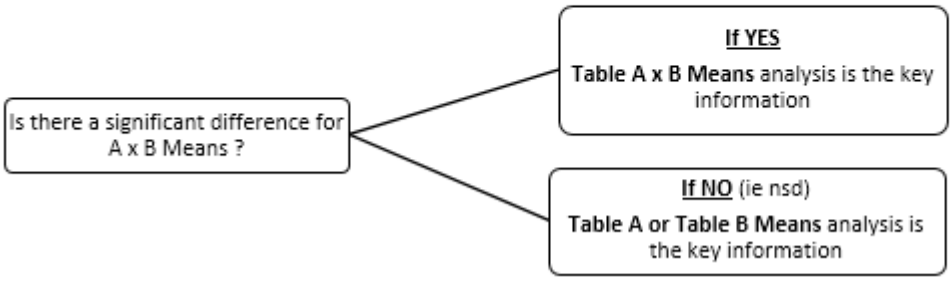
# N Management in Sorghum

**Trial ID:** LB1719 **Location:** St Ruth **Trial Year:** 2017
**Investigator:** Linda Bailey

| | | | |
|---|---|---|---|
| **Objective:** | **To evaluate the impact of urea timing, method and rate in Sorghum (Trial initiated as part of wheat project. Limited planting moisture meant paddock planted to sorghum)** | | |
| **Planting Date:** | **27/10/2017** | | |
| **Planting Equipment:** | **Small Plot Disc Planter** | | |
| **Row Spacing:** | **1 m** | | |
| **Planting Rate:** | **Target 8 Plants/m row** | | |
| **Planting Depth:** | **4.5cm** | | |
| **Nitrogen Source:** | **Urea only** | | |
| **Application Code:** | **A** | **B** | **C** |
| **Application Date:** | **17/01/2017** | **8/03/2017** | **3/08/2017** |
| **Method & Rates:** | **Spread, no incorporation: 50, 100 and 200 kg N/ha** | | |
| | **Spread with incorporation by narrow point tyne: 100 kg N/ha** | | |
| | **Spread AFTER cultivation by narrow point tyne: 100 kg N/ha** | | |
| | **Banded: 100 kg N/ha** | | |
| | **Split Application: 50 kg N/ha spread, no incorporation followed by 50 kg N/ha spread at GS30 (30/11/2017)** | | |
| **Harvest Date:** | **3/03/2018** | | |
| **Trial Reliability:** | **Moderate** | | |
| **Keywords:** | **Nitrogen, Sorghum** | | |

**NB: Trial designed and analysed as a Factorial**

| | In Simple Terms |
|---|---|
| Table of A Means: | Mean of 'METHOD X RATE' performance with **ALL** 'TIMING' treatments |
| Table of B Means: | Mean of 'TIMING' performance with **ALL** 'METHOD X RATE' treatments |
| Table of A x B Means: | 'METHOD X RATE' performance with **EACH** 'TIMING' treatment |



