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EVALUATION OF BIOAG BIOSTIMULANTS FOR IMPROVING CROP GROWTH AND YIELD IN WHEAT

ONE TRIAL, LAKE BOLAC, VICTORIA, AUSTRALIA, 2010

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- CONTENTS -

Page Number

1. SUMMARY 3

2. INTRODUCTION.....4

3. EXPERIMENTAL DETAILS 5

4. RESULTS AND DISCUSSION 8

5. CONCLUSIONS.....12

6. APPENDICES.....13

1. SUMMARY

One small plot replicated field trial was conducted between July 2010 and January 2011 to evaluate BioAg biostimulants for improving crop growth and yield in wheat. The trial was conducted near Lake Bolac in Victoria, Australia.

The following treatments were evaluated:

Treatment*	Application Timing and Method	Application Rate
1. Untreated		
2. BIOAG SOIL AND SEED	Pre-sowing ground application	3 L/ha
3. BIOAG SOIL AND SEED	Pre-sowing ground application	6 L/ha
4. BIOAG SOIL AND SEED	Pre-sowing ground application	3 L/ha
BIOAG BALANCE AND GROW	Foliar applied at mid-tillering	2 L/ha
5. BIOAG SOIL AND SEED	Pre-sowing ground application	3 L/ha
BIOAG BALANCE AND GROW	Foliar applied at mid-tillering	2 L/ha
BIOAG FRUIT AND BALANCE	Foliar applied at 2nd inter-node elongation	2 L/ha

* NB all plots received 100 kg/ha MAP at planting + 70 L/ha UAN at Z39 + 40 L/ha UAN at Z49

Treatments were applied using a hand operated, gas pressurised boom, incorporating four 110010 AI nozzles. At an application speed of 1.5 metres/second and a pressure of 220 kPa, treatments were applied in a total volume of 80 L/ha. The treatments were applied at sowing on 16 July 2010, at GS 21 on 22 September 2010 and at GS 41 on 27 October 2010.

The trial was established as a randomised complete block design, with four replicates. Plot size was 1.5 m x 20 m.

Detailed assessments were conducted at 0 DAT1, 31 DAT1, flowering, harvest and post harvest. These included soil samples, tiller counts at flowering, plot yields at harvest and quality assessments post harvest.

The BioAg products SOIL AND SEED, BALANCE AND GROW and FRUIT AND BALANCE did not affect crop tillering, however all treatments significantly increased crop yield compared to the untreated control.

There was no yield benefit gained by applying BIOAG SOIL AND SEED at rates of 6 L/ha compared to 3 L/ha.

The two way mixture of BIOAG BALANCE AND GROW plus BIOAG SOIL AND SEED did not increase yield compared to BIOAG SOIL AND SEED alone, however the addition of BIOAG FRUIT AND BALANCE to BIOAG SOIL AND SEED + BIOAG BALANCE AND GROW resulted in a significant yield increase compared to the mixture of BIOAG BALANCE AND GROW to BIOAG SOIL AND SEED.

None of the products tested influence grain quality parameters of test weight, screenings, moisture or protein.

2. INTRODUCTION

One small plot replicated field trial was conducted between July 2010 and January 2011 to evaluate BioAg biostimulants for improving crop growth and yield in wheat. The trial was conducted near Lake Bolac in Victoria, Australia.

This report contains the experimental methods used and presents the results obtained.

The trial was conducted under Agrisearch project BIOAG/10/01/b.

3. EXPERIMENTAL DETAILS

3.1 Site Details

Co-operator and Location	Jonathon Coutts, Lake Bolac, Victoria, Australia
Experimenter	Jeremy White
Variety	Young
Soil Type	Brown clay-loam
Site History	2009 - Wheat, 2008 - Oats
Sowing Date	16 July 2010
Crop Management	Pre-sow- Roundup (2 L/ha), Hammer(75 mL/ha), Trifluralin (1.5 L/ha) Post-sow, pre-emergence- Dual Gold (250 mL/ha), Lorsban (2 L/ha) ZGS 38- Propiconazole (500 mL/L formulation) (0.25 L/ha) ZGS 39- UAN (70 L/ha) ZGS 49- UAN (40 L/ha)
Seasonal Conditions	Moist conditions at sowing, allowing good establishment. A wet winter and spring put trial under much stress, but timed applications of nitrogen ensured maximum yield was achieved given the conditions

