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GRDC
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GRDC
GRAINS RESEARCH
& DEVELOPMENT
CORPORATION

SORGHUM

SECTION 11

CROP DESICCATION / SPRAY OUT

SORGHUM SPRAY-OUT TIMING

Crop desiccation/spray out

Desiccation allows crops to be harvested earlier and more efficiently. Herbicide application at this time can also be used as a salvage weed spray.

A pre-harvest spray of knockdown herbicides glyphosate or Reglone® can be applied to sorghum immediately after physiological maturity has been reached. This will hasten dry-down of the grain and should kill or desiccate the crop.

The timing of the pre-harvest sprays is critical. Crops should be sprayed preferably before the end of March when the temperatures are still warm and the crops are green. The aim is to maximise yield through the assimilation of carbohydrate in the seed, but balance this moisture use with the need to store water for the next crop.

When 95–100% of the grains have formed a 'black layer' (i.e. are physiologically mature) (Figure 1), the crop is ready to be desiccated. Sprayed crops should be harvested as soon as they have dried down and the withholding period for the herbicide has been met, as they are more prone to lodging.

Figure 1: *Researchers say the black layer on this sorghum seed is 'close to ideal' for spray-out.*

Recent research by the NSW Department of Primary Industries (NSW DPI) and the Northern Grower Alliance (NGA) has shown that significant reductions in yield and quality occur when crops are sprayed prior to physiological maturity. By contrast, when spraying is delayed beyond physiological maturity, the amount of water stored in the profile is reduced.

Desiccated crops stop using moisture and therefore allow soil moisture storage in the profile to begin. Many growers in northern NSW have found that in wet summers, spraying out an early sorghum crop for harvest has given them a higher return over 14 months, because it also allowed them to grow a successful double crop such as chickpeas. [1]

MORE INFORMATION

http://www.nga.org.au/results-and-publications/browse/20/sorghum-spray-out

http://www.nga.org.au/results-and-publications/download/21/grdc-update-papers-general-/sorghum-spray-out-1/grdc-adviser-update-paper-dalby-august-2008-.pdf

http://www.farmingahead.com.au/News/efarmingnews/9574/spray-out-timing-critical-for-sorghum-crop-success

http://www.farmingahead.com.au/News/efarmingnews/7530/trials-increase-timing-confidence-in-sorghum-spray-out

1 N Moore, L Serafin, L Jenkins (2014) Grain sorghum. Summer crop production guide 2014, pp. 5–16, NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/303485/Summer-crop-production-guide-2014.pdf

11.1 Sorghum spray-out timing

Sorghum spray-out with glyphosate is a common practice for sorghum growers in both NSW and Queensland.

Desiccation can be used to:

1. Manipulate time to harvest and assist in paddock harvest scheduling
2. Maximise potential soil water available for the following crop by reducing late season transpiration losses
3. Increase the effective length of the fallow period to maximise future cropping opportunities

Desiccating the crop too early can result in greater lodging, particularly if harvest is then delayed, and may affect both grain yield and quality. Desiccating too late, however, provides poor returns on the spray operation and may result in lost soil moisture, which will limit future planting options.

Sorghum growers and advisers in Queensland have appeared more comfortable with an optimal timing of sorghum spray-out largely based on grain black-layer (abscission zone) development.

However, industry feedback from northern NSW indicated that growers and advisers were frequently much more conservative in their spray-out timing. A project funded by the Grains Research and Development Corporation (GRDC) was established to help validate the impact of spray-out timing and, consequently, assist growers and advisers in their decision-making.

11.1.1 Trial design

Nine trials were conducted during the 2007–08 and 2008–09. In 2007–08, two small plot trials were established in commercial sorghum paddocks on the Liverpool Plains. Paddocks were targeted where growers indicated that they were at least 4 weeks from commercially planned desiccation. Plots consisted of four rows of 20 m length arranged in a completely randomised block design with four replications.

Both trials evaluated five desiccation timings, applied at approximately weekly intervals (Table 1). Glyphosate (Roundup® CT) was applied at 1.6 L/ha in all applications using a hand-boom.

Table 1: *Timing of desiccation sprays 2007-08 (variety in parentheses).*

Application	Wandobah (Pacific MR43)	Pine Ridge (MR Buster)
Timing 1	27 March 08	27 March 08
Timing 2	3 April 08	3 April 08
Timing 3	10 April 08	10 April 08
Timing 4	18 April 08	18 April 08
Timing 5	29 April 08	30 April 08

In 2008–09, seven trials were established from Goondiwindi, Queensland, to Premer, NSW. Trial commencement was determined differently from 2007–08. In 2007–08, growers and advisers indicated when they believed they were ~4 weeks from commercial spray-out. In 2008–09, the first application timing was made ~14 days after flowering (DAF) on the main heads (Table 2). The trials evaluated five or six desiccation timings again applied at approximately weekly intervals. Glyphosate (Roundup PowerMAX®) was applied at 2.0 L/ha in all applications using a hand-boom.