# N Management in Sorghum

**Trial ID:** LB1719 **Location:** St Ruth **Trial Year:** 2017

| Crop Name | | | | Sorghum | | | |
|---|---|---|---|---|---|---|---|
| Crop Variety | | | | MR Buster | | | |
| Description | | | | Total Heads | Immature Heads | Moisture Adjusted |
| Assessment Date | | | | 9/11/2017 | 13/02/2018 | 13/02/2018 | 3/03/2018 |
| Assessment Type | | | | EMERGENCE | COUNT | COUNT | YIELD |
| Assessment Unit | | | | /m Row | /m Row | /m Row | t/ha |
| Crop Stage Majority | | | | 14 | | | |
| Plant-Evaluation Interval | | | | 13 DP1 | 109 DP1 | 109 DP1 | 127 DP1 |
| ARM Action Codes | | | | T1 | T5 | T6 | TY4 |
| Trt No. | Treatment | Nitrogen Rate | Appln. Code | | | | |
| **TABLE OF A MEANS (Method and Rate)** | | | | | | | |
| 1 | Untreated | - | | 8.0- | 8.8e | 0.7c | 2.57- |
| 2 | Spread | 50kg ai/ha | | 7.5- | 9.3de | 0.9b | 2.43- |
| 3 | Spread | 100kg ai/ha | | 7.9- | 10.0ab | 1.1ab | 2.66- |
| 4 | Spread & Incorporated | 100kg ai/ha | | 8.0- | 9.7bcd | 1.2ab | 2.59- |
| 5 | Spread after Cultivation | 100kg ai/ha | | 7.7- | 9.4cd | 1.2ab | 2.56- |
| 6 | Banded | 100kg ai/ha | | 8.2- | 9.9abc | 1.0ab | 2.63- |
| 7 | Spread | 200kg ai/ha | | 8.2- | 10.5a | 1.2a | 2.76- |
| 8 | Split Application | 100kg ai/ha | | 8.1- | 9.5bcd | 1.3a | 2.56- |
| **TABLE OF B MEANS (Timing)** | | | | | | | |
| 1 | January | | A | 8.1- | 9.9a | 1.1- | 2.67- |
| 2 | March | | B | 8.0- | 9.8a | 1.0- | 2.55- |
| 3 | August | | C | 7.8- | 9.2b | 1.1- | 2.56- |
| **TABLE OF A x B MEANS (Method and Rate x Timing)** | | | | | | | |
| 1a | Untreated | | A | 8.7abc | 8.9- | 0.7- | 2.37- |
| 1b | Untreated | | B | 7.2de | 9.0- | 0.6- | 2.45- |
| 1c | Untreated | | C | 8.2a-e | 8.5- | 0.6- | 2.89- |
| 2a | Spread | 50kg ai/ha | A | 7.6a-e | 9.4- | 1.0- | 2.51- |
| 2b | Spread | 50kg ai/ha | B | 8.2a-e | 9.8- | 0.7- | 2.50- |
| 2c | Spread | 50kg ai/ha | C | 6.9e | 8.8- | 1.1- | 2.30- |
| 3a | Spread | 100kg ai/ha | A | 7.3de | 9.6- | 1.1- | 2.69- |
| 3b | Spread | 100kg ai/ha | B | 8.8ab | 10.0- | 1.0- | 2.78- |
| 3c | Spread | 100kg ai/ha | C | 7.6a-e | 10.3- | 1.2- | 2.50- |
| 4a | Spread & Incorporated | 100kg ai/ha | A | 8.1a-e | 10.3- | 1.3- | 2.62- |
| 4b | Spread & Incorporated | 100kg ai/ha | B | 8.7abc | 9.4- | 1.1- | 2.40- |
| 4c | Spread & Incorporated | 100kg ai/ha | C | 7.4cde | 9.5- | 1.1- | 2.74- |
| 5a | Spread after Cultivation | 100kg ai/ha | A | 8.3a-d | 10.0- | 0.9- | 2.80- |
| 5b | Spread after cultivation | 100kg ai/ha | B | 8.0a-e | 10.0- | 1.1- | 2.73- |
| 5c | Spread after cultivation | 100kg ai/ha | C | 6.9e | 8.2- | 1.4- | 2.14- |
| 6a | Banded | 100kg ai/ha | A | 8.1a-e | 9.7- | 1.0- | 2.66- |
| 6b | Banded | 100kg ai/ha | B | 7.6a-e | 10.5- | 1.1- | 2.31- |
| 6c | Banded | 100kg ai/ha | C | 8.9a | 9.6- | 1.1- | 2.91- |
| 7a | Spread | 200kg ai/ha | A | 8.1a-e | 10.8- | 1.3- | 2.80- |
| 7b | Spread | 200kg ai/ha | B | 8.0a-e | 10.6- | 1.2- | 2.70- |
| 7c | Spread | 200kg ai/ha | C | 8.4a-d | 10.0- | 1.1- | 2.77- |
| 8a | Split Application | 100kg ai/ha | A | 8.4a-d | 10.3- | 1.3- | 2.88- |
| 8b | Split Application | 100kg ai/ha | B | 7.5b-e | 9.3- | 1.3- | 2.56- |
| 8c | Split Application | 100kg ai/ha | C | 8.3a-d | 8.8- | 1.3- | 2.25- |