3.2 Treatment List

Treatment*	Application Timing and Method	Application Rate
1. Untreated		
2. BIOAG SOIL AND SEED	Pre-sowing ground application	3 L/ha
3. BIOAG SOIL AND SEED	Pre-sowing ground application	6 L/ha
4. BIOAG SOIL AND SEED	Pre-sowing ground application	3 L/ha
BIOAG BALANCE AND GROW	Foliar applied at mid-tillering	2 L/ha
5. BIOAG SOIL AND SEED	Pre-sowing ground application	3 L/ha
BIOAG BALANCE AND GROW	Foliar applied at mid-tillering	2 L/ha
BIOAG FRUIT AND BALANCE	Foliar applied at 2nd inter-node elongation	2 L/ha

* NB all plots received 100 kg/ha MAP at planting + 70 L/ha UAN at Z39 + 40 L/ha UAN at Z49

3.3 Formulations

BIOAG SOIL AND SEED – a fermented liquid formulation for soil microbial balance containing organic and non organic products supplied by BioAg.

BIOAG BALANCE AND GROW – a fermented liquid formulation for plant and root development containing organic and non organic products supplied by BioAg.

BIOAG FRUIT AND BALANCE - a fermented liquid formulation for fruit development containing organic and non organic products supplied by BioAg.

3.4 Treatment Method

Equipment	Hand operated, gas pressurised boom
Nozzles	4 x 110010 AI
Nozzle Spacing	50 cm
Pressure	220 kPa
Water Volume	84 L/ha
Boom Height	50 cm above target
Application Timing	Application 1- pre sow Application 2- ZGS 21 Application 3- ZGS 41

3.5 Sowing Method

Equipment	Six row plot cone seeder
Sowing Rate	110 kg/ha
Fertiliser	100 kg MAP/ha
Soil Surface at Planting	Moist
Germination	Excellent

3.6 Application Details

Date	Time of Day	Temperature (^{o}C)	Relative Humidity (%)	Cloud Cover (%)	Wind (km/hr)	Crop Growth Stage	Disease Incidence
16-Jul-10	11.45	14.0	73.0	40	2.3 N	Pre-sow	-
22-Sep-10	12.30	11.3	79.5	100	9.2 S	GS 21	-
27-Oct-10	14.30	17.2	56.4	60	14.2 S	GS 41	-

3.7 Trial Design

Design	Randomised complete block design
Replicates	4
Plot Size	1.5 m x 20 m
Buffers	0.75 m

3.8 Assessments

Date	Timing	Assessment
16-Jul-10	0 DAT	Soil Sample
16-Aug-10	31 DAT	Soil sample
Not taken at client request	Late tillering	Plant samples
26-Nov-10	Flowering	Tiller counts
01-Feb-11	Harvest	Yield
Feb-11	Post Harvest	Grain Quality

3.8.1 Soil Sample

Prespray (0 DAT) - 0-15 soil core sample was taken in 5 random locations across the trial and bulked. Samples were sent to BioAg.

31 DAT – a soil sample for treatments 1, 2, 3 and 6 was taken in each replicate (each treatment was bulked from replicates leaving 1 soil sample per treatment) and sent to BioAg.

3.8.2 Plant Sample

Not completed at client request.

3.8.3 Tiller Count

At flowering the number of tillers per metre of row was determined by counting 3 randomly selected 1 lineal metre of rows for each replicate.

3.8.4 Yield

At harvest each plot was harvested by a KEW mall plot harvester for grain yield and presented as t/ha.

3.8.5 Grain Quality

Samples were collected and protein (%), moisture (%), test weight (kg/hL) and screenings (%) determined.

3.9 Statistical Analysis

Statistical analyses conducted using GenStat Release 11.1 (PC/Windows 2008 – Lawes Agricultural Trust, Rothamsted Experimental Station). The model includes all treatment effects. Analysis of variance and least significant difference (LSD) procedures used.

4. RESULTS AND DISCUSSION

Results are summarised in Tables 1 and 2 and are given fully in the appendices.

