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GRDC GROWNOTES™

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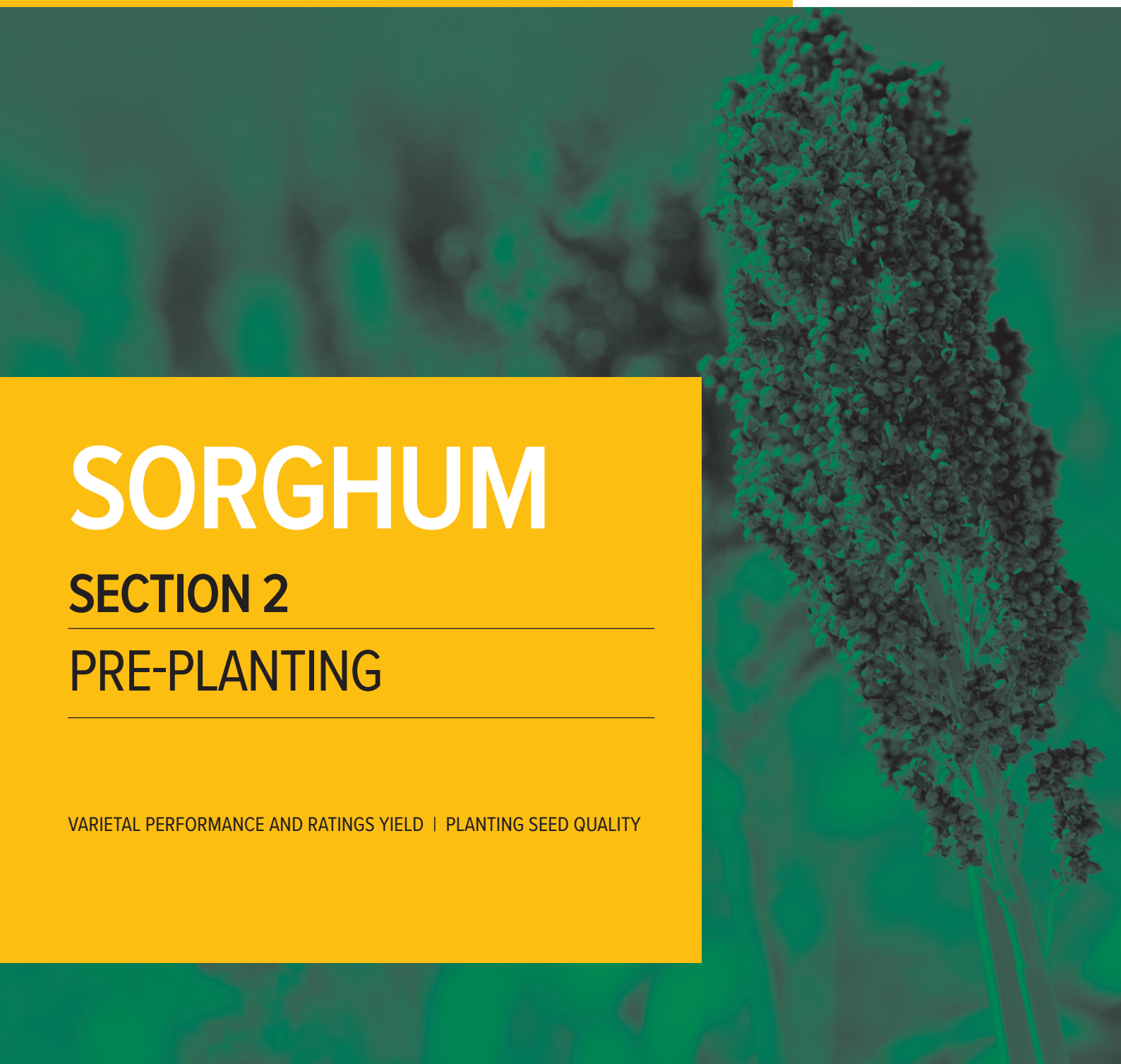
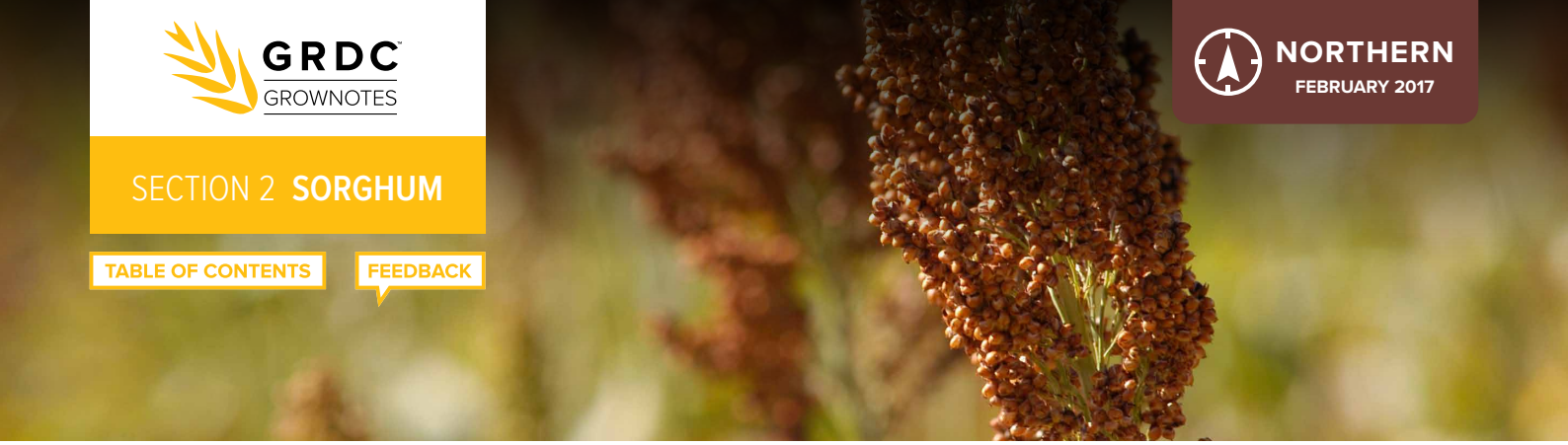


