Independent Trial

Banana Trial Report 2011–2012 Kolkata

Kolkata	**2011**
Location	Year
Dr S.K. Barthan Roy, Centre for Strategic Studies, Kolkata	**Bananas**
Conducted by	Crop
Randomised plantings	
Trial Type	

Trial Outline

Evaluation of BioAg biostimulants in the production of Bananas in North India.

1. Introduction

In 2011, BioAg Pty Ltd commissioned the Centre for Strategic Studies, in Kolkata, West Bengal to assess the economic benefit of applying biostimulants to banana crops in Northern India. BioAg is a manufacturer and supplier of biostimulants and natural fertilisers in Australia. The trial objective was to investigate the effectiveness of BioAg biostimulants for improving the growth, yield quality, and maturation of banana crops.

The trial was undertaken on two 0.2 ha sites in the Hooghly District in West Bengal, at Kumpur and Goalda. It commenced with planting at the former site on the 18th of March 2011 and the latter on the 10th of April 2011 and was completed with harvesting in November/December 2011. These were grower trials, with randomised plantings of trees treated according to standard district practice (recommended by the Department of Agriculture, West Bengal) as the ‘control’, and two different BioAg nutrient regimes.

2. Background

India is the largest banana producer of the world, accounting for over 23% of global production of 75 million tonne, to which over 0.5million ha of India's land area is devoted. Over 90% of the banana production is destined for the domestic market, although India is the largest exporter of fresh bananas into markets such as the Middle East, USA, Iran, UK and Canada. India's geographical situation is ideal for supplying to the Middle East and European markets.

Bananas are grown in wide variety of climatic conditions, from the tropical southern states, including Tamil Nadu, Karnataka and Andra Pradesh, to the sub tropical northern states, such as Maharashtra, West Bengal, Uttar Pradesh, and Bihar.

In the last decade, the introduction of biotechnological production methods has aided the growth of the banana industry in India, and enhanced the export capabilities of Indian banana producers.

- Over 20% of banana plantlets derive from virus free tissue cultures.
- India has over 100 commercial tissue culture laboratories producing over 10 million tissue culture derived banana plantlets annually.
- In last ten years 30% of the commercial banana growers introduced drip irrigation systems. Most of these growers are located in the state of Maharashtra, where the average yield is over 60 t/ha, compared with the national average yield of 32.5 t/ha.[1]

3. Trial Methodology

3.1 Design

The design of the trial is shown in Table 1.

Table 1 – Trial Design

Design	Grower trial on 0.2 ha (0.5 ac) blocks
Trial Sites	One each in Kumpur and Goalda, West Bengal
Planting Date	18th March and 10th April 2011
Banana Variety	Cavandish G9
Plant Material	Tissue culture derived banana plantlets
Planting Density	3,000 plants per ha
No. Treatments	2

[1] Economics of Banana Plantation under Organic and In-organic Farming Systems, by Dr Gangadhar Banerjee, General Manager, National Bank of Agriculture and Rural Development India, Head Office, Mumbai (2010)

Table 2 – Data Collected

The information listed in Table 2. was collected by the research team.

- Plant height (100 Days After Planting)
- Plant diameter (100 Days After Planting)
- Date of harvesting
- Weight of the bunch
- Average size of banana
- No. bananas per bunch
- Market price (Rs/bunch)

3.2 Treatments

The following treatments were applied at each site (approximately one third of each block for each treatment on a randomised basis).

Table 3: Trial Treatments

Per ha	Urea (T/ha)	SSP (T/ha)	MOP (T/ha)	*Soil & Seed* (L/ha)	Cow Manure (T/ha)	BioAg Banana Blend (T/ha)	*Balance & Grow* (L/ha)	*Fruit & Balance* (L/ha)
T1 (control)	5.5	2.4	6.75		30[2]	0	0	0
T2 (BioAg 1)	3.6		3.38	30		21[3]	25L	20L
T3 (BioAg 2)	3.6		3.38	22		21[4]	6L	4L

BioAg Banana Blend 10t cow manure, 1.5t *BioAgPhos*, 5L *Soil & Seed*

[2] 10kg per pit
[3] 7kg per pit
[4] 7kg per pit

The treatment used in the control plots comprised urea, single superphosphate, muriate of potash (MOP) and cow manure at district practice recommended levels (Agriculture Department, West Bengal).