Table 2: *Timing (days after flowering, DAF) of desiccation sprays 2008–09 (variety in parentheses)*

Application	Goondiwindi (86G56)	Goondiwindi (Pacific MR43)	Premer (MR-Buster)	Spring Ridge (Pacific MR43)	Millie (Pacific MR43)	Spring Ridge (86G56)	Pine Ridge (MR-Buster)
14 DAF	22 Dec. 08	19 Feb. 09	24 Feb. 09	9 March 09	10 March 09	-	23 March 09
21 DAF	29 Dec. 08	26 Feb. 09	3 March 09	16 March 09	17 March 09	23 March 09	30 March 09
28 DAF	5 Jan. 09	4 March 09	10 March 09	23 March 09	24 March 09	30 March 09	8 April 09
35 DAF	12 Jan. 09	12 March 09	17 March 09	30 March 09	31 March 09	8 April 09	17 April 09
42 DAF	19 Jan. 09	19 March 09	24 March 09	6 April 09	7 April 09	–	27 April 09
49 DAF	27 Jan. 09	25 March 09	–	–	15 April 09	26 April 09	–

11.1.2 Assessments

Grain samples were taken at each application to determine grain moisture. Although grain-head moisture of ~25% is a useful guide to spray-out timing and is specified on the various glyphosate labels as the maximum grain moisture under which glyphosate can be used as a pre-harvest aid, it is often difficult to measure.

The formation of the black abscission layer at the base of the seed is a more reliable and easy-to-assess parameter for growers to assess.

Plots were scored visually for leaf brown-out and using a hand-held GreenSeeker® to measure crop reflectance as NDVI (normalised difference vegetation Index) for all Liverpool Plains trials. Digital photos were taken at each of the desiccation timings to indicate grain maturity. Plots were harvested using a small-plot harvester, with grain yield, protein, screenings, hectolitre weights and grain size measured. Soil cores were taken from each plot shortly after harvest, with soil moisture determined gravimetrically.

In 2007, one trial site was ready for desiccation even when the trial commenced. Therefore, there was no impact on yield or grain quality from any timing.

11.1.3 Yield impact

Figure 2 shows the yield of each spray-out timing as a percentage of the final desiccation-timing yield. ‘Safe’ timings would have an average yield close to 100%.

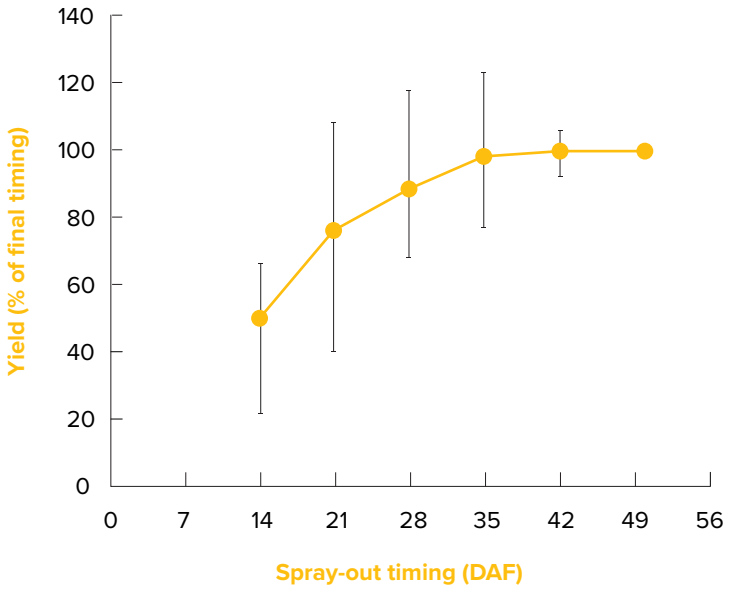

Figure 2: *Sorghum yield (%) compared with final spray-out timing in 2008 (mean of seven trials). Range bar shows maximum and minimum percentage yields, and individual points show average yield.*

11.1.4 Key messages—yield

- Spray-out at 14 DAF resulted in dramatic yield losses in all trials, with a 50% mean loss.
- Spray-out at 21 DAF was also unacceptable, with mean losses >20%.
- Spray-out at 28 DAF resulted in significant yield losses in three of the seven trials, with a yield reduction of ~10%.
- Spray-out at 35 DAF resulted in only one significant yield reduction (in a trial with larger numbers of late-maturing heads), with an average yield ~2% lower than the final desiccation timing.

