Sorghum in the western zone: row configuration x population x hybrid – "Kelvin", Gurley 2014–15

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Key findings

Neither varying row configuration or hybrid affected yield at this site, given average site yields of 2.14 t/ha.

Slightly higher yields were obtained from the 30,000 plants/ha and 50,000 plants/ha target plant populations.

Thousand grain weight increased as row spacing widened, and decreased as plant population increased. Screenings were low across all treatments.

Introduction

Sorghum is a reliable summer crop in eastern areas of northern NSW. However, there is a need to improve its reliability in western cropping areas, and to assess strategies that will allow growers to adapt to increasingly variable seasonal conditions. Introducing hybrids with increasing levels of Staygreen (SG), or using a combination of different tillering habits, plant population and row configuration could help improve sorghum reliability yield in western regions.

In the eastern zone there has been a reasonable amount of research evaluating population and row spacing. Modelling studies suggest that sorghum can be a reliable component of western cropping systems, but this work needs applied research to verify the modelling and give growers confidence to incorporate sorghum into their rotations.

In northern NSW crown rot, a stubble-borne fungal pathogen, continues to be the most prevalent and damaging disease affecting winter cereals. Sorghum is recommended as a break crop, but the success is dictated by the amount of breakdown of the winter cereal stubble. Although altering row configuration and population might improve the reliability of sorghum, it might also reduce the decomposition rate of cereal stubble and reduce water accumulation during the fallow period and hence the break crop benefits.

The trial outlined below aimed to answer some of these questions and provide data for use in modelling the trial outcomes over long-term climatic data sets. This was one of three sites planted across northern NSW in the 2014–15 season. The other sites were located at Bellata and north of Ashley.

Site details

Location: **"Kelvin", Gurley**

Co-operator: **Scott Carrigan**

Sowing date: **6 and 7 January 2015**

Harvest date: **13 May 2015**

Fertiliser: **42 kg Granulock Z at sowing**

Starting soil water

The site was cored pre-sowing to establish starting soil water. There was 195 mm plant available water (PAW) for sorghum.

Starting nutrition

The site was cored just before sowing to determine starting soil nutrition (Table 1).

Table 1. *Starting soil nutrition at "Kelvin" Gurley*

Depth (cm)	Nitrate (mg/kg)	Colwell P (mg/kg)	Colwell K (mg/kg)	Sulfur (mg/kg)	Organic carbon (%)	Conductivity (dS/m)	pH ($CaCl_2$)
0–10	2	6	184	290.3	0.39	0.188	7.6
10–30	1	6	216	1158.0	0.18	1.677	7.3

Treatments

Hybrids
- MR Apollo (low tillering and high SG)
- MR 43 (moderate SG and tillering)
- MR Bazley (high tillering and low SG)

Row configuration
- Solid on 1 m spacings
- Single skip
- Double skip
- Superwide (1.5 m spacings)

Plant populations Populations were targeted using germination for each hybrid and an estimated establishment of 80%. Three populations were targeted in each of the row configurations:
15,000 plants/ha
30,000 plants/ha
50,000 plants/ha

Results

Note Throughout tables values followed by the same letter are not significantly different at the 95% confidence level (P = 0.05).

Plant establishment

Plant establishment was quite good at this site, achieving slightly higher than the targeted 15,000 plants/ha population and slightly lower at the 30,000 and 50,000 plants/ha targets (Table 3). Row configuration also affected plant establishment with the superwide and double skip treatments establishing slightly fewer plants (Table 2).

There was no significant difference in establishment of the different hybrids (data not shown).

Table 2. *Impact of row configuration on plant population*

Configuration	Established population (plants/ha)
Solid	31,500 a
Single skip	29,900 a
Superwide	26,200 b
Double skip	24,800 b

Table 3. *Target plant population versus established plant population*

Target population (plants/ha)	Established population (plants/ha)
15,000	16,500 c
30,000	27,600 b
50,000	40,100 a

Tillering

There were significant impacts of nearly all treatments on the number of tillers produced per m^2 and per plant. The number of tillers produced per m^2 declined as the effective row spacing widened (Table 4). This was most likely due to the additional inter-row competition between plants.

Table 4. *Impact of row configuration on tillering*

Configuration	Tillers (number/m^2)
Solid	4.21 a
Superwide	2.85 bc
Single skip	3.12 b
Double skip	2.35 c

Similarly as plant population increased the number of tillers per m^2 and per plant decreased (Table 5).

Table 5. *Impact of plant population on tillering*

Target population (plants/ha)	Tillers (number/m^2)	Tillers (number/plant)
15,000	3.55 a	2.15 a
30,000	3.28 a	1.21 b
50,000	2.58 b	0.65 c

The hybrids performed as expected with MR Apollo producing the least number of tillers and MR Bazley the most (Table 6).

Table 6. *Impact of hybrid on tillering*

Hybrid	Tillers (number/m²)	Tillers (number/plant)
MR Apollo	2.60 c	1.09 c
MR 43	3.02 b	1.33 b
MR Bazley	3.78 a	1.59 a

Head production

The number of heads produced per m² decreased as the effective row spacing increased, in the same manner as the tillering (Table 7).

