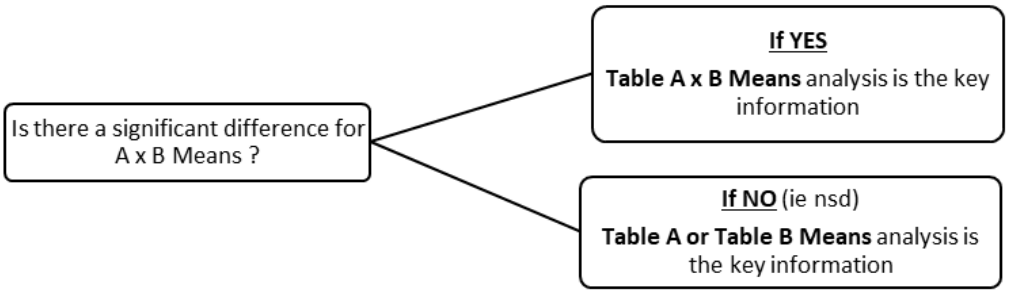
Indigo Impact on Yield & Grain Quality

Trial ID:	**BB1902**	**Location:**	**Goondiwindi**	**Trial Year:**	**2019**
		Investigator:	**Brendan Burton**		

Objective:	**To evaluate the impact of Indigo seed treatment on cereal and chickpea yield and grain quality**
Application:	**21/05/2019 (one day prior to planting)**
Planting Date:	**22/05/2019**
Row spacing:	**32 cm**
Crops/Variety:	**Barley (Commander), Durum (Bindaroi), Wheat (Suntop), Chickpea (PBA Seamer)**
Plant Population Targets:	**Cereals 90 plants/m^2, Chickpeas 30 plants/m^2**
Harvest Date:	**25/10/2019**
Keywords:	**Indigo, barley, wheat, durum, chickpea**
NB: NB Barley, wheat and chickpea seed was commercially treated with fungicide, durum was bare seed **Granulock Z applied at planting (22/05/2019)** **Chickpeas received Altacor 16/08/2019 and Alpha Cypermethrin 30/09/2019**	

Trial designed and analysed as a Split Plot

	In Simple Terms
Table of A Means:	Mean of 'Crop' performance with **BOTH** 'Indigo' treatments
Table of B Means:	Mean of 'Indigo' performance with **ALL** 'Crop' treatments
Table of A x B Means:	'Crop' performance with **EACH** 'Indigo' treatment



Indigo Impact on Yield & Grain Quality

Trial ID: BB1902 **Location:** Goondiwindi **Trial Year:** 2019

Table 1: Emergence, Biomass and Yield

Assessment Date			13/06/2019	29/08/2019	25/10/2019
Assessment Type			EMERGENCE	NDVI	YIELD
Assessment Unit			/m²	Ratio	t/ha
Plant-Evaluation Interval			22 DP	99 DP	156 DP
ARM Action Codes			AL T1		
Trt No.	Treatment	Product Rate			
TABLE OF A MEANS (Crop)					
1	Barley		65t a	0.70 a	1.94 a
2	Durum		56t b	0.55 c	1.72 b
3	Wheat		58t ab	0.58 b	1.90 a
4	Chickpea		25t c	0.71 a	1.43 c
TABLE OF B MEANS (Seed Treatment)					
1	Untreated	-	49t -	0.63 -	1.74 -
2	Indigo 76	3 ml/1000 kg	47t -	0.63 -	1.76 -
TABLE OF A x B MEANS (Crop x Seed Treatment)					
1a	Barley, Untreated	-	66t -	0.70 -	1.94 -
1b	Barley, Indigo 76	3 ml/1000 kg	64t -	0.70 -	1.93 -
2a	Durum, Untreated	-	59t -	0.55 -	1.70 -
2b	Durum, Indigo 76	3 ml/1000 kg	54t -	0.54 -	1.74 -
3a	Wheat, Untreated	-	60t -	0.57 -	1.89 -
3b	Wheat, Indigo 76	3 ml/1000 kg	56t -	0.58 -	1.92 -
4a	Chickpea, Untreated	-	24t -	0.72 -	1.42 -
4b	Chickpea, Indigo 76	3 ml/1000 kg	25t -	0.71 -	1.44 -