# SORGHUM

## SECTION 2

## PRE-PLANTING

VARIETAL PERFORMANCE AND RATINGS YIELD | PLANTING SEED QUALITY



## PODCAST

The GEKKO phenotyping tractor is being used by the University of Queensland as a remote sensing vehicle that can drive over trial sorghum plots during different growth stages and compile a composite picture for high definition 3D profiles of the plant canopy. Ground Cover Radio 122: All seeing tractor takes crop science to the future

## MORE INFORMATION

Ground Cover Issue 122: All-seeing 'tractor' takes crop science to the future

# Pre-planting

## 2.1 Hybrid sorghum characteristics

Selecting the right hybrid will depend on the location and season prospects. Growing two or three hybrids with slightly different characteristics can help spread your production risk.

### 2.1.1 Hybrid maturity

Select hybrids with a maturity length suitable for the local climatic conditions. With good to average dryland conditions on the North West Slopes and Liverpool Plains, the medium–slow to medium-maturity hybrids are recommended. On the North West Plains, the medium to medium–quick hybrids are recommended, depending on subsoil moisture storage. Growers need to select on highest yield potential and reliability, which includes the appropriate agronomic traits.

In northern NSW, quick-maturity hybrids take ~66 days from planting to the start of flowering, medium-maturity hybrids ~73 days, and slow-maturity hybrids ~80 days. The time a hybrid takes to flower will vary, depending on temperature. At Moree, for example, medium-maturity hybrids planted in early October take ~80 days to flower but when planted in mid-November only take ~60 days. At Spring Ridge, medium-maturity hybrids planted in early November flower in ~80 days compared with 65 days if sown during late November. [1]

As a rule, medium–late maturing sorghums are higher yielding, particularly under conditions of good moisture and nutrients. However, as moisture conditions become more limiting, the earlier maturing hybrids have greater yield reliability. Slower maturing hybrids generally give higher yields than quick-maturing hybrids when moisture and nutrients are not limiting. When moisture is limiting, the quicker maturing hybrids may offer better reliability. The choice of maturity will therefore depend on conditions at planting (e.g. soil type, stored water) and grower's attitude to risk (Figure 1). [2]

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

2 QDAF (2011) Sorghum—planting information. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/sorghum/planting-information

**Figure 1:** *Growing two or three sorghum hybrids spreads production risk.*

Photo: Loretta Serafin, NSW DPI

## 2.1.2 Yielding ability

Choose hybrids that have a high yielding ability under a range of seasonal conditions, and grow more than one hybrid each season. Trial hybrids on your farm over several seasons and grow those that perform best on average.