Table 7. *Impact of row configuration on head production*

Configuration	Heads (number/m²)
Solid	5.98 a
Superwide	4.58 bc
Single skip	5.04 b
Double skip	3.99 c

In contrast the number of heads per m² increased as plant population increased. The number of viable heads produced per plant declined though as the population increased (Table 8).

Table 8. *Impact of plant population on head production*

Target population (plants/ha)	Head (number/m²)	Heads (number/plant)
15,000	4.56 b	2.76 a
30,000	4.98 a	1.83 b
50,000	5.15 a	1.29 c

There were also differences in the performance of the hybrids with MR Apollo producing the least heads, followed by MR 43 and then MR Bazley (Table 9).

Table 9. *Impact of hybrid on head production*

Hybrid	Heads (number/m²)	Heads (number/plant)
MR Apollo	4.58 b	1.78 c
MR 43	4.77 b	1.96 b
MR Bazley	5.34 a	2.15 a

Dry matter production

Plant cuts were taken at flowering and produced an average of 3.26 tonnes of dry matter per ha. There was no difference in the dry matter production between hybrids. However, dry matter production declined as effective row spacing increased (Table 10).

Table 10. *Effect of row configuration on dry matter production*

Configuration	Dry matter (t/ha)
Solid	3.95 a
Single skip	3.39 ab
Superwide	3.06 bc
Double skip	2.63 c

The low plant population had the lowest dry matter production but there was no difference in the dry matter production from the 30,000 or 50,000 plants/ha populations (Table 11).

Table 11. *Effect of plant population on dry matter production*

Target population (plants/ha)	Dry matter (t/ha)
15,000	2.84 b
30,000	3.34 a
50,000	3.61 a

Average days to flowering

The days to 50% flowering of the main head was recorded in each plot. The double skip treatments were slightly quicker to flower than the solid plant treatments (Table 12).

Table 12. *Effect of row configuration on days to flower*

Configuration	Days to 50% flowering
Solid	60.00 a
Single skip	59.33 bc
Superwide	59.70 ab
Double skip	59.07 c

There was also an impact of increasing plant population, with the lowest plant population being slightly slower to reach 50% flowering (Table 13).

Table 13. *Effect of plant population on days to flower*

Target population (plants/ha)	Days to 50% flowering
15,000	60.03 a
30,000	59.53 b
50,000	59.03 c

There was no difference between MR 43 and MR Bazley in the days to flowering. MR Apollo was slower to flower by around three days (Table 14).

Table 14. *Effect of hybrid on days to flower*

Hybrid	Days to 50% flowering
MR Apollo	61.44 a
MR 43	58.78 b
MR Bazley	58.36 b

Grain yield

The average grain yield at the site was 2.14 t/ha. There was only a significant impact of varying plant population on grain yield (Table 15). The highest yields were achieved with either 30,000 or 50,000 plants/ha. The 15,000 plants/ha population yielded significantly less than the 50,000 plants/ha target population. There was no impact of configuration or hybrid on final grain yield.

Table 15. *Impact of varying plant population on grain yield*

Target population (plants/ha)	Grain yield (t/ha @ 13.5% moisture)
15,000	1.97 b
30,000	2.13 ab
50,000	2.33 a

Grain quality

Subsamples were collected from each plot at harvest and were used to measure grain quality parameters including grain protein, 1000 grain weight and test weight.

Grain protein averaged 11.24%, indicating there was sufficient nitrogen to achieve maximum yields. Row configuration did not affect final grain protein. However, increasing plant population reduced grain protein levels (Table 17).

Screenings levels were very low across the trial, however, the biggest differences were between the hybrids with the low tillering MR Apollo having a higher level of screenings. MR Apollo also had the lowest test weight (Table 18).

Thousand grain weights increased as row spacing widened (Table 16) and decreased as plant population increased (Table 17).

Table 16. *Effect of row configuration on grain quality*

Row configuration	Screenings (%)	1000 grain weight (g)
Solid	1.86 a	31.21 b
Single skip	1.71 ab	31.59 b
Superwide	1.43 b	32.97 a
Double skip	1.91 a	32.69 a

Table 17. *Effect of plant population on grain quality*

Target population (plants/ha)	Grain protein (%)	1000 grain weight (g)
15,000	11.39 a	33.74 a
30,000	11.24 b	31.90 b
50,000	11.01 c	30.70 c

Table 18. *Effect of hybrid on grain quality*

Hybrid	Grain protein (%)	Screenings (%)	1000 grain weight (g)	Test weight (kg/hL)
MR Apollo	11.06 a	2.05 a	33.84 a	72.30 b
MR 43	11.14 b	1.64 b	30.18 c	75.50 a
MR Bazley	11.06 b	1.50 b	32.32 b	75.22 a

Summary

Starting soil moisture was high at this site, but in-crop rainfall was limited resulting in average sorghum yields of just over 2 t/ha. Neither varying row configuration nor hybrid affected yield at this site, however, slightly higher yields were obtained from the 30,000 plants/ha and 50,000 plants/ha target plant populations. In terms of impacts on grain quality, thousand grain weight increased as row spacing widened and decreased as plant population increased. Screenings were low across all treatments.

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