Means followed by same letter do not significantly differ (P=.05, LSD)

# N Management in Sorghum

**Trial ID:** LB1719 **Location:** St Ruth **Trial Year:** 2017

| Crop Name / Crop Variety / Assessment Date / Assessment Type / Assessment Unit / ARM Action Codes | | | | Sorghum MR Buster | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 5/03/2018 PROTEIN % | 5/03/2018 MOISTURE % | 5/03/2018 TEST WEIGHT kg/hL | 5/03/2018 SCREENING % | 5/03/2018 N RECOVERY kg N/ha T2 |
| Trt No. | Treatment | Nitrogen Rate | Appln. Code | | | | | |
| **TABLE OF A MEANS (Method and Rate)** | | | | | | | | |
| 1 | Untreated | | | 9.3c | 14.3a | 70.5- | 1.3- | 37.5- |
| 2 | Spread | 50kg ai/ha | | 9.9ab | 14.0bc | 69.9- | 1.3- | 37.4- |
| 3 | Spread | 100kg ai/ha | | 9.7ab | 13.9c | 69.4- | 1.4- | 40.9- |
| 4 | Spread & Incorporated | 100kg ai/ha | | 10.1a | 14.3ab | 69.9- | 1.3- | 41.1- |
| 5 | Spread after Cultivation | 100kg ai/ha | | 9.8ab | 14.1abc | 70.1- | 1.3- | 39.5- |
| 6 | Banded | 100kg ai/ha | | 10.1a | 14.1abc | 69.9- | 1.3- | 41.1- |
| 7 | Spread | 200kg ai/ha | | 9.6bc | 14.0c | 69.4- | 1.3- | 42.0- |
| 8 | Split Application | 100kg ai/ha | | 9.8ab | 14.1abc | 69.2- | 1.2- | 39.8- |
| **TABLE OF B MEANS (Timing)** | | | | | | | | |
| 1 | January | | A | 9.8- | 14.1- | 69.9- | 1.3- | 41.4- |
| 2 | March | | B | 9.7- | 14.1- | 69.7- | 1.3- | 39.1- |
| 3 | August | | C | 9.8- | 14.1- | 69.7- | 1.3- | 39.2- |
| **TABLE OF A x B MEANS (Method and Rate x Timing)** | | | | | | | | |
| 1a | Untreated | - | A | 9.9- | 14.2- | 70.4- | 1.3- | 36.9- |
| 1b | Untreated | - | B | 9.1- | 14.3- | 70.4- | 1.2- | 35.1- |
| 1c | Untreated | - | C | 8.8- | 14.4- | 70.7- | 1.4- | 40.5- |
| 2a | Spread | 50kg ai/ha | A | 9.8- | 14.1- | 70.3- | 1.4- | 38.2- |
| 2b | Spread | 50kg ai/ha | B | 10.0- | 14.2- | 69.7- | 1.3- | 38.6- |
| 2c | Spread | 50kg ai/ha | C | 9.9- | 13.9- | 69.7- | 1.3- | 35.3- |
| 3a | Spread | 100kg ai/ha | A | 9.7- | 13.8- | 68.4- | 1.3- | 41.4- |
| 3b | Spread | 100kg ai/ha | B | 9.7- | 13.9- | 69.9- | 1.5- | 42.5- |
| 3c | Spread | 100kg ai/ha | C | 9.9- | 13.9- | 69.8- | 1.3- | 39.0- |
| 4a | Spread & Incorporated | 100kg ai/ha | A | 10.3- | 14.3- | 70.2- | 1.4- | 42.3- |
| 4b | Spread & Incorporated | 100kg ai/ha | B | 9.8- | 14.5- | 69.8- | 1.3- | 37.3- |
| 4c | Spread & Incorporated | 100kg ai/ha | C | 10.0- | 14.1- | 69.8- | 1.3- | 43.9- |
| 5a | Spread after Cultivation | 100kg ai/ha | A | 9.7- | 14.3- | 71.2- | 1.3- | 42.6- |
| 5b | Spread after Cultivation | 100kg ai/ha | B | 9.7- | 14.1- | 69.2- | 1.2- | 42.1- |
| 5c | Spread after Cultivation | 100kg ai/ha | C | 10.1- | 14.0- | 70.1- | 1.6- | 33.8- |
| 6a | Banded | 100kg ai/ha | A | 10.0- | 14.1- | 70.6- | 1.3- | 42.6- |
| 6b | Banded | 100kg ai/ha | B | 10.2- | 14.1- | 69.8- | 1.4- | 36.7- |
| 6c | Banded | 100kg ai/ha | C | 10.0- | 14.2- | 69.2- | 1.2- | 43.9- |
| 7a | Spread | 200kg ai/ha | A | 9.6- | 14.2- | 69.1- | 1.4- | 42.8- |
| 7b | Spread | 200kg ai/ha | B | 9.5- | 13.9- | 70.1- | 1.2- | 40.9- |
| 7c | Spread | 200kg ai/ha | C | 9.6- | 13.9- | 69.1- | 1.3- | 42.4- |
| 8a | Split Application | 100kg ai/ha | A | 9.7- | 14.2- | 69.4- | 1.2- | 44.7- |
| 8b | Split Application | 100kg ai/ha | B | 9.8- | 13.8- | 68.8- | 1.3- | 39.8- |
| 8c | Split Application | 100kg ai/ha | C | 9.9- | 14.3- | 69.4- | 1.3- | 34.9- |