11.1.5 Grain quality and spray-out timing

Spray-out at 14 DAF resulted in increased grain screenings at all sites. When applied at 21 DAF, spray-out significantly increased screenings at four of six sites. There was no significant impact on screenings from application at 28 DAF or later.

There were large decreases in test weight with the 14 DAF timing. Test weight was unaffected when desiccation occurred at 28 DAF or later.

11.1.6 Soil-water impact

Soil water was measured at each site by taking cores from each plot shortly after harvest. Soil-water contents were compared with those of the final desiccation timing at each site. The greatest water savings were from early application timings but these were associated with unacceptable yield losses. There was some inconsistency in soil-moisture benefit, especially with 86G56. With spray-out timing at 35 DAF or later, the average soil moisture benefit was <10 mm, with 24 mm the largest benefit measured.

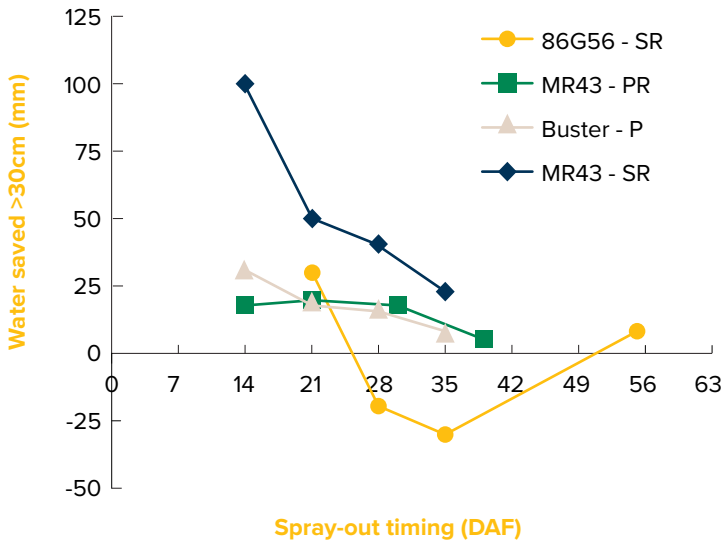

Figure 3: *Soil moisture saved below 30 cm from sites on the Liverpool Plains in 2008, relative to the final desiccation timing.*

Most of the water that was remaining in the profile though was deeper in the profile (below 30 cm). This soil water is significantly more valuable to the next crop in the sequence, because it is used later in the season and results in higher Water Use Efficiency at this time. Timing spray-out correctly may save some water in the profile (Figure 3) but it also commences the fallow period sooner, stopping unproductive water use from weeds and regrowth sorghum.

11.1.7 Tools to schedule spray-out timing

Spray-out timing can safely commence after grain physiological maturity. In sorghum, grain moisture of ~25% often coincides with this stage, but is hard to measure. Data (not presented) from these trials would support that an average grain moisture of 25% is suitable to schedule desiccation, and this supports the 25% moisture cut-off that appears on various glyphosate product labels.

In 2008, the rule-of-thumb recommended by seed companies of roughly timing spray-out at 35 DAF was evaluated. This proved useful, but is likely to be influenced by operator assessment of maturity, tiller or head synchronicity, environmental conditions and, possibly, unexpected differences in variety maturity.

The 35 DAF approach appears a useful starting point to 'mark the calendar', and from there commence field inspection.

Black-layer (abscission layer) formation in field was shown to be the best tool to schedule spray-out timing safely. Using this tool ensures that growers can determine their own risk approach and modify by variety and paddock as necessary. Assessment in a uniform, solid-plant crop is rarely a problem but is more challenging when there are multiple tiller maturities and increased paddock variability.

The results from these trials suggest that the most practical approach is to identify heads of the latest maturity considered 'economic to take to harvest'. Inspect grain about two-thirds of the way down the head and ensure that black-layer formation has occurred. Although there will still be some grains below this point that are less mature, timing at this stage will ensure negligible yield or grain quality impact but will maximise the opportunity for soil-moisture retention and consequently minimise the recropping period. By waiting for every grain in late-maturing heads to reach black-layer stage, the approach will be too conservative.

MORE INFORMATION

http://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2012/03/Sorghum-sprayout-timing