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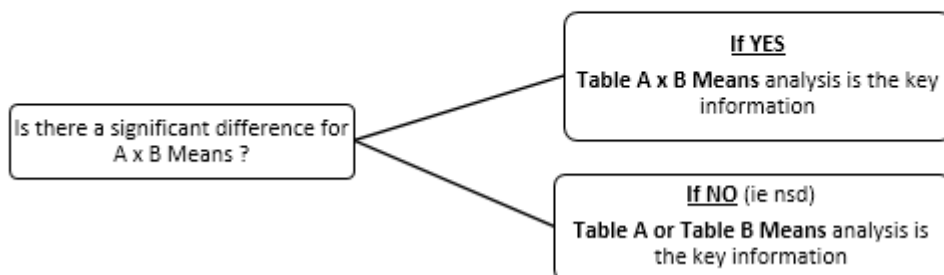
Nitrogen Management in Wheat – Timing, Method and Rate

Trial ID: DK1701	Location: Billa Billa	Trial Year: 2017
	Investigator: Denielle Kilby	

Objective:	To evaluate the impact of urea timing, method and rate in wheat		
Planting Date:	5/05/2017		
Planting Equipment:	Small Plot Tyne Planter		
Row Spacing:	32cm		
Planting Depth:	5cm		
Target Plant Population:	90 Plants /m ²		
Nitrogen Source:	Urea only		
Application Code:	A	B	C
Application Date:	22/12/2016	8/03/2017	6/05/2017 (Planting)
Methods and Rates:	Spread, no incorporation: 50, 100 and 200 kg N/ha		
	Spread with incorporation 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 (3/07/2017)		
Harvest Date:	14/11/2017		
Trial Reliability:	Moderate		
Keywords:	Nitrogen, wheat, timing, method, rate		

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



Nitrogen Management in Wheat – Timing, Method and Rate

Trial ID: DK1701

Location: Billa Billa

Trial Year: 2017

Crop Name Crop Variety Assessment Date Assessment Type Assessment Unit Crop Stage Majority Plant-Evaluation Interval ARM Action Codes cv				Wheat LRPB Lancer			
				18/05/2017 EMERGENCE /m ² 12 13 DP1 T1	3/07/2017 NDVI RATIO 32 59 DP1	7/08/2017 NDVI RATIO 61 94 DP1	4/11/2017 YIELD t/ha 183 DP1 TY2 24.9
Trt No.	Treatment	Nitrogen Rate	Appln. Code				
TABLE OF A MEANS (Method x Rate)							
1	Untreated	-		43-	0.37-	0.34b	1.14b
2	Spread	50kg/ha		43-	0.43-	0.42a	1.45a
3	Spread	100kg/ha		40-	0.42-	0.43a	1.45a
4	Spread & Incorporated	100kg/ha		40-	0.43-	0.45a	1.65a
5	Banded	100kg/ha		39-	0.38-	0.41a	1.38ab
6	Spread	200kg/ha		46-	0.44-	0.45a	1.55a
7	Split application	100kg/ha		41-	0.39-	0.41a	1.44a
TABLE OF B MEANS (Timing)							
1	December		A	43-	0.42a	0.43a	1.48a
2	March		B	42-	0.44a	0.45a	1.60a
3	Planting		C	40-	0.37b	0.37b	1.22b
TABLE OF A x B MEANS (Method x Rate x Timing)							
1	Untreated	-	A	49-	0.37-	0.34-	1.14-
1a	Untreated	-	B	43-	0.38-	0.34-	1.14-
1b	Untreated		C	38-	0.37-	0.34-	1.13-
2	Spread	50kg/ha	A	47-	0.45-	0.46-	1.59-
2a	Spread	50kg/ha	B	44-	0.48-	0.45-	1.75-
2b	Spread	50kg/ha	C	38-	0.35-	0.33-	1.02-
3	Spread	100kg/ha	A	42-	0.46-	0.47-	1.55-
3a	Spread	100kg/ha	B	36-	0.40-	0.43-	1.56-
3b	Spread	100kg/ha	C	41-	0.41-	0.40-	1.23-
4	Spread & Incorporated	100kg/ha	A	41-	0.45-	0.47-	1.76-
4a	Spread & Incorporated	100kg/ha	B	47-	0.48-	0.51-	1.81-
4b	Spread & Incorporated	100kg/ha	C	33-	0.37-	0.37-	1.39-
5	Banded	100kg/ha	A	36-	0.40-	0.43-	1.47-
5a	Banded	100kg/ha	B	41-	0.41-	0.43-	1.56-
5b	Banded	100kg/ha	C	38-	0.34-	0.36-	1.10-
6	Spread	200kg/ha	A	47-	0.43-	0.46-	1.63-
6a	Spread	200kg/ha	B	44-	0.52-	0.52-	1.83-
6b	Spread	200kg/ha	C	47-	0.36-	0.37-	1.18-
7	Split application	100kg/ha	A	38-	0.35-	0.38-	1.25-
7a	Split application	100kg/ha	B	40-	0.43-	0.45-	1.57-
7b	Split application	100kg/ha	C	45-	0.41-	0.39-	1.51-