# N Management in Sorghum

**Trial ID:** LB1719 **Location:** St Ruth **Trial Year:** 2017

**FACTORIAL/POOLED ERROR AOV**
**Sorghum - MR Buster**
**9/11/2017**
**EMERGENCE /m² 14 13 DP1 T1**

| Source | DF | Sum of Squares | Mean Square | F | Prob.(F) | LSD (.05) |
|---|---|---|---|---|---|---|
| Total | 95 | 102.164063 | | | | |
| R | 3 | 8.304688 | 2.768229 | 3.044 | 0.0345 | |
| A | 7 | 4.372396 | 0.624628 | 0.687 | 0.6828 | 0.8 |
| B | 2 | 1.136719 | 0.568359 | 0.625 | 0.5383 | 0.5 |
| AB | 14 | 25.592448 | 1.828032 | 2.010 | 0.0295 | 1.3 |
| ERROR | 69 | 62.757813 | 0.909534 | | | |

**FACTORIAL/POOLED ERROR AOV**
**Sorghum - MR Buster**
**Total Heads**
**13/02/2018**
**COUNT /m Row 109 DP1 T5**

| Source | DF | Sum of Squares | Mean Square | F | Prob.(F) | LSD (.05) |
|---|---|---|---|---|---|---|
| Total | 71 | 64.057639 | | | | |
| R | 2 | 8.555278 | 4.277639 | 8.794 | 0.0006 | |
| A | 7 | 16.575170 | 2.367881 | 4.868 | 0.0004 | 0.6 |
| B | 2 | 6.665833 | 3.332917 | 6.852 | 0.0025 | 0.4 |
| AB | 14 | 9.884784 | 0.706056 | 1.451 | 0.1688 | 1.0 |
| ERROR | 46 | 22.376574 | 0.486447 | | | |

**FACTORIAL/POOLED ERROR AOV**
**Sorghum - MR Buster**
**Immature Heads**
**13/02/2018**
**COUNT /m Row 109 DP1 T6**

| Source | DF | Sum of Squares | Mean Square | F | Prob.(F) | LSD (.05) |
|---|---|---|---|---|---|---|
| Total | 71 | 8.994306 | | | | |
| R | 2 | 0.483611 | 0.241806 | 2.233 | 0.1187 | |
| A | 7 | 2.578503 | 0.368358 | 3.401 | 0.0052 | 0.3 |
| B | 2 | 0.165093 | 0.082546 | 0.762 | 0.4724 | 0.2 |
| AB | 14 | 0.785525 | 0.056109 | 0.518 | 0.9100 | 0.5 |
| ERROR | 46 | 4.981574 | 0.108295 | | | |