NSW DPI researchers investigated six key agronomic practices; row spacing, plant population, hybrid selection, nitrogen (N) and phosphorus (P) nutrition and time of sowing at two locations on the Liverpool Plains during the growing seasons of 2013–14, 2014–15 and 2015–16. [3]

In each season, trials were conducted at two locations, the NSW DPI Research Station at Breeza and in commercial sorghum paddocks at Pine Ridge (2013–14), Willow Tree (2014–15) or Premer (2015–16) in the respective seasons.

*Key points*

- Time of sowing can have large impacts on final crop yield, however being able to identify when to plant depending on the season is not possible.
- Nitrogen nutrition had the largest impact on crop yield across the three seasons.
- Hybrid performance varied between seasons and sowing times, however there was no consistent pattern of which hybrid yielded the best. [4]

## 2.1.3 Lodging and disease resistance

Lodging can be a problem in all dryland growing areas. Select hybrids with good lodging resistance where moisture stress is likely during the latter stages of grainfill. Moisture stress is the most common cause of lodging. Fusarium and charcoal stem rots are often associated with lodging, leading to plant death and considerable yield loss. Crops that remain green with some available soil moisture during grainfill are generally less prone to lodging. Northern Grower Alliance (NGA) trials in 2010–11

### MORE INFORMATION

GRDC Update Paper: High yielding sorghum and closing the yield gap

3 L Serafin, G McMullen (2016) High yielding sorghum and closing the yield gap, GRDC Update Papers 21 July 2016, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/07/High-yielding-sorghum-and-closing-the-yield-gap

4 L Serafin, G McMullen (2016) High yielding sorghum and closing the yield gap, GRDC Update Papers 21 July 2016, https://grdc.com.au/Research-and-Development/GRDC-Update-Papers/2016/07/High-yielding-sorghum-and-closing-the-yield-gap

showed that applications of glyphosate pre-harvest exacerbated the proliferation of *Fusarium*, resulting in the potential for increased lodging.

Agronomic practices such as no-till, stubble retention and controlled-traffic farming, all of which aim to store more fallow and in-crop rainfall, will to help reduce lodging. The use of wide or skip-rows, especially in the North West Plains, will also help.

These practices allow medium-maturity hybrids with higher yield potential to be grown.

Lodging is rarely a problem on fully irrigated crops, but can occur in specific varieties in partially irrigated crops that are stressed during the later stages of grainfill or following desiccation.

### 2.1.4 Sorghum midge resistance

Most hybrids have some level of resistance to sorghum midge.

Newly released hybrids are tested for their midge resistance by the Industry Testing Group, comprising Department of Agriculture, Fisheries and Forestry Queensland (QDAF) and seed companies (Figure 2, Table 1). Resistant hybrids have significantly reduced the need to spray for midge. [5]

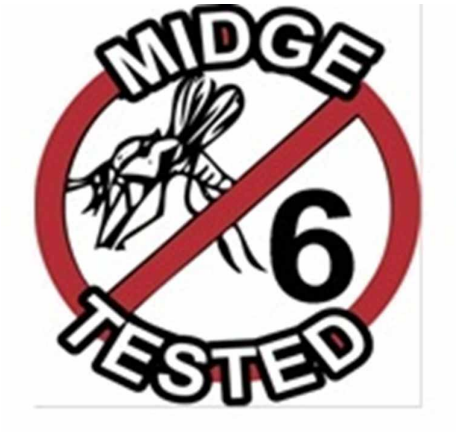



**Figure 2:** *Hybrids are assessed and given a midge rating.*

5 QDAF (2011) Sorghum—planting information. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/sorghum/planting-information

## MORE INFORMATION

http://www.grdc.com.au/Research-and-Development/Major-Initiatives/The-Sorghum-Midge-Tested-Scheme

https://www.pacificseeds.com.au/products/grain-sorghum.html

http://www.heritageseeds.com.au/products/hgs-114-grain-sorghum

http://www.pioneer.com/web/site/australia

http://www.nuseed.com.au/AU/Home

http://www.pacificseeds.com.au/images/stories/brochures/lowresforweb.pdf

**Table 1:** *The Industry Testing Group assigns midge resistance (MR) ratings from 1 to 7 (current top rating).*

| Hybrid | MR rating | Seed company |
|---|---|---|
| HGS-102 | 6 | Heritage Seeds |
| Enforcer | 6 | Nuseed |
| MR-Apollo | 6 | Pacific Seeds |
| MR-Eclipse | 6 | Pacific Seeds |
| MR-Taurus | 6 | Pacific Seeds |
| MR-Scorpio | 6 | Pacific Seeds |
| HGS-114 | 6 | Heritage Seeds |
| 85G33 | 5 | Pioneer |
| Dominator | 5 | Nuseed |
| Venture | 5 | Nuseed |
| Pacific MR 43 | 5 | Pacific Seeds |
| 84G99 | 5 | Pioneer |
| MR-Bazley | 4 | Pacific Seeds |
| Liberty White | 4 | Nuseed |
| MR-Buster | 4 | Pacific Seeds |
| 84G22 | 4 | Pioneer |
| 85G08 | 4 | Pioneer |
| Tiger | 3 | Nuseed |