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

Nitrogen Management in Wheat – Timing, Method and Rate

Trial ID: DK1701

Location: Billa Billa

Trial Year: 2017

Crop Name Crop Variety Assessment Date Assessment Type Assessment Unit ARM Action Codes				Wheat LRPB Lancer			
				5/11/2017 PROTEIN % ER4	5/11/2017 TEST WEIGHT kg/hL ER1	5/11/2017 SCREENING %	5/11/2017 N RECOVERY kg N/ha
Trt No.	Treatment	Nitrogen Rate	Appln. Code				
TABLE OF A MEANS (Method x Rate)							
1	Untreated	-		11.6d	76.4-	2.2-	22.8b
2	Spread	50kg/ha		12.1c	76.8-	1.7-	30.6a
3	Spread	100kg/ha		12.6ab	76.7-	1.8-	31.9a
4	Spread & Incorporated	100kg/ha		12.0c	76.8-	1.9-	34.8a
5	Banded	100kg/ha		12.9a	76.8-	1.9-	31.0a
6	Spread	200kg/ha		12.8a	76.6-	1.9-	34.7a
7	Split application	100kg/ha		12.4bc	76.6-	2.0-	30.9a
TABLE OF B MEANS (Timing)							
1	December		A	12.6a	76.6-	1.9-	32.7a
2	March		B	12.3b	76.8-	1.8-	34.5a
3	Planting		C	12.1b	76.5-	2.1-	25.7b
TABLE OF A x B MEANS (Method x Rate x Timing)							
1	Untreated	-	A	11.8-	76.7-	2.2-	23.5-
1a	Untreated	-	B	11.3-	76.4-	2.5-	22.5-
1b	Untreated		C	11.6-	76.1-	2.0-	22.4-
2	Spread	50kg/ha	A	12.5-	76.8-	1.6-	34.6-
2a	Spread	50kg/ha	B	11.9-	77.0-	1.4-	36.4-
2b	Spread	50kg/ha	C	11.8-	76.6-	2.2-	20.7-
3	Spread	100kg/ha	A	12.9-	76.8-	2.0-	34.9-
3a	Spread	100kg/ha	B	12.7-	76.8-	1.5-	34.7-
3b	Spread	100kg/ha	C	12.2-	76.4-	2.0-	26.3-
4	Spread & Incorporated	100kg/ha	A	12.6-	76.8-	1.6-	38.8-
4a	Spread & Incorporated	100kg/ha	B	12.1-	76.8-	1.7-	38.3-
4b	Spread & Incorporated	100kg/ha	C	11.4-	76.9-	2.5-	27.4-
5	Banded	100kg/ha	A	12.9-	76.7-	1.9-	33.0-
5a	Banded	100kg/ha	B	12.7-	77.0-	1.9-	34.6-
5b	Banded	100kg/ha	C	13.1-	76.6-	1.9-	25.3-
6	Spread	200kg/ha	A	12.8-	76.2-	2.1-	36.6-
6a	Spread	200kg/ha	B	12.9-	77.1-	1.8-	41.4-
6b	Spread	200kg/ha	C	12.7-	76.5-	2.0-	26.1-
7	Split application	100kg/ha	A	12.7-	76.4-	2.1-	27.6-
7a	Split application	100kg/ha	B	12.3-	76.9-	2.1-	33.6-
7b	Split application	100kg/ha	C	12.1-	76.7-	2.0-	31.6-