**FACTORIAL/POOLED ERROR AOV**
**Sorghum - MR Buster**
**Moisture Adjusted**
**3/03/2018**
**YIELD t/ha 127 DP1 TY4**

| Source | DF | Sum of Squares | Mean Square | F | Prob.(F) | LSD (.05) |
|---|---|---|---|---|---|---|
| Total | 93 | 60.554717 | | | | |
| R | 3 | 45.134590 | 15.044863 | 91.775 | 0.0001 | |
| A | 7 | 0.721911 | 0.103130 | 0.629 | 0.7301 | 0.33 |
| B | 2 | 0.258301 | 0.129151 | 0.788 | 0.4590 | 0.20 |
| AB | 14 | 3.456479 | 0.246891 | 1.506 | 0.1331 | 0.57 |
| ERROR | 67 | 10.983435 | 0.163932 | | | |

# N Management in Sorghum

**Trial ID:** LB1719 **Location:** St Ruth **Trial Year:** 2017

**FACTORIAL/POOLED ERROR AOV**
**Sorghum - MR Buster**
**5/03/2018**
**PROTEIN %**

| Source | DF | Sum of Squares | Mean Square | F | Prob.(F) | LSD (.05) |
|---|---|---|---|---|---|---|
| Total | 95 | 42.142396 | | | | |
| R | 3 | 17.088646 | 5.696215 | 25.213 | 0.0001 | |
| A | 7 | 5.524896 | 0.789271 | 3.494 | 0.0029 | 0.4 |
| B | 2 | 0.303333 | 0.151667 | 0.671 | 0.5143 | 0.2 |
| AB | 14 | 3.636667 | 0.259762 | 1.150 | 0.3332 | 0.7 |
| ERROR | 69 | 15.588854 | 0.225925 | | | |

**FACTORIAL/POOLED ERROR AOV**
**Sorghum - MR Buster**
**5/03/2018**
**MOISTURE %**

| Source | DF | Sum of Squares | Mean Square | F | Prob.(F) | LSD (.05) |
|---|---|---|---|---|---|---|
| Total | 95 | 20.479583 | | | | |
| R | 3 | 10.081250 | 3.360417 | 32.076 | 0.0001 | |
| A | 7 | 1.712917 | 0.244702 | 2.336 | 0.0336 | 0.3 |
| B | 2 | 0.023333 | 0.011667 | 0.111 | 0.8948 | 0.2 |
| AB | 14 | 1.433333 | 0.102381 | 0.977 | 0.4852 | 0.5 |
| ERROR | 69 | 7.228750 | 0.104764 | | | |

**FACTORIAL/POOLED ERROR AOV**
**Sorghum - MR Buster**
**5/03/2018**
**TEST WEIGHT kg/hL**

| Source | DF | Sum of Squares | Mean Square | F | Prob.(F) | LSD (.05) |
|---|---|---|---|---|---|---|
| Total | 95 | 295.373333 | | | | |
| R | 3 | 125.802500 | 41.934167 | 22.143 | 0.0001 | |
| A | 7 | 15.891667 | 2.270238 | 1.199 | 0.3153 | 1.1 |
| B | 2 | 1.095208 | 0.547604 | 0.289 | 0.7498 | 0.7 |
| AB | 14 | 21.911458 | 1.565104 | 0.826 | 0.6386 | 1.9 |
| ERROR | 69 | 130.672500 | 1.893804 | | | |

**FACTORIAL/POOLED ERROR AOV**
**Sorghum/ MR Buster**
**5/03/2018**
**SCREENING %**

| Source | DF | Sum of Squares | Mean Square | F | Prob.(F) | LSD (.05) |
|---|---|---|---|---|---|---|
| Total | 95 | 5.949896 | | | | |
| R | 3 | 1.111146 | 0.370382 | 6.627 | 0.0005 | |
| A | 7 | 0.129063 | 0.018438 | 0.330 | 0.9378 | 0.2 |
| B | 2 | 0.007708 | 0.003854 | 0.069 | 0.9334 | 0.1 |
| AB | 14 | 0.845625 | 0.060402 | 1.081 | 0.3900 | 0.3 |
| ERROR | 69 | 3.856354 | 0.055889 | | | |