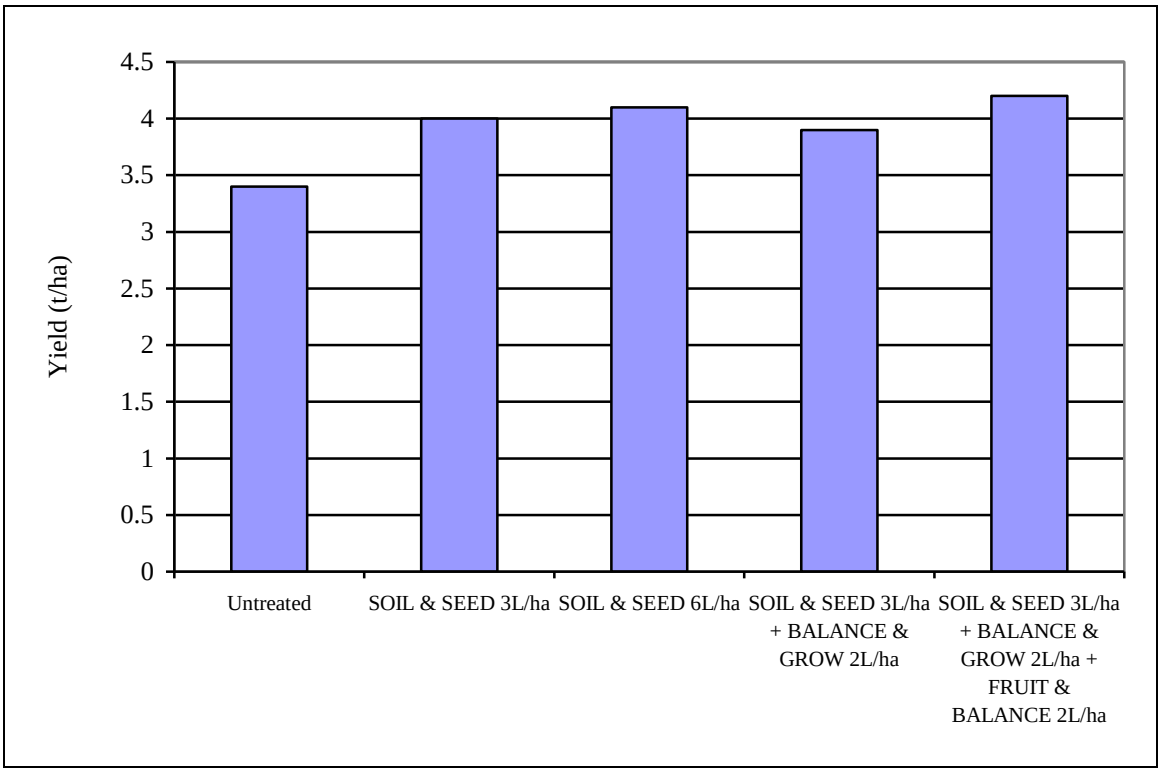
4.1 Crop Tillering

Treatments applied did not significantly influence the number of tillers present compared with the untreated control.

4.2 Crop Yield

All treatments significantly increased crop yield compared to the untreated control. There was no difference in yield between 3 L/ha and 6 L/ha of BIOAG SOIL AND SEED applied pre-sowing
The addition of BIOAG BALANCE AND GROW to BIOAG SOIL AND SEED at mid tillering did not increase yield compared to BIOAG SOIL AND SEED alone. However when BIOAG FRUIT AND BALANCE was added to the combination of BIOAG BALANCE AND GROW and BIOAG SOIL AND SEED, yield was significantly higher than the combination alone.

Figure 1 Mean Crop Yield (t/ha)



4.3 Grain Quality

4.3.1 Protein

Overall grain protein levels were moderate, with average of treatments meeting H2 specification. Statistical analysis found no significant differences between treatments.

4.3.2 Moisture

Grain moisture was consistent throughout the trial (10.8 to 10.9%) and no treatment effects were detected. All plots fell well below the 12.5% grain moisture quality standard.

4.3.3 Test Weight

Test weights showed little variation, ranging from 71.9 to 73.1 kg/hL. Test weights in this range are considered low and place the grain within the AUH2 specification of 71 kg/hL. This result is attributed to the late harvest and weathering experienced at this site due to repeated rainfall events.

4.3.4 Screenings

Screenings were similar throughout the trial (3.4 to 4.0%) and no treatment effects were detected. All plots exceeded the 5% screenings wheat quality standard.

Table 1 Agrisearch Services Summary of Results - Lake Bolac, Victoria
Mean Tillers m^2 and Yield (t/ha)

Treatment*	Rate/ha	Application Timing and Method	Tillers/m^2 26-Nov-10	Yield (t/ha) 01-Feb-11
1. Untreated	-	-	108.0	3.4 c
2. BIOAG SOIL & SEED	3 L	Pre-sowing ground application	95.7	4.0 ab
3. BIOAG SOIL & SEED	6 L	Pre-sowing ground application	100.3	4.1 ab
4. BIOAG SOIL & SEED BIOAG BALANCE & GROW	3 L 2 L	Pre-sowing ground application Foliar applied at mid-tillering	98.3	3.9 b
5. BIOAG SOIL & SEED BIOAG BALANCE & GROW BIOAG FRUIT & BALANCE	3 L 2 L 2 L	Pre-sowing ground application Foliar applied at mid-tillering Foliar applied at 2nd inter-node elongation	108.7	4.2 a
F Probability			0.279	<0.001
LSD 5 %			ns	0.242
CV %			9.5	4.0

