

# Greenhouse Trial Centre

## EM NatureBoost® Protocol Trial Report

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Evaluating the ability of EM® Technology and the EM NatureBoost® protocol to improve fertilizer efficiency and lower the demand of fertilizer use in Maize and Beans



**EM** NatureBoost

mzp **MICROZONE**



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## 1. INTRODUCTION

Effective Microorganisms® (EM®) is widely used in an effort to improve plant growth and nutrient use efficiency. The mechanisms of improved plant growth or stimulation vary widely, mostly due to symbiotic effects between the organisms and the plant, and the effective mineralisation of organic material. In this study the ability of EM NatureBoost® to improve growth with less fertilizer was investigated.

When evaluating EM NatureBoost® with possible claims of its ability to reduce fertiliser requirements of crops, it is important to not only evaluate the efficacy in this regard, but also ascertain that it has no potential detrimental and or phyto-toxicity effects on the plants.

### 1.1 Scope:

The aim of this trial was to evaluate EM NatureBoost® to improve the growth of maize and beans due to more effective nutrient use efficiency.

The scope of this study was to do a pot trial under controlled environmental conditions using EM NatureBoost® with different fertilizer application rates to evaluate the following:

- The product's efficacy to improve plant growth due to more efficient use of nutrients in the soil.
- Whether the product has any detrimental or phyto-toxicity effects on growth of maize and beans.

## 2. METHODS AND MATERIALS

The following procedures were followed during the study:

### 2.1 Soil

A loamy sandy soil was used.

### 2.2 Test products and treatments

Based on the recommended application rate as prescribed for this EM NatureBoost® and urea, it was used with a standard 3:0:2 (25) fertilizer at 2 grams per pot. The product tested and the different treatments are set out in Table I below:

Treatment no	Soil treatment at planting		
1	Control 5:10:15(30) 100% urea N	5:0:0(5) urea N	5:0:0 (5) urea N
2	1.6:10:15 (26.6) (30% urea +70 l/ha EM NatureBoost®)	1.6:0:0 (1.6) +70 l/ha EM NatureBoost®	1.6:0:0 (1.6) urea +70 l/ha EM NatureBoost®
3	2.5:10:15 (27.5) (50% urea) +70 l/ha EM NatureBoost®	2.5:0:0 (2.5) +70 l/ha EM NatureBoost®	2.5:0:0 (2.5) urea +70 l/ha EM NatureBoost®
4	3.2:10:15 (28.2) (70% urea) +70 l/ha EM NatureBoost®	3.2:0:0 (2.5) +70 l/ha EM NatureBoost®	3.2:0:0 (2.5) urea +70 l/ha EM NatureBoost®
5	2.5:10:15 (27.5) (50% urea) +543 l/ha EM NatureBoost®	2.5:0:0 (27.5) (50% urea) +543 l/ha EM NatureBoost®	2.5:0:0 (27.5) (50% urea) +543 l/ha EM NatureBoost®

### 2.3 Crops

Maize and beans.

### 2.4 Trial layout

**Pots containing 6 kg of soil were treated as follows:**

At planting 6 seed were planted per pot, which was later thinned out to 2 plants per pot. At planting the different fertilizer mixture were band placed in the middle of the pot 4 cm deep. The EM NatureBoost® and N in the form of urea was divided in three portions, one third at planting and the rest 2 and 4 weeks after seed germination (table I). Treatments were replicated 5 times.



### At the end of the trial, the following process was followed:

- At harvest the plants of each pot were cut above the soil, weighed (wet mass), oven dried at 65°C and weighed again (dry mass).
- After harvest, the plant samples of the different replicates were pooled and send to Intertek laboratory for standard chemical analysis; and
- The soils of the different replicates of each treatment were also pooled together, mixed and a composite sample sent to Intertek laboratory for chemical analysis.

## 2.5 Statistics

The Muller ANOVA generator 4 program was used to calculate ANOVAS and CV, using a randomised complete block design and an unprotected LSD (P= 0.05).

## 3. RESULTS AND DISCUSSION

### 3.1 Yield results

The yield results of the maize and beans are presented in table 2.

#### 3.1.1 Maize

The yield of maize did not decline in any significant way due to a reduction in urea N application rate when it was amended with EM NatureBoost®. This indicate that at the recommended EM NatureBoost® application rate, the lower N application rate could be compensated for by the EM NatureBoost® application.