The BioAg products under trial were:

BioAgPhos (BAP)® Biologically digested reactive phosphate rock (in the BioAg Banana Blend).

Soil & Seed® A soil and seed treatment that encourages rapid germination, root development and soil microbial activity.

Balance & Grow® A foliar treatment that provides growing crops pastures with the nutrients to stimulate vegetative growth and improve soil microbial activity.

Fruit & Balance® A foliar treatment that provides a source of nutrients to improve yield and quality of fruits and grains.

3.3 Trial Sites

The two sites selected were in north eastern India, in the Gangetic plains of West Bengal, generally subject to flooding and water logging during the monsoon season. The Gangetic plains of North India are recognised as being suitable for commercial banana cultivation.

3.4 Applications

The treatments listed in Table 3 were applied in accordance with the following schedule:

Control (T1)

Time of Application	Product (per ha)	
Base Application	Urea	132kg
	SSP	2.4T
	FYM[5]	10kg[6]
90 Days After Planting	Urea	1.8T
	MOP	2.25T
180 Days After Planting	Urea	1.8T
	MOP	2.25T
240 Days After Planting	Urea	1.8T
	MOP	2.25T

[5] Farm Yard Manure
[6] per pit

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BioAg – 1 (T2)

Time of Application	Product (per ha)	
Base Application	BioAg Blend	7kg per pit
90 Days After Planting	Urea	1.2T
	MOP	1.125T
	S&S	10L
	B&G (foliar)	10L
	F&B (foliar)	5L
180 Days After Planting	Urea	1.2T
	MOP	1.125T
	S&S	10L
	B&G (foliar)	10L
	F&B (foliar)	5L
240 Days After Planting	Urea	1.2T
	MOP	1.125T
	S&S	10L
	B&G (foliar)	5L
	F&B (foliar)	10L

Independent Trial

BioAg – 2 (T3)

Time of Application	Product (per ha)	
Base Application	BioAg Blend	7kg per pit
	S&S	8L
60 Days After Planting	*S&S*	2L
90 Days After Planting	Urea	1.2T
	MOP	1.125T
	S&S	2L
	B&G (foliar)	2L
120 Days After Planting	*S&S*	2L
150 Days After Planting	*S&S*	2L
	B&G (foliar)	2L
180 Days After Planting	Urea	1.2T
	MOP	1.125T
	S&S	2L
	B&G (foliar)	2L
210 Days After Planting	*S&S*	2L
	B&G (foliar)	2L
240 Days After Planting	Urea	1.2T
	MOP	1.125T
	S&S	2L
	F&B (foliar)	10L

4. Conditions

4.1 Climatic Conditions

The climate data for the region for a 10 year period is provided in Table 4.

Table 4 – Annual Weather Data for West Bengal

Climate Data for Kolkata (West Bengal) (1971–1990)													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C	26.4	29.1	33.5	35.3	35.4	34.0	32.3	32.1	32.4	32.3	30.3	27.0	**31.7**
Average low °C	13.8	16.9	21.7	25.1	26.0	26.5	26.1	26.1	25.8	23.9	19.6	14.5	**22.2**
Rainfall mm	11	30	35	60	142	288	411	349	288	143	26	17	**1,800**
Avg. rainy days (≥ 1.0mm)	1.2	2.2	3.0	4.8	8.7	14.7	20.5	20.2	15.7	8.1	1.5	0.9	**101.5**
Mean monthly sunshine hours	204.6	203.4	226.3	234.0	226.3	123.0	93.0	105.4	117.0	182.9	192.0	204.6	**2,112.5**

4.2 Soil Test Results

The sites selected were typical Gangetic alluvial type soil, low in phosphorus and organic matter. Generally, the Gangetic soil texture is loamy to sandy clay, slightly low in pH. These soil types prevail in most parts of North India. The results of soil tests at the trial sites are shown in Table 5.

Table 5 – Composite Soil Sample Results of Goalda and Kumpur Sites

Parameter	Kumpur Site	Goalda Site
pH	5.71	5.78
CEC (Meq/100g soil)	3.98	8.25
Organic matter %	0.78	0.84
C:N ratio	132.6:1	74.9:1
N – NO_3^- (ppm)	29.4	60.9
N – NH_4^+(ppm)	29.5	51.4
N – Organic (ppm)	162.0	
P – Inorganic (ppm)	39.2	1.84
Ca (%)	0.05%	0.14%
Mg (%)	0.04%	0.013%
K – ppm	16.3	300
Zn – ppm	2.2	1.6
Fe – µg/g	21.9	26
Cu – µg/g	1.65	1.2
B – µg/g	0.4	
Mn – µg/g	36.7	

5. Observations

5.1 Vegetative Growth

There was a significant increase in the vegetative growth in the BioAg treated crops, particularly in the initial stage of the growth, as shown in Figure 1. and Table 6.