* NB all plots received 100 kg/ha MAP at planting + 70 L/ha UAN at Z39 + 40 L/ha UAN at Z49
Means within the same cell with a letter in common are not significantly different (P>0.05)
ns- not significant

Table 2 Agrisearch Services Summary of Results - Lake Bolac, Victoria
Mean Grain Protein (%), Moisture (%), Test Weight (kg/hL) and Screenings (%)

Treatment*	Rate/ha	Application Timing and Method	Test Weight (kg/hL)	Screenings (%)	Moisture (%)	Protein (%)
1. Untreated	-	-	72.3	4.0	10.8	11.6
2. BIOAG SOIL & SEED	3 L	Pre-sowing ground application	73.2	3.4	10.9	11.4
3. BIOAG SOIL & SEED	6 L	Pre-sowing ground application	73.0	3.5	10.9	11.7
4. BIOAG SOIL & SEED	3 L	Pre-sowing ground application	71.9	4.0	10.9	11.5
BIOAG BALANCE & GROW	2 L	Foliar applied at mid-tillering				
5. BIOAG SOIL & SEED	3 L	Pre-sowing ground application	72.4	3.9	10.9	11.6
BIOAG BALANCE & GROW	2 L	Foliar applied at mid-tillering				
BIOAG FRUIT & BALANCE	2 L	Foliar applied at 2nd inter-node elongation				
F Probability			0.848	0.231	0.975	0.477
LSD 5 %			ns	ns	ns	ns
CV %			2.4	10.5	1.1	1.9

* NB all plots received 100 kg/ha MAP at planting + 70 L/ha UAN at Z39 + 40 L/ha UAN at Z49
ns- not significant

5. CONCLUSIONS

The BioAg products SOIL AND SEED, BALANCE AND GROW and FRUIT AND BALANCE did not affect crop tillering, however all treatments significantly increased crop yield compared to the untreated control.

There was no yield benefit gained by applying BIOAG SOIL AND SEED at rates of 6 L/ha compared to 3 L/ha.

The two way mixture of BIOAG BALANCE AND GROW plus BIOAG SOIL and SEED did not increase yield compared to BIOAG SOIL AND SEED alone, however the addition of BIOAG FRUIT AND BALANCE to BIOAG SOIL AND SEED + BIOAG BALANCE AND GROW resulted in a significant yield increase compared to the mixture of BIOAG BALANCE AND GROW to BIOAG SOIL and SEED.

None of the products tested influence grain quality parameters of test weight, screenings, moisture or protein.

6. APPENDICES

6.1 Full Results

6.1.1 Tillers per Metre Crop Row and Crop Yield

Treatment*	Rate/ha	Application Timing and Method	Rep	Tillers/m^2 26-Nov-10	Yield 01-Feb-11
			1	109.3	3.4
			2	104.7	3.4
			3	100.0	3.5
			4	118.0	3.5
1. Untreated	-	-	Mean	108.0	3.4
			1	98.0	3.8
			2	108.7	4.1
			3	84.0	4.2
			4	92.0	3.9
2. BIOAG SOIL & SEED	3 L	Pre-sowing ground application	Mean	95.7	4.0
			1	82.7	4.2
			2	106.0	3.7
			3	102.0	4.3
			4	110.7	4.1
3. BIOAG SOIL & SEED	6 L	Pre-sowing ground application	Mean	100.3	4.1
			1	95.3	3.9
			2	86.7	4.1
			3	96.7	3.9
4. BIOAG SOIL & SEED	3 L	Pre-sowing ground application	4	114.7	3.8
BIOAG BALANCE & GROW	2 L	Foliar applied at mid-tillering	Mean	98.3	3.9
			1	110.0	4.1
			2	102.7	4.2
5. BIOAG SOIL & SEED	3 L	Pre-sowing ground application	3	114.0	4.3
BIOAG BALANCE & GROW	2 L	Foliar applied at mid-tillering	4	108.0	4.3
BIOAG FRUIT & BALANCE	2 L	Foliar applied at 2nd inter-node elongation	Mean	108.7	4.2

* NB all plots received 100 kg/ha MAP at planting + 70 L/ha UAN at Z39 + 40 L/ha UAN at Z49