At the highest EM NatureBoost® application rate, the wet mass increase statistically significantly higher than the control, while the dry mass was also the highest but not statistically significantly higher than the control. This clearly indicate that the reduction of the N application rate could be compensated for with the use of EM NatureBoost®.

#### 3.1.2 Beans

In the case of beans, the wet yields were not affected by the reduction in the N application rate when EM NatureBoost® was applied. In the case of the dry mass the yields did not decline when the urea application was lowered (30%) and EM NatureBoost® applied. Yield increased with increasing application rate of urea and became statistically significant when 70 % of the control was applied. Higher EM NatureBoost® application rates also improved the yield.

**Table 2: Biomass yield of Maize and Beans at the end of the trial**

Tr no	Treatment	Maize	Beans		
		Wet mass g/pot	Dry mass		
g/pot	Wet mass g/pot	Dry mass g/pot			
1	Control 100% urea	101,6 a	12,1 a	55,0 a	8,2 a
2	30% urea + 210 l/ha EM NatureBoost®	97,6 a	11,6 a	55,8 a	8,6 a
3	50% urea +210 l/ha EM NatureBoost®	97,0 a	10,6 a	58,0 a	9,4 a
4	70% urea + 210 l/ha EM NatureBoost®	98,8 a	10,8 a	55,4 a	11,0 b
5	50% urea + 1630 l/ha EM NatureBoost®	113,6 b	12,5 a	55,2 a	10,3 b
	LSD (P = 0.05)	10.09	1.58	8.3	2
	CV	7.5	10.37	11.2	15.9

### Anova wet Maize yields

Source of variation	df	SS	MS	F-test	Prob > F	Significant?
Total	24	2115,04				
Treatments	4	944,64	236,16	4,04	0,01	Significant
Error	20	1170,40	58,52			
LSD	10,09			C.V.	7,52	
Tukey's	14,51					

<b>Anova wet Maize yields</b>						
Source of variation	df	SS	MS	F-test	Prob > F	Significant?
Total	24	41,77				
Treatments	4	13,15	3,29	2,30	0,09	Not Significant
Error	20	28,63	1,43			
LSD	1,58	Unprotected		C.V.	10,37	
Tukey's	2,27					

<b>ANOVA dry Bean yields</b>						
Source of variation	df	SS	MS	F-test	Prob > F	Significant?
Total	24	822,64				
Treatments	4	29,84	7,46	0,19	0,94	Not Significant
Error	20	792,80	39,64			
LSD	8,31	Unprotected		C.V.	11,27	
Tukey's	11,94					

<b>ANOVA dry Bean yields</b>						
Source of variation	df	SS	MS	F-test	Prob > F	Significant?
Total	24	72,28				
Treatments	4	26,43	6,61	2,88	0,05	Significant
Error	20	45,85	2,29			
LSD	2,00			C.V.	15,94	
Tukey's	2,87					

## 3.2 Plant analysis

### 3.2.1 Maize

The results of the plant analysis done on the different treatments are presented in Table 3. The results of the control (Treatment 1) were used to compare the influence of the products on the nutrient content of the plants. The nutrient contents of the plants at the end of the trial did not show any consistent trends due to the treatments applied. The exceptions were two elements namely the P and N contents that were slightly higher than the control although the influence of the application rate of urea were not consistent.

<b>Table 3: Plant analysis data of Maize at the end of the trial</b>														
Tr no	Treatment	Ca	Mg	K	Na	S	P	Fe	Mn	Cu	Zn	B	Mo	N
		%	%	%	mg/kg	%	%	mg/kg	%	%	%	%	%	mg/kg
1	Control 100% urea	0,68	0,39	3,58	70	0,20	0,35	327	43	9,2	57	14,3	0,61	1,88
2	30% urea +210 l/ha EM NatureBoost®	0,57	0,36	3,93	68	0,16	0,38	293	49	8,0	80	15,8	0,34	1,56
3	50% urea +210 l/ha EM NatureBoost®	0,72	0,42	3,88	68	0,24	0,41	324	52	9,4	68	14,5	0,57	2,33
4	70% urea +210 l/ha EM NatureBoost®	0,57	0,33	3,47	77	0,19	0,36	324	52	8,4	73	12,8	0,66	1,82
5	50% urea +1630 l/ha EM NatureBoost®	0,66	0,37	3,83	74	0,26	0,43	317	67	9,1	70	13,6	0,77	2,61

