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Early planting grain sorghum in northern NSW

Grain sorghum is a major summer crop of northern New South Wales allowing growers to include a summer crop in their predominantly winter based rotations. This enables the use of alternative herbicide chemistry, the capability to spread labour and machinery use, split logistics and increase cash flow. The stubble also provides ground cover for following crops which can increase both water infiltration and nitrogen mineralisation. Sorghum provides an important disease break as it is not a host of crown rot and is resistant to the root lesion nematode *Pratylenchus thorneii*.

One of the main challenges of growing a profitable sorghum crop is the limited planting opportunities and the likelihood of periods of extreme heat and moisture stress during and after flowering. These extreme conditions are becoming more common with climate change and increased climate variability. These risks have led to reduced grower confidence, particularly in the drier and hotter environments such as north west NSW.

Since 2018, experiments have been conducted to test the boundaries of early planting of sorghum. Experiments have been conducted in a range of environments, from the Liverpool Plains in New South Wales in the south to central Queensland in the north, as part of the *Optimising sorghum agronomy* project, a joint investment between GRDC, UQ, NSW DPI and QDAF.

NSW DPI has managed the experiment program in northern New South Wales with sites at Moree, Mungindi and Breeza. Research has focused on the effect of early planting on plant establishment, crop development, water use, grain yield and quality. These experiments will continue in 2021–22.

Early planting sorghum: *more benefits than risks.*

Why plant sorghum earlier?

Experiments conducted as part of the *Optimising sorghum agronomy* project have shown that planting sorghum early provides benefits that far outweigh the risks.

Traditionally in northern New South Wales sorghum planting starts in mid September in northwest New South Wales and late October on the Liverpool Plains when soil temperatures reach 16–18°C (at 8 am EST at planting depth). NSW DPI has been experimenting with planting sorghum when soil temperatures are greater than a minimum

of 12°C. This roughly correlates to mid August at Mungindi/north of Moree and mid September on the Liverpool Plains, depending on the season.

Moving the planting date of sorghum earlier, shifts the flowering and grain fill periods forward. Early planted sorghum can flower in mid–late November (Moree/ Mungindi regions) and early–mid December for the Liverpool plains, avoiding the risk of extreme heat.

There is still an inherent risk of frost (ranging from mild damage to complete loss) when planting earlier than traditionally recommended.

Early planted sorghum: *established successfully from planting on 17 September at Breeza. Photo taken 23 October.*

Benefits of early planted sorghum

Compared to normal planting time, early planted sorghum results in:

- Longer vegetative period under cooler temperatures potentially making more water available for grain fill.
- Moving the flowering window earlier, reducing the risk of flowering in extreme heat.
- The potential increase in water use efficiency (WUE).
- Comparable or greater grain yield depending on seasonal conditions.
- The potential for improved grain quality and reduced screenings.
- Increased chance of double cropping with a winter crop as sorghum harvest is earlier.

Changes in the growth pattern

Early planted sorghum has a slower germination and emergence due to colder soil temperatures. Emergence may take 2–3 weeks at soil temperatures of 12°C at the planting depth. Cooler temperatures in late winter, early spring result in a longer time to accumulate day degrees, the driver of plant growth.

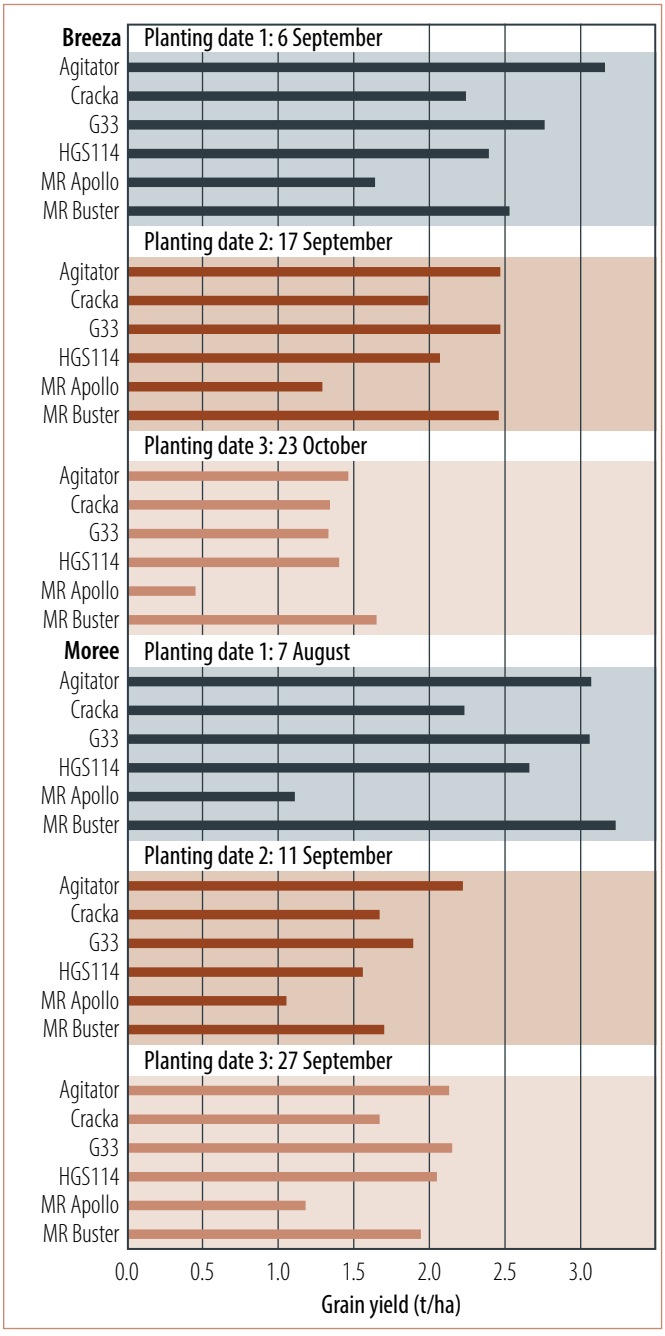
Sorghum plants tend to produce more tillers when planted earlier and have a longer period of vegetative and panicle growth. As a result, it takes more days to reach 50% flowering when compared to a normal planting time, but the flowering period is earlier.