Figure 1 – Plant Height at 100 Days After Planting

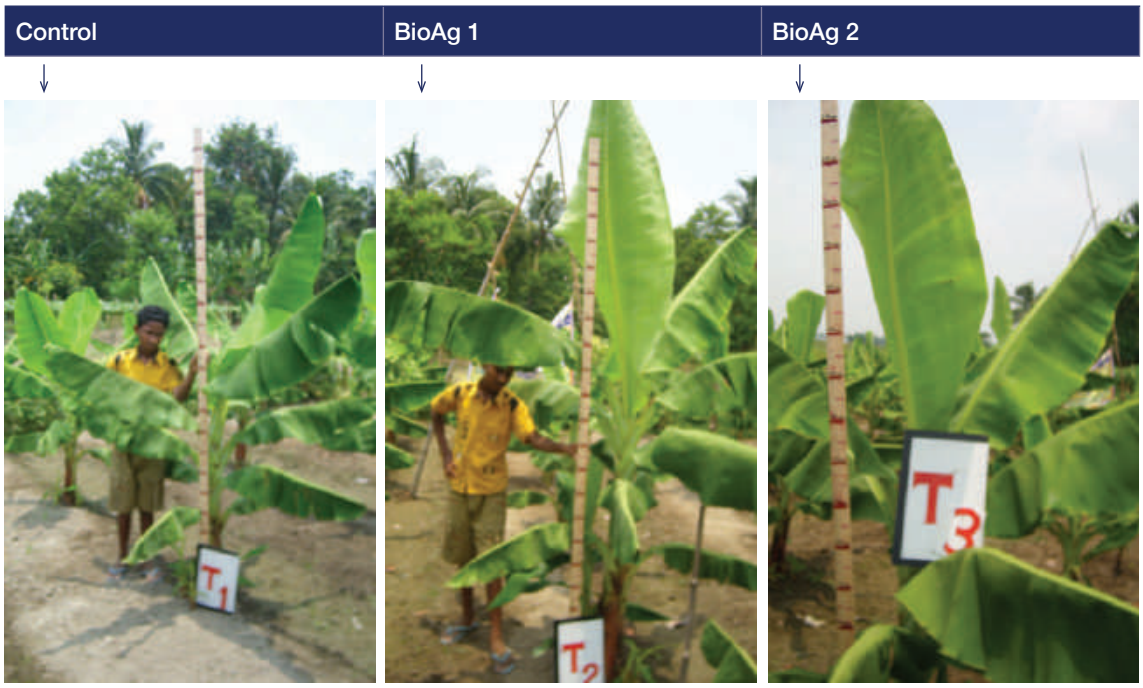


Table 6 – Plant Height at 100 Days After Planting at the Kumpur Trial Site

Treatment	Plant height (cm) mean & range	Stem Diameter (cm) Mean & range
T1 (Control)	183 (110-220)	37 (17-42)
T2 (BioAg 1)	194 (140-240)	46 (35-54)
T3 (BioAg 2)	190 (140- 240)	46 (37-54)