Table 2: Grain Quality

Assessment Type			PROTEIN	MOISTURE	TEST WEIGHT	SCREENINGS
Assessment Unit			%	%	kg/hL	%
ARM Action Codes					AS	AL
Trt No.	Treatment	Product Rate				
TABLE OF A MEANS (Crop)						
1	Barley		15.0 b	9.2 a	64.3t c	5.3t b
2	Durum		14.4 c	8.6 c	79.8t a	3.8t c
3	Wheat		13.2 d	8.9 b	80.0t a	5.3t b
4	Chickpea		25.7 a	7.9 d	72.7t b	6.7t a
TABLE OF B MEANS (Seed Treatment)						
1	Untreated	-	17.0 -	8.6 -	73.8t -	5.6t a
2	Indigo 76	3ml/1000 kg	17.0 -	8.7 -	74.3t -	4.9t b
TABLE OF A x B MEANS (Crop x Seed Treatment)						
1a	Barley, Untreated	-	14.9 -	9.1 -	64.3t -	5.3t -
1b	Barley, Indigo 76	3ml/1000 kg	15.1 -	9.3 -	64.3t -	5.4t -
2a	Durum, Untreated	-	14.4 -	8.6 -	79.3t -	4.4t -
2b	Durum, Indigo 76	3ml/1000 kg	14.3 -	8.6 -	80.3t -	3.3t -
3a	Wheat, Untreated	-	13.2 -	8.8 -	80.1t -	5.6t -
3b	Wheat, Indigo 76	3ml/1000 kg	13.2 -	8.9 -	80.0t -	5.0t -
4a	Chickpea, Untreated	-	25.7 -	7.8 -	72.2t -	7.3t -
4b	Chickpea, Indigo 76	3ml/1000 kg	25.7 -	8.0 -	73.1t -	6.1t -

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

Indigo Impact on Yield & Grain Quality

Trial ID: BB1902 **Location:** Goondiwindi **Trial Year:** 2019

Table 3: Additional Grain Quality

Assessment Type Assessment Unit			RETENTION %	VITREOUS GRAIN %
Trt No.	Treatment	Product Rate		
TABLE OF A x B MEANS (Crop x Seed Treatment)				
1a	Barley, Untreated	-	59.4 -	
1b	Barley, Indigo 76	3ml/1000 kg	62.3 -	
2a	Durum, Untreated	-		62.3 -
2b	Durum, Indigo 76	3ml/1000 kg		60.1 -
		LSD P=.05	nsd	nsd
		Treatment Prob.(F)=	0.05	0.15

Retention only assessed in barley. Vitreous grain only assessed in durum.
nsd = no significant difference

COMPLETE SPLIT-PLOT AOV 13/06/2019 EMERGENCE /m² 22 DAA AL						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	1.458669				
R	5	0.023959	0.004792	0.996	0.4451	
A	3	1.280031	0.426677	125.815	0.0001	0.1
ERROR A	15	0.050869	0.003391			
B	1	0.002070	0.002070	0.430	0.5193	0.0
AB	3	0.005530	0.001843	0.383	0.7662	0.1
ERROR B	20	0.096210	0.004811			

COMPLETE SPLIT-PLOT AOV 29/08/2019 NDVI Ratio 100 DAA						
Source	DF	Sum of Squares	Mean Square	F	Prob.(F)	LSD (.05)
Total	47	0.350218				
R	5	0.044074	0.008815	4.019	0.0110	
A	3	0.252594	0.084198	136.537	0.0001	0.022
ERROR A	15	0.009250	0.000617			
B	1	0.000043	0.000043	0.020	0.8900	0.028
AB	3	0.000391	0.000130	0.059	0.9805	0.056
ERROR B	20	0.043866	0.002193			