Nitrogen Management in Wheat – Timing, Method and Rate

Trial ID: DK1701

Location: Billa Billa

Trial Year: 2017

Conclusions:

This trial was conducted to evaluate the impact of nitrogen application timing and method on wheat production.

Incorporation of nitrogen during the fallow can impact on available soil moisture levels at establishment. In this trial there was no significant difference in soil moisture between treatments when measured with an EM38 shortly prior to planting (or at GS32).

Rainfall was recorded at the trial site using a tipping bucket gauge installed on March 14, 2017. A total of 154mm was recorded up till planting with the largest falls of 41mm (14/15 March) and 94mm (31 March). From planting until the end of the September a total of only 72mm were recorded with the major fall of 28mm on July 7.

There was no interaction between application timing and rate/method in this trial. Under challenging growing conditions, treatments responded in a similar manner at each of the application timings.

A clear timing effect was evident. Application of N in either December or March improved both NDVI ratios (~crop biomass) and yield compared to the same treatments applied at planting. Protein was increased significantly only by the December timing.

With the exception of the banded application, all rates and methods increased yield compared to the untreated. The yield benefit ranged from ~0.3-0.5t/ha with no indication of an N rate response. The lack of rate response was not surprising given the low rainfall received and the site yield average of ~1.4t/ha. All treatments increased protein compared to the untreated with an N rate response evident. Increases in protein level of ~0.5-1.3% were recorded. Nitrogen recovery (yield x protein) showed no difference between N rates or methods with recoveries of an extra ~8-12 kg N/ha compared to the untreated.

There was no benefit from split application. This was not surprising due to the lack of rate response and low in-crop rainfall.

Despite the moisture limited season and low yields, there was no impact from any N rate or method on test weight or screenings compared to the untreated.

Nitrogen Management in Wheat – Timing, Method and Rate

Trial ID: DK1701

Location: Billa Billa

Trial Year: 2017

FACTORIAL/POOLED ERROR AOV Wheat - LRPB Lancer 18/05/2017 EMERGENCE /m² 12 13 DP1 T1						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	83	9409.286340				
R	3	420.320250	140.106750	1.122	0.3473	
A	6	477.770046	79.628341	0.638	0.6995	9
B	2	122.295733	61.147866	0.490	0.6152	6
AB	12	897.912433	74.826036	0.599	0.8341	16
ERROR	60	7490.987878	124.849798			

FACTORIAL/POOLED ERROR AOV Wheat - LRPB Lancer 3/07/2017 NDVI RATIO 32 59 DP1						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	83	0.632981				
R	3	0.053354	0.017785	2.792	0.0480	
A	6	0.050071	0.008345	1.310	0.2666	0.07
B	2	0.069261	0.034631	5.437	0.0068	0.04
AB	12	0.078120	0.006510	1.022	0.4410	0.11
ERROR	60	0.382176	0.006370			

FACTORIAL/POOLED ERROR AOV Wheat - LRPB Lancer 7/08/2017 NDVI RATIO 61 94 DP1						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	83	0.613127				
R	3	0.026551	0.008850	1.690	0.1787	
A	6	0.099180	0.016530	3.157	0.0093	0.06
B	2	0.106698	0.053349	10.187	0.0002	0.04
AB	12	0.066492	0.005541	1.058	0.4107	0.10
ERROR	60	0.314207	0.005237			

