target plant population for the trial was 35 plants/m^2. Crop establishment was measured 26 days after sowing. Soya791 recorded significantly lower populations in all plots, averaging 15 plants/m^2. Investigations into the seed used revealed only 66% germination, with the remaining seed made-up of 11% dead seeds and 23% abnormal seedlings that produced diseased and damaged cotyledons and stunted roots. Whilst seeding rates were calculated to achieve the specified target population, the combination of poor quality seed and low seedbed moisture affected establishment. Planting depth was not measured.

Plant growth and development

- Crop vegetative growth phase (sowing to late January / mid-February – depending on variety) recorded just 3 rainfall events – totalling 39.6 mm. The most significant fall was 18.4 mm that occurred 5 days after sowing. Daily temperatures during this period were above historical averages, only 4 days recording a maximum temperature below 30 °C. The four day period 15–18 January recorded daily maximum temperatures of between 43 and 45.1 °C.
- Hale was the quickest maturing variety, commencing flowering during the last week of January, followed by Bunya$^{\phi}$ and Moonbi$^{\phi}$ in the first week of February.
- Observations 88 DAS (11 March) recorded Hale with pods containing green seed filling the pod cavity (growth stage R6). Moonbi$^{\phi}$ averaged GS R5 where seeds within pods were still increasing in size within the pod. Soya 791 and PR443 were at GS R4, where pods were still lengthening prior to seed development. Richmond$^{\phi}$ was transitioning between GS R4 and R5 as pods reached full length and seed formation within commenced. Seasonal conditions during March recorded average daily temperatures between 20 and 23 °C and daily maximums below 30 °C and rainfall totalling 136 mm over 9 days.

Height at flowering

- Overall crop height at flowering showed significant differences between varieties (Figure 2). Bunya$^{\phi}$ was the tallest at 70 cm. There was no significant difference between all other varieties with the exception of Hale, averaging 56 cm.

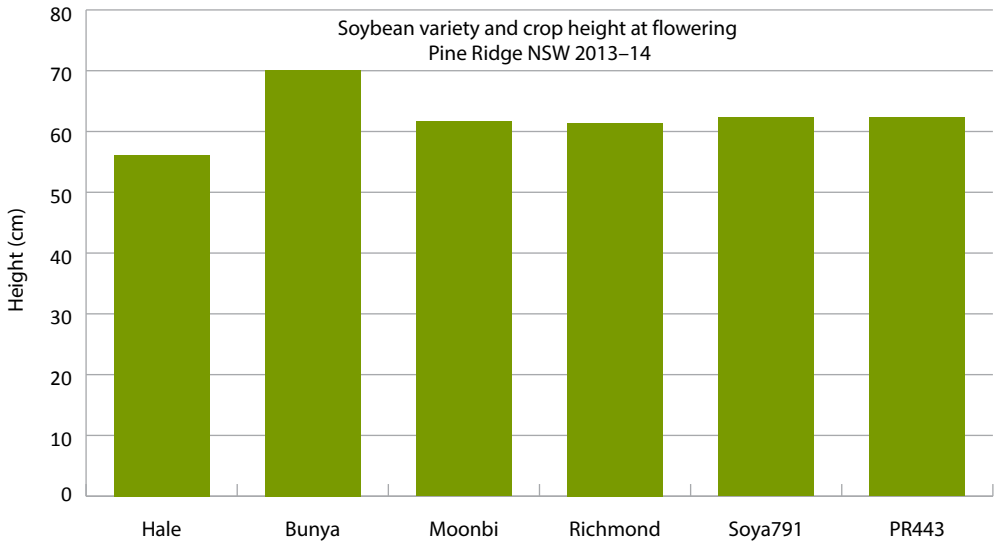

***Figure 2**. Height of soybean varieties at flowering at 'Windy Station' Pine Ridge in 2013–14*

Yield

- Overall site yield was 2.01 t /ha (Table 2). The experimental line PR443 yielded 2.51 t/ha, equivalent to 25% above the site average. Whilst Richmond(ф) yielded 2.27 t/ha, in this experiment this was not statistically different to PR443. Similarly, there was no significant difference between Moonbi(ф) yielding 2.12 t/ha and Richmond(ф). The lowest yielding variety was Hale at 1.16 t/ha or just 58% of the site average.