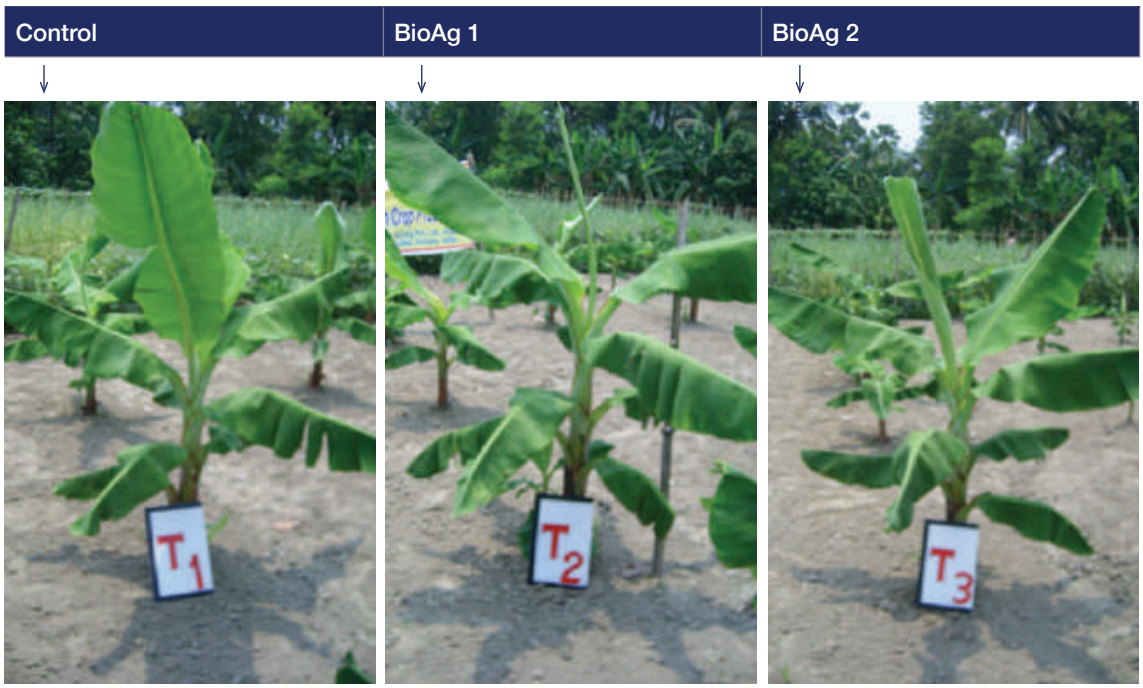
The figures within the brackets represent the range of measurements. All plants were measured.

At 100 days after planting, the following observations were made:

- The height of the BioAg treated plants was greater than that of the control plants.
- The stem diameters of the BioAg treated plants was greater than that of the control plants.

While the control treatments were notably lower in stem diameter they were also more varied with some plants under the control treatment recording stem diameters of only 17cm. The plants under a BioAg treatment recorded higher as well as more consistent stem diameters.

Figure 2 – Early Vegetative Growth 90 Days After Planting (Kumpur site)



5.2 Flower Induction

The banana plants at the Kumpur site commenced flowering in mid August 2011, and the plants at the Goalda site on 20th August. The BioAg 2 treated trees began flowering 10–14 days earlier than those under the other two treatments.

Table 7 – Flower Induction at the Two Trial Sites

	Control (T1)	BioAg 1 (T2)	BioAg 2 (T3)
Kumpur	Commencement of Flowering		
	1st - 7th Sept	4th - 10th Sept	14th - 19th Aug
Goalda	Commencement of Flowering		
	24th - 26th Sept	22nd - 24th Aug	20th - 25th Aug

5.3 Harvest Timing

Harvest timing is critical in the Indian banana industry, with early crops commanding significantly higher prices. Harvesting was able to be carried out 10 to 14 days earlier on the BioAg treated crops than on the controls at both sites. Table 8 shows the differences in the harvest commencement dates between the control and BioAg treated crops.