Earlier flowering reduces the risk of heat stress and reduced pollen viability from high temperatures.

Water use and water use efficiency (WUE)

One of the major factors affecting yield potential of crops in the northern NSW is moisture. Ways to manipulate soil water use to produce the highest WUE (kg grain/ha/mm water used) are key profit drivers for growers.

In 2020, experiments with early planted sorghum crops



Improved yield: *from early planting at both Breeza and Moree in 2018–2019.*

showed a potential to increase WUE. Continuing trial work across locations will be conducted to investigate this further. Early sown sorghum uses less water in the vegetative phase allowing more soil water to be available for grain fill. This could also result in an increase in residual moisture for following winter crops.

Early planted sorghum has produced grain yields which have been better than or equal to those resulting from normal planting times in most sites and seasons. There has also been improvements in grain quality. This has primarily been through reduced levels of screenings compared to the normal planting time.

Tips to get it right

The level of success in establishing a uniform plant stand from early sowing depends on:

- Knowing the germination % and quality of your seed lot.
- Adjust your sowing rate to compensate for reduced seed emergence and establishment.
- Monitoring of soil temperatures at sowing depth.
- Adequate soil moisture in the seed bed.

Know the germination % and quality of your seed – source high quality seed

Successful establishment starts with seed which has both good germination and vigour percentages. Seed quality testing in trials has shown high variability in seed germination percentages between hybrids, seed lots and across temperatures. Cold soil temperatures are an additional stress on seedlings, so use only the best quality seed available. Poor vigour can lead to poor and prolonged emergence, particularly when seed is planted into cool soil.

Increase your seeding rate to compensate for reduced emergence and establishment

Planting rates are typically calculated on establishment percentages of around 80%. NSW DPI experiments have shown that early planting can result in much lower establishment percentages. This may be due to several factors including:

- Colder soil temperatures

Successful establishment: *planted 17 September at Breeza.*

- A longer time for seed to germinate and emerge
- Disease/pests
- Inadequate soil moisture around the seed.

Early planted crops often have reduced establishment and as such more seeds per hectare may need to be planted to achieve the target plant population. Where soil temperatures are at 12°C, seed losses of 30–40% can be expected. Seeding rate needs to be adjusted accordingly. Target a plant population of ~5.0 plants/m^2 regardless of your row spacing.

Monitor soil temperatures

Soil temperatures fluctuate widely during late winter and early spring. This is exacerbated in shallower soil depths, where there is less insulation against changing day/night temperatures.

Growers looking to plant early sorghum should target soil temperatures of at least 12°C and rising for a period of seven days. Soil temperature needs to be measured at the intended planting depth and at the same time of the day e.g. 8 am EST (which is close to the soils daily minimum temperature).

Adequate soil moisture around the seed

Early planting of sorghum into cooler soils results in the seed taking longer to emerge compared to normal planting dates. Planting in mid August results in an emergence time of 2–3 weeks. There needs to be adequate moisture around the seed at planting to ensure the seed does not dry out and stop the

germination process. For normal planting times, plants emerge in 5–7 days and in as little as three days when planting in summer.

Are there hybrid differences?

A number of commercial sorghum hybrids have been compared in experiments and include HGS 114, MR Buster, Cracka, G33 and A66. These hybrids have varying maturity as well as differing plant types.

To date there has been no significant difference between hybrids for cold tolerance and emergence. All hybrids displayed variation in their days to flowering with all varieties taking longer to reach flowering from an early planting compared to a normal planting.

For more information contact:

Loretta Serafin
Research Agronomist, Summer Grains
Northern Cropping Systems
NSW DPI, 4 Marsden Park Road, Calala NSW 2340

loretta.serafin@dpi.nsw.gov.au

M: 0427 311 819

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