Ratings can range from 1 (no resistance) to 8+ (practical field immunity; some new hybrids)

### 2.1.5 Organophosphate insecticide reaction

Some hybrids have a phytotoxic reaction to organophosphate (OP) insecticides. This causes symptoms from spotting to intense purpling of leaves and stems. When crops are likely to be sprayed with OP insecticides, it is suggested to grow tolerant hybrids with a rating of 4–5 to reduce possible yield losses. See Table 2 and consult seed companies for hybrid ratings. [6]

6 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

**Table 2:** *Sorghum hybrid characteristics 2011—see key below for ratings.*

| Company | Hybrid | Maturity | Height | Standability | Sorghum midge[A] | OP reaction[B] | Head type | Irrigation suitability |
|---|---|---|---|---|---|---|---|---|
| Nuseed | Venture | MQ | M | 5 | 5 | CC | SO | Yes |
| | Tiger | M | M | 5 | 3 | CC | SC | Yes |
| | Dominator | M | M | 5 | 5 | MIN | O | Yes |
| | Liberty White | M | M | 5 | 4 | MIN | SO | Yes |
| | Enforcer | MS | M | 4 | 6 | MIN | O | Yes |
| Pacific Seeds | MR Eclipse | MQ | M | 4 | 6 | MIN | SO | Yes |
| | Pacific MR43 | M | MT | 4 | 5 | MIN | O | Yes |
| | MR Buster | M | M | 5 | 4 | SEV | SO | Yes |
| | MR Bazley | M | M–S | 5 | 4 | CC | SC | Yes |
| | MR Apollo | ML | M | 5 | 6 | CC | SO | Yes |
| | MR Scorpio | M | M | 4.5 | 6 | CC | SO | Yes |
| | MR Taurus | MQ | M | 5 | 6 | CC | SO | Yes |
| Pioneer | 85G33 | MQ | S–M | 5 | 6 | NA | SO | Yes |
| | 84G99 | M | M | 5 | 5 | MIN | O | No |
| | 85G22 | M | M | 5 | 4 | MIN | SO | Yes |
| Heritage Seeds | HGS-102 | M | M | 5 (charcoal rot 6) | 7 | 8 (minimal) | SO | Yes |
| | HGS-114 | M | M–S | 5.5 (charcoal rot 6.5) | 6 | 9 (minimal) | SO | Yes |

The information presented in this table was kindly supplied by seed companies and is not based on DPI data. Only varieties commercially available in NSW and Queensland are listed. Consult seed companies before final selection of sorghum hybrids for particular markets and for particular localities

[A]Midge rating is the factor by which a hybrid's midge resistance exceeds that of a fully susceptible hybrid (rating 1). For example, if it is cost-effective to control 2 midges/head in a rating 1 hybrid, then cost-effective control in a rating 7 hybrid occurs when there are 14 midges/head.

[B]Joint seed company approved ratings based on visible leaf damage only. Ratings may not reflect possible yield losses due to the chemical.

Key for Table 2

| Maturity | Height | Standability | Midge resistance | OP reaction | Head type | Irrigation suitability |
|---|---|---|---|---|---|---|
| **M**edium–<br>**Q**uick<br>**M**edium<br>**M**edium **S**low | **S**hort<br>**M**edium<br>**M**edium<br>**T**all | **1** Poor<br>**2** Fair<br>**3** Good<br>**4** Very Good<br>**5** Excellent | **1** Susceptible<br>**2** Low<br>**4** Moderate<br>**6** Very high<br>**7** High<br>**8+** Excellent<br>**P** Preliminary | **SEV** Severe<br>**MOD** Moderate<br>**MIN** Minimal<br>**CC** Consult Company | **O**pen<br>**S**emi-**O**pen<br>**S**emi-**C**ompact<br>**C**ompact | Company recommendations |

## MORE INFORMATION

http://www.hsrseeds.com.au/grain-sorghum.aspx

http://www.pacificseeds.com.au/products/sorghum.html

http://www.pioneer.com/CMRoot/International/Australia_Intl/web_content/media/summer.pdf

http://www.daff.gov.au/__data/assets/pdf_file/0007/2281228/sorghum.pdf

## 2.2 Safe rates of fertiliser sown with seed

Care must be taken when applying nitrogenous fertilisers at planting. Release of ammonia from the fertiliser can damage the germinating seedling if applied with the seed at planting. Table 3 details the safe rates for application with the sorghum seed at planting.