# N Management in Sorghum

**Trial ID:** LB1719 **Location:** St Ruth **Trial Year:** 2017

| FACTORIAL/POOLED ERROR AOV<br>Sorghum - MR Buster<br>5/03/2018<br>N RECOVERY kg N/ha T2 | | | | | | |
|---|---|---|---|---|---|---|
| **Source** | **DF** | **Sum of Squares** | **Mean Square** | **F** | **Prob.(F)** | **LSD (.05)** |
| Total | 93 | 12741.459189 | | | | |
| R | 3 | 8916.305816 | 2972.101939 | 69.842 | 0.0001 | |
| A | 7 | 252.343061 | 36.049009 | 0.847 | 0.5526 | 5.3 |
| B | 2 | 110.252229 | 55.126114 | 1.295 | 0.2806 | 3.3 |
| AB | 14 | 611.377499 | 43.669821 | 1.026 | 0.4392 | 9.2 |
| ERROR | 67 | 2851.180585 | 42.554934 | | | |

Assessment Type
N RECOVERY = Nitrogen recovery in grain
Crop Stage Majority
14 = 4 Leaves unfolded
ARM Action Codes
T1 = [C1]/4
T5 = [C8] / [C7]
T6 = [C10] / [C7]
TY4 = 0.5376344*[C12]*(100-[C16])/86.5
T2 = [C15]*[C14]*1.6

DP1 = Days after Planting

| Application Description | | | | | | | |
|---|---|---|---|---|---|---|---|
| | A | | B | | C | | D |
| **Application Date:** | 17/01/2017 | | 8/02/2017 | | 3/08/2017 | | 30/11/2017 |
| **Application Method:** | SPREAD | BANDED | SPREAD | BANDED | SPREAD | BANDED | SPREAD |
| **Application Placement:** | TOPDRESS | BAND | TOPDRESS | BAND | TOPDRESS | BAND | TOPDRESS |
| **Next Moisture Occurred On:** | 20/01/2017 | | 14/03/2017 | | 3/10/2017 | | 3/12/2017 |

**Conclusions:**

This trial was established to evaluate the impact of urea application method and timing on wheat production. However a lack of planting moisture prevented wheat being planted and the treatments already initiated were utilised to generate sorghum data. Unfortunately, one section of the trial area was over-sprayed with a commercial fallow treatment. No data was generated from the damaged area. There was ~80 kg N/ha present to 120cm depth in the Untreated plots at planting with the majority in the 0-45cm depth.

Emergence counts showed no significant difference due to the main effects of application timing or N method and rate.

Head counts were taken 3 days prior to crop desiccation. There was a significant effect from timing of N application with increased total head counts from the January or March applications compared to the same treatments applied in August. There was also a N rate response evident. There was no significant difference apparent between the methods of application. Counts of immature heads showed all N rates and methods had significantly increased heads compared to the Untreated. These were unlikely to impact on yield due to crop desiccation shortly after assessment.

There was no significant difference in yield from any N rate, method or application timing with yields only averaging ~2.6t/ha. Significant increases in grain protein were apparent from all applications of N but at a low magnitude (~0.3-0.8%).

Under the low yields achieved, there was no significant impact on yield from any N application, despite positive results in head counts. The Untreated level of soil nitrogen at planting (80 kg N/ha) was sufficient for the yield potential achieved.

Soil samples taken two weeks after harvest from the Untreated and 200 kg N/ha plots showed limited movement of nitrogen in the soil. The majority of soil nitrogen was found in the top 30 cm of the soil profile: 64% of the extra N was still in the top 30 cm of soil from application in January 2017. For March 2017 and August 2017 applications this figure was 81% and 87% respectively.