### 3.2.2 Beans

The plant analysis results of the bean trial are presented in Table 4. The control (Treatment 1) was used to compare the nutrient contents of the different treatments. In the case of the bean plants there were increases in the Ca, Mg, K and N contents when treated with EM NatureBoost® and compared to the control. This are attributed to the application of the EM NatureBoost® and not to the variable urea applications that were part of the treatments,

Tr no	Treatment	Ca	Mg	K	Na	S	P	Fe	Mn	Cu	Zn	B	Mo	N
		%	%	%	mg/kg	%	%	mg/kg	%	%	%	%	%	mg/kg
1	Control 100% urea	2,80	0,64	2,68	69,77	0,31	0,46	350	61	8,92	72	31,3	0,25	2,81
2	30% urea +210 l/ha EM NatureBoost®	3,13	0,75	2,84	95,89	0,29	0,46	320	69	9,16	68	23,3	0,87	2,83
3	50% urea +210 l/ha EM NatureBoost®	3,49	0,78	2,73	78,15	0,28	0,42	366	70	8,07	78	22,2	0,62	2,94
4	70% urea +210 l/ha EM NatureBoost®	3,20	0,73	2,85	73,05	0,30	0,50	334	77	8,49	76	24,2	0,51	3,21
5	50% urea +1630 l/ha EM NatureBoost®	3,23	0,75	2,74	75,22	0,31	0,42	344	98	13,69	74	33,4	0,09	3,20

### 3.3 Soil analysis

#### 3.3.1 Maize soil

The analytical data of the soil analysis are presented in Table 5. In this trial the analysis results of the control (Treatment 1) were used to compare the nutrient contents in the soil of the different treatments. The nutrient contents in the maize soil were not influenced by any of the treatments in any consistent way.

Tr no	Treatment	pH (KCl)	PBrayl	Na	K	Ca	Mg	S
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1	Control 100% urea	7,22	61	24	43	589	84	11,5
2	30% urea +210 l/ha EM NatureBoost®	7,06	70	24	42	597	81	15,1
3	50% urea +210 l/ha EM NatureBoost®	6,86	62	23	66	492	76	12,39
4	70% urea +210 l/ha EM NatureBoost®	7,06	52	24	39	599	76	14,78
5	50% urea +1630 l/ha EM NatureBoost®	6,91	63	24	32	545	72	12,95

#### 3.3.2 Bean soil

The results of the soil analysis data are presented in Table 6. The soil analysis results of the control (Treatment 1) were used to compare the nutrient content in the soil of the different treatments. None of the nutrient elements were influenced by any of the EM NatureBoost® treatments.

Tr no	Treatment	pH (KCl)	PBrayl	Na	K	Ca	Mg	S
			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
1	Control 100% urea	6,71	94	24	98	546	73	17,16
2	30% urea +210 l/ha EM NatureBoost®	6,58	95	25	97	592	76	17,52
3	50% urea +210 l/ha EM NatureBoost®	6,6	93	25	110	577	74	22,7
4	70% urea +210 l/ha EM NatureBoost®	6,61	99	28	103	613	76	24,37
5	50% urea +1630 l/ha EM NatureBoost®	6,59	99	32	129	698	86	30,6

## 4. CONCLUSIONS

### 4.1 Yield results:

#### Maize

The yield of maize did not decline due to lower urea application rates. This indicates that EM NatureBoost® application lowers the N urea requirement.

Higher EM NatureBoost® application rates improved the yield.

#### Beans

The bean yields did not decline when only 30% of the urea was applied.

Higher applications rates of urea tend to increase yield which became statistically significant when 70% of the urea was applied.

Higher EM NatureBoost® application rates also improved the yield.

### 4.2 Plant analysis

#### Maize

Apart from the P and N contents that were slightly higher than the control, the other nutrients were not affected.

#### Beans

The Ca, Mg, K and N contents increased when treated with EM NatureBoost® and these trends were attributed to the application of the EM NatureBoost® and not to the variable urea applications.

#### Soil analysis

The soil analysis results were not influenced by any of the EM NatureBoost® treatments.

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