**Table 3:** *Safe rates (kg/ha) of some nitrogen fertiliser products sown with sorghum seed at planting.*

| Row spacing (cm) | N applied | Urea | DAP | MAP Starterfos |
|---|---|---|---|---|
| 18 | 25 | 54 | 130 | 200 |
| 25 | 18 | 39 | 90 | 138 |
| 50 | 9 | 20 | 45 | 69 |
| 75 | 6 | 13 | 30 | 46 |
| 100 (1-m rows) | 4.5 | 10 | 23 | 35 |
| 150 (single-skip) | 3.0 | 6.7 | 15 | 20 |
| 200 (double-skip) | 2.3 | 5 | 11 | 17 |

Rates in Table 3 should be reduced by 50% for very sandy soil sand may be increased by 30% for heavy-textured soils or where soil moisture conditions at planting are excellent.

Rates should be reduced by 50% when planting equipment with narrow-slit openers is used (the fertiliser concentration is increased around the seed).

Rates may be increased by 50% when airseeders are used operating at high pressures with wide openers. Airseeders spread the fertiliser bands when operating at high pressures, reducing the fertiliser concentration around the seed. [7]

## 2.3 Sprouted grain and feed quality

Premium Grains for Livestock Program (PGLP) research shows that sprouting has little or no effect on feed value, provided the grain is not contaminated with fungal growth.

Trials showed that the energy content of sprouted grains for animals was not decreased, and in some circumstances may be increased, compared with non-sprouted grain. The effects of germination were particularly favourable for a barley sample fed to broiler chickens and sorghum fed to cattle.

PGLP was funded by GRDC, Meat and Livestock Australia (MLA), Australian Pork Limited (APL), Rural Industries R&D Corporation (RIRDC), Australian Egg Corporation Limited (AEC), Ridley AgriProducts and Dairy Australia (DA). The project which carried out by the several research organisations across Australia and coordinated by researcher Dr John Black, John L Black Consulting, Warrimoo, NSW.

There was no detrimental effect of sprouting on the energy value of grains for animals; however, the effects of storage on the possible deterioration of sprouted grain or of mycotoxins that may develop needed to be examined.

The research analysed sprouted sorghum samples collected from the Moree district of NSW that had been significantly downgraded at the grain depot. The starch content and *in vitro* fermentation and digestion were compared with the mean values from all other sorghum samples. Results suggested that the starch content and nutritional value of sorghum were unaffected by sprouting.

As part of the trials, grain was fed to sheep, pigs, broiler chickens and layers. A comparison of available energy content and total available energy intake suggested the sprouted sorghum was not substantially different from the other sorghum samples examined.

Two cultivars each of wheat and barley and three cultivars of sorghum were also germinated for periods of 16–48 h and germination was ceased by drying. Germination for these periods did not alter the starch content of the grains, but reduced significantly the falling number values, which measure the degree of starch breakdown by the grain enzyme amylase.

Germination did not affect the microbial fermentation of starch. However, the rate of starch digestion appeared to increase, with a significant increase in total acid and lactic acid production with all grain species. These results indicate that germination increases the accessibility of both rumen microbial and animal digestive enzymes to starch, and increases the rate of starch digestion for all cereal species examined. [8]

For more details on weather-damaged or mouldy grains, see GrowNotes Sorghum 15. Marketing.

### MORE INFORMATION

http://www.grdc.com.au/Media-Centre/Media-News/Misc/2013/03/sprouted-sorghum--feed-quality-not-dampened

http://ses.library.usyd.edu.au/handle/2123/5441

https://www.grdc.com.au/uploads/documents/2010ASGCEditedPapersPDF/Lawrence_Feedlot_edited_paper.pdf

http://www.brahman.com.au/technical_information/nutrition/fastSlowGrains.html

7 QDAF (2011) Sorghum— nutrition, irrigation and harvest issues. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/sorghum/nutrition,-irrigation-and-harvest

8 R Bowman (2013) Sprouted sorghum: feed quality not dampened. GRDC Media Centre, http://www.grdc.com.au/Media-Centre/Media-News/Misc/2013/03/sprouted-sorghum--feed-quality-not-dampened