***Table 2**. Soybean grain results at "Windy Station" Pine Ridge in 2013-14.*

Variety	Yield (t/ha)	Yield as % site mean	Yield as % Soya 791	Oil (%)	Seed protein (%) DM basis	100 seed weight (g)
Moonbi(ф)	2.12	106	108	19.10	43.20	20.75
Richmond(ф)	2.27	113	116	18.73	43.40	21.20
Soya 791	1.96	98	100	18.57	41.40	19.64
Bunya(ф)	2.01	105	102	19.43	42.77	25.31
Hale	1.16	58	59	19.90	42.60	15.00
PR443	2.51	125	128	18.70	41.23	20.96
Site mean	2.01			19.07	42.43	20.48
L.S.D. (p 0.05) *(p 0.1)	0.35			*0.96	1.41	1.67

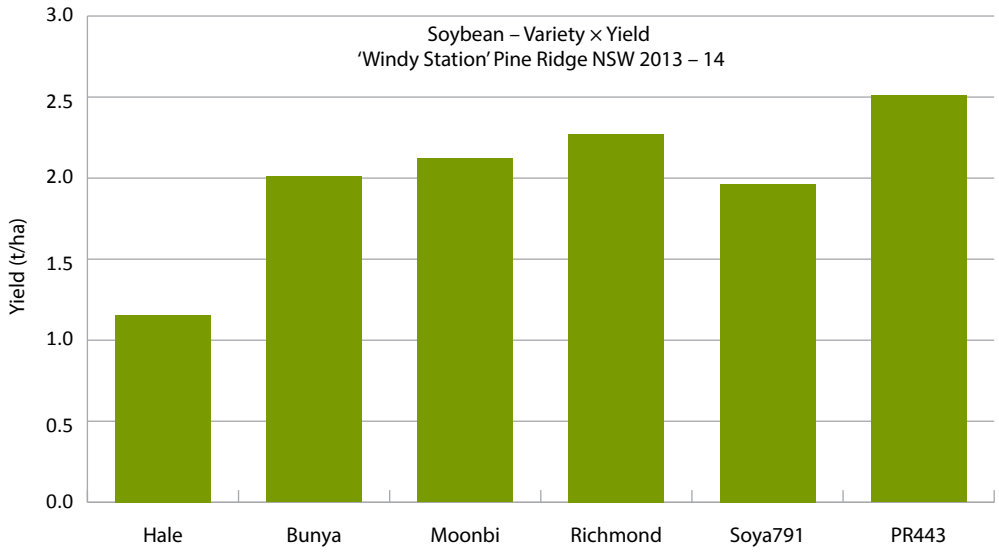

***Figure 3**. Variety yields at 'Windy Station' Pine Ridge in 2013–14*

Seed size

- Seed size, measured as a 100 seed weight is an inherent varietal characteristic. In order from largest to smallest, varieties were ranked as follows: Bunya(ф) > Richmond(ф) > PR443 > Moonbi(ф) > Soya 791 > Hale.

Oil

- There were significant differences in seed oil content varieties (L.S.D. 0.96). Average oil content was 19.07%.

Protein

- There was no significant difference in seed protein levels between varieties with the exception of PR443 and Soya 791 which both measured significantly lower protein contents at 41.12% and 41.4% respectively (L.S.D. 1.409). Richmond$^{\Phi}$ measured the highest protein level at 43.4%. Average protein content was 42.43%.

Summary

- This experiment includes key soybean genotypes from the Australian Soybean Breeding Program adapted for the Northern Grains Region. The recently released elite genotypes, Moonbi$^{\Phi}$ and Richmond$^{\Phi}$ have demonstrated the improvements that have been made compared with the benchmark variety Soya 791. Results in this experiment show differences in agronomic characteristics, grain quality and yield performance.
- In conjunction with biomass measurements and collected samples, further results are pending from the collaborative work with the GRDC funded Project DAQ00181: Optimising nitrogen *fixation in grain legumes – northern region*, led by Dr Nikki Seymour at DAFF in Queensland. The data aims to quantify the nitrogen benefit to northern farming systems over the longer term.

Acknowledgements

Project funding by NSW DPI and GRDC under the Northern Pulse Agronomy Initiative Project (DAN00171).

Romani Pastoral Company, Peter Winton (Crop Manager) 'Windy Station' Pine Ridge.

Hale seed kindly supplied by Brian Fletcher ('Marydale' Caroona) and John Webster (Quirindi Grain & Produce, Quirindi NSW); Bunya$^{\Phi}$ seed kindly supplied by Ian Morgan (PB Agrifood, Toowoomba Queensland).

Technical support: Joe Morphew, Pete Formann, Rosie Holcombe, Jim Murphy, Joel Hargreaves and Dave Eglington.

Quality testing conducted by Futari Grain Technology Services, Narrabri.