Indigo Impact on Yield & Grain Quality

Trial ID: BB1902 **Location:** Goondiwindi **Trial Year:** 2019

COMPLETE SPLIT-PLOT AOV 25/10/2019 YIELD t/ha 157 DAA TY2						
Source	**DF**	**Sum of Squares**	**Mean Square**	**F**	**Prob.(F)**	**LSD (.05)**
Total	47	2.625991				
R	5	0.393178	0.078636	11.143	0.0001	
A	3	1.909696	0.636565	55.590	0.0001	0.09
ERROR A	15	0.171767	0.011451			
B	1	0.004263	0.004263	0.604	0.4461	0.05
AB	3	0.005946	0.001982	0.281	0.8386	0.10
ERROR B	20	0.141140	0.007057			

COMPLETE SPLIT-PLOT AOV 25/10/2019 PROTEIN %						
Source	**DF**	**Sum of Squares**	**Mean Square**	**F**	**Prob.(F)**	**LSD (.05)**
Total	47	1218.758125				
R	5	0.676875	0.135375	0.298	0.9085	
A	3	1206.672292	402.224097	2762.581	0.0001	0.3
ERROR A	15	2.183958	0.145597			
B	1	0.000208	0.000208	0.000	0.9831	0.4
AB	3	0.127292	0.042431	0.093	0.9629	0.8
ERROR B	20	9.097500	0.454875			

COMPLETE SPLIT-PLOT AOV 25/10/2019 MOISTURE %						
Source	**DF**	**Sum of Squares**	**Mean Square**	**F**	**Prob.(F)**	**LSD (.05)**
Total	47	13.289792				
R	5	0.063542	0.012708	0.119	0.9867	
A	3	10.312292	3.437431	92.246	0.0001	0.2
ERROR A	15	0.558958	0.037264			
B	1	0.091875	0.091875	0.858	0.3654	0.2
AB	3	0.120625	0.040208	0.375	0.7717	0.4
ERROR B	20	2.142500	0.107125			

COMPLETE SPLIT-PLOT AOV 25/10/2019 TEST WEIGHT kg/hL AS						
Source	**DF**	**Sum of Squares**	**Mean Square**	**F**	**Prob.(F)**	**LSD (.05)**
Total	47	7.203513				
R	5	0.056043	0.011209	1.346	0.2860	
A	3	6.861875	2.287292	343.072	0.0001	0.1
ERROR A	15	0.100006	0.006667			
B	1	0.008687	0.008687	1.043	0.3193	0.1
AB	3	0.010326	0.003442	0.413	0.7453	0.1
ERROR B	20	0.166576	0.008329			

Indigo Impact on Yield & Grain Quality

Trial ID: BB1902 **Location:** Goondiwindi **Trial Year:** 2019

COMPLETE SPLIT-PLOT AOV 25/10/2019 SCREENING % AL						
Source	**DF**	**Sum of Squares**	**Mean Square**	**F**	**Prob.(F)**	**LSD (.05)**
Total	47	0.406611				
R	5	0.020555	0.004111	1.519	0.2287	
A	3	0.256700	0.085567	45.566	0.0001	0.0
ERROR A	15	0.028168	0.001878			
B	1	0.028028	0.028028	10.353	0.0043	0.0
AB	3	0.019017	0.006339	2.342	0.1039	0.1
ERROR B	20	0.054142	0.002707			

ARM Action Codes
AL = Automatic log transformation of X+1
AS = Automatic square root transformation of X+0.5
DP1 = Days after Planting

Conclusions:

Indigo 76 microbial seed treatment was applied @ 3mL/1000kg seed one day prior to planting. There was no significant impact on establishment, NDVI (~crop biomass) or grain yield across the four crop types evaluated.

There was however a significant reduction in grain screenings in Indigo treated plots with a reduction in average screenings from 5.6% to 4.9%.The level of impact did not made any difference in the receival grade for any crop.

There was no significant difference in barley retention but a clear trend to increased retention when Indigo was applied. Retention increased from 59 to 62%. No change in grain quality was obtained in this situation.

In this trial, the application of Indigo 76 microbial seed treatment did not achieve a significant impact on yield or quality grade when applied to wheat, barley, durum or chickpea seed.