6.1.2 Grain Quality Data

Treatment*	Rate/ha	Application Timing and Method	Rep	Test Weight kg/hl	Screenings %	Moisture %	Protein %
			1	74.1	4.1	10.8	11.2
			2	*	*	*	*
			3	73.7	3.7	10.8	11.6
			4	69.6	4.2	10.9	11.9
1. Untreated	-	-	Mean	72.5	4.0	10.8	11.6
			1	74.0	3.1	10.9	11.3
			2	73.2	3.4	10.9	11.5
			3	*	*	*	*
			4	71.7	3.6	10.9	11.5
2. BIOAG SOIL & SEED	3 L	Pre-sowing ground application	Mean	73.0	3.4	10.9	11.4
			1	73.3	3.4	10.8	11.5
			2	74.1	3.0	10.9	11.6
			3	71.6	3.8	10.8	11.8
			4	72.9	3.9	11.1	11.9
3. BIOAG SOIL & SEED	6 L	Pre-sowing ground application	Mean	73.0	3.5	10.9	11.7
			1	73.2	3.4	10.7	11.7
			2	68.5	4.6	11.2	11.5
			3	74.0	3.8	10.9	11.0
4. BIOAG SOIL & SEED	3 L	Pre-sowing ground application	4	71.7	4.1	10.8	11.7
BIOAG BALANCE & GROW	2 L	Foliar applied at mid-tillering	Mean	71.9	4.0	10.9	11.5
			1	71.6	4.0	10.8	11.4
			2	72.3	4.0	10.9	11.6
5. BIOAG SOIL & SEED	3 L	Pre-sowing ground application	3	*	*	*	*
BIOAG BALANCE & GROW	2 L	Foliar applied at mid-tillering	4	72.5	3.7	10.9	11.9
BIOAG FRUIT & BALANCE	2 L	Foliar applied at 2nd inter-node elongation	Mean	72.1	3.9	10.9	11.6

* NB all plots received 100 kg/ha MAP at planting + 70 L/ha UAN at Z39 + 40 L/ha UAN at Z49

6.2 Rainfall Data

From BOM weather station at Lake Bolac, 10 km away.

Month Day	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11
1	0.2	1.0	13.6	4.2	0.0	1.2	1.0	0.0
2	0.0	7.8	24.4	1.4	0.0	1.6	13.4	0.0
3	0.0	0.8	1.0	0.4	0.0	1.8	8.4	0.0
4	0.2	0.0	0.8		0.8	0.6		0.0
5	0.0	1.2	7.4		0.2	0.2		0.0
6		0.0	1.0	12.8	0.0	0.0	4.8	0.0
7	3.0	0.0		3.8	1.2	0.0	6.4	0.0
8	0.0	0.0		0.0	0.2	0.0	45.4	0.0
9	1.0	0.0	0.8	0.4	0.0	0.0	4.6	
10	1.2	0.0	0.0	8.2	0.0	0.0	2.0	2.0
11	0.4	0.0	36.8		0.0	0.0	0.0	5.0
12	2.2	4.4	33.8		0.0	0.0	0.0	62.0
13	0.0	0.0	4.6	0.4	5.8		5.0	0.0
14	0.0	7.2		0.0	0.2		0.0	55.4
15	0.4	6.2		0.0	26.2	23.4	0.0	0.0
16	0.0	0.0	7.8	0.8	8.0	0.0	0.0	0.0
17	6.4	0.0	0.8	0.4	0.0	0.0	0.0	0.0
18	2.0	0.0	0.0		1.4	0.0	0.0	0.4
19	0.0	3.4	9.0		1.2	0.4	0.0	0.2
20		0.0	1.8	2.6	0.0	0.0	10.0	0.0
21	1.8	0.6		1.4	0.0	0.0	3.4	0.0
22	0.0	0.4		0.4	0.0	0.0	0.6	0.0
23	0.0	0.4	1.4	0.2	0.0	0.0	0.0	
24	0.0	0.0	0.4	0.0	0.0	0.0	0.0	1.8
25	1.2	0.0	4.8	0.0	0.0	27.4	0.0	0.0
26	2.0	0.0	9.8	0.0	1.4	0.4	0.0	4.8
27		0.0	7.0	0.0	1.0	10.0	0.0	0.0
28	1.8	0.0		4.2	0.0	0.0	0.2	0.0
29	0.4	1.8		1.4	0.0	12.4	0.0	0.0
30	12.0	2.0	2.0	0.4	4.4	0.0	0.0	0.0
31		1.4	0.0		17.0		0.0	0.0
Monthly Total	36.2	38.6	169.0	43.4	69.0	79.4	105.2	131.6