FACTORIAL/POOLED ERROR AOV Wheat - LRPB Lancer 4/11/2017 YIELD t/ha 183 DP1 TY2						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	83	15.363243				
R	3	2.350305	0.783435	6.070	0.0011	
A	6	1.801564	0.300261	2.327	0.0437	0.29
B	2	2.110594	1.055297	8.177	0.0007	0.19
AB	12	1.357387	0.113116	0.876	0.5745	0.51
ERROR	60	7.743394	0.129057			

Nitrogen Management in Wheat – Timing, Method and Rate

Trial ID: DK1701

Location: Billa Billa

Trial Year: 2017

FACTORIAL/POOLED ERROR AOV Wheat - LRPB Lancer 5/11/2017 PROTEIN % 184 DP1 ER4						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	83	35.577500				
R	3	0.982262	0.327421	1.696	0.1774	
A	6	16.145000	2.690833	13.942	0.0001	0.4
B	2	3.185000	1.592500	8.251	0.0007	0.2
AB	12	3.685000	0.307083	1.591	0.1187	0.6
ERROR	60	11.580238	0.193004			

FACTORIAL/POOLED ERROR AOV Wheat - LRPB Lancer 5/11/2017 TEST WEIGHT kg/hL 184 DP1 ER1						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	83	25.426667				
R	3	2.282857	0.760952	2.603	0.0602	
A	6	1.673333	0.278889	0.954	0.4641	0.4
B	2	1.451667	0.725833	2.483	0.0921	0.3
AB	12	2.476667	0.206389	0.706	0.7396	0.8
ERROR	60	17.542143	0.292369			

FACTORIAL/POOLED ERROR AOV Wheat - LRPB Lancer 5/11/2017 SCREENING % 184 DP1						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	83	28.192857				
R	3	1.461429	0.487143	1.451	0.2370	
A	6	1.862857	0.310476	0.925	0.4838	0.5
B	2	0.812143	0.406071	1.210	0.3055	0.3
AB	12	3.912857	0.326071	0.971	0.4858	0.8
ERROR	60	20.143571	0.335726			

FACTORIAL/POOLED ERROR AOV Wheat - LRPB Lancer 5/11/2017 N RECOVERY kg/ha 184 DP1						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	83	7391.677020				
R	3	976.707172	325.569057	5.785	0.0015	
A	6	1164.625228	194.104205	3.449	0.0054	6.1
B	2	1214.698875	607.349438	10.793	0.0001	4.0
AB	12	659.185776	54.932148	0.976	0.4814	10.6
ERROR	60	3376.459968	56.274333			

Nitrogen Management in Wheat - Timing

Trial ID: **DK1701**Location: **Billa Billa**Trial Year: **2017**Assessment Type

N RECOVERY = nitrogen recovery in grain KG n/HA

Crop Stage Majority

12 = 2 leaves unfolded

32 = Node 2 at least 2 cm above node 1

61 = Beginning of flowering: first anthers visible

Plant-Evaluation Interval

13 DP1 = 1 TRZAS 5/05/2017

59 DP1 = 1 TRZAS 5/05/2017

94 DP1 = 1 TRZAS 5/05/2017

183 DP1 = 1 TRZAS 5/05/2017

ARM Action Codes

ER4 = Excluded replicate 4

ER1 = Excluded replicate 1

T1 = [C4]*0.789

TY2 = 0.555555*[C11]*(100-[C14])/87.5

DP1 = Days after Planting

Application Description				
	A	B	C	D
Application Date:	22/12/2016	8/03/2017	6/05/2017	3/07/2017
Application Start Time:	10:00 AM			
Application Stop Time:	12:00 PM			
Application Timing:	DECEMBER	MARCH	PLANTING	GS30
Air Temperature, Unit:	35 C			
% Relative Humidity:	40			
Wind Velocity, Unit:	15 km/h			
Wind Direction:	NE			
Dew Presence (Y/N):	No			
% Cloud Cover:	10			
Next Moisture Occurred On:	22/12/2016	14/3/2017	13/6/2017	7/7/2017