Table 8 – Harvest Commencement Dates

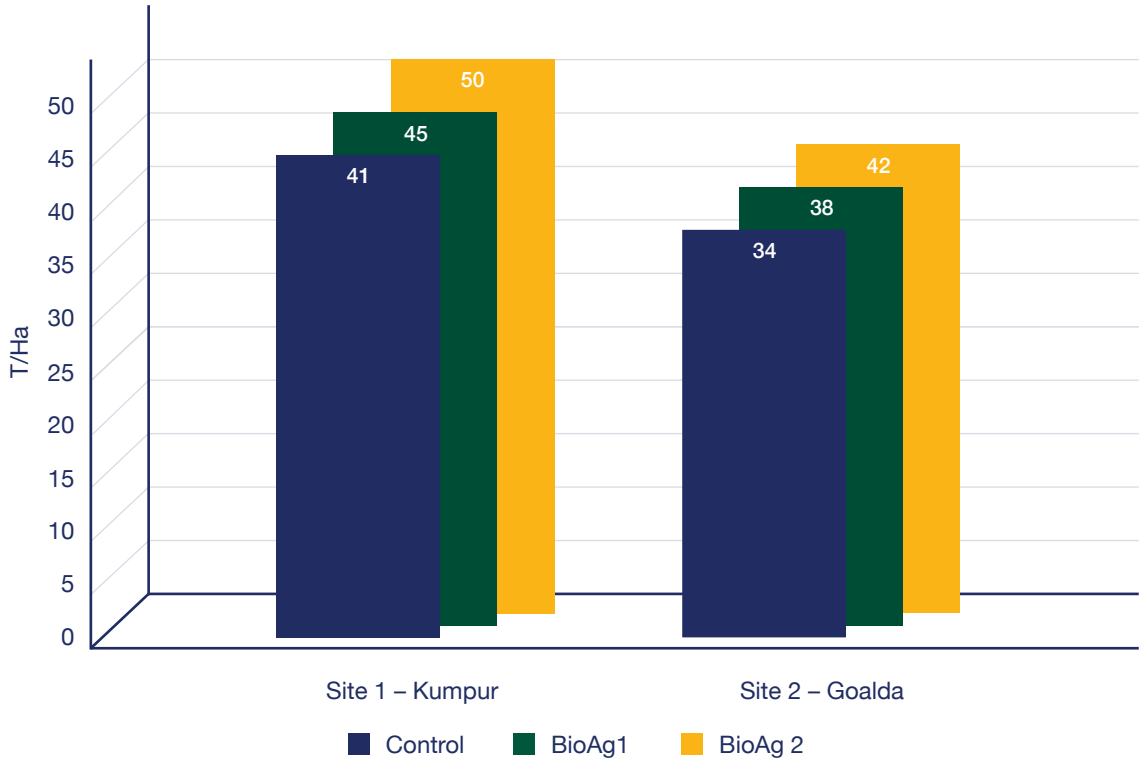
	Control (T1)	BioAg 1 (T2)	BioAg 2 (T3)
Kumpur	Harvesting Started		
	30th Nov	10th Nov	26th Nov
Goalda	Harvesting Started		
	14th Dec	3rd Dec	3rd Dec

Fruit at harvest

5.4 Yield

Banana productivity in India is not uniform; crops yield as little as 15 t/ha to as much as 70 t/ha. The average productivity throughout India is 32.5 t/ha. The BioAg crops yielded between 38 and 50 t/ha, depending on the site, and achieved a 22-23% increase over the controls, as is shown in Figure 3.

Figure 3 – BioAg Banana Trial, West Bengal (2011)



BioAg 1 – 10% yield improvement
BioAg 2 – 22% yield improvment

5.5 Consumer Acceptability

Comparison of fruit from the Goalda trial site:

Market acceptability was tested by the prices offered for the fruit at the district wholesale fruit market with the following results:

Table 9 – Average Wholesale Price per Bunch

	Price per Bunch (INR)
Control	200
BioAg 1	244
BioAg 2	255

The factors influencing the prices offered for the fruit were:

- Size
- Colour
- Ripeness

The bananas produced using the BioAg treatments rated highly, obtaining a 22-28% premium over those from the control crops.

5.6 Gross Revenue

The BioAg banana trial delivered 22-23% higher yields than the standard practice in West Bengal.

This positive outcome in yield and consumer acceptability has delivered significantly better results for the BioAg treatments as shown Table 10.

Table 10 – Gross Revenue Comparison

	Gross Revenue Per Ha (INR)	Increase (%)
Control	336,000	
BioAg 1	409,920	22.0
BioAg 2	466,650	38.8

The table shows that revenue realised from the fruit of the BioAg 2 treated crop was 22% higher than the control crop, and the BioAg 3 crop 39%.

6. Conclusion

This trial has shown that BioAg programs utilising biostimulants and a combination of proprietary and mainstream fertilisers and ameliorants was able to deliver a benefit in plant vigor, in particular early growth, a reduction in time to harvest as well as improvements in the size, quality and yield of bananas.

Encouragingly under a full program yields were increased by 22% with quality benefits helping to increase the financial benefit to 38% over grower standard practice.

Independent Trial

Two BioAg nutritional programs have tested in this trial.

BioAg 1 – High doses with less frequent application

BioAg 2 – Low doses with more frequent application

This study has demonstrated that the second nutritional program (low doses with more frequent application) is more suitable for banana cultivation, with greater yield improvement and consumer acceptance.

Abbreviations

S&S – BioAg *Soil & Seed*
B&G – BioAg *Balance & Grow*
F&B – BioAg *Fruit & Balance*

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