

**TWIN RIVERS RESEARCH CENTER
Madaum, Tagum City**

**TERMINAL REPORT
on**

**SEMI-COMMERCIAL TRIAL OF ANTICA AGAINST BLACK LEAF STREAK/SIGATOKA
DISEASE IN CAVENDISH BANANA**

Thelma B. Flores

ABSTRACT

The semi-commercial bio-efficacy evaluation of Antica in 26 has. for straight 8 cycles at 6 days interval against black leaf streak or black Sigatoka disease of Cavendish banana in comparison with plantation Standard spraying scheme of systemic and contact fungicides and their combinations showed unique results. Antica showed better performance over the Standard with higher number of functional leaves at harvest, considered the most important parameter in efficacy evaluation of the product against Sigatoka. Although it showed higher earlier infections but were not translated into corresponding losses of leaves but retained these up to harvest.

The results confirm the booster effect of Antica on the leaves aside from its fungicidal activity of containing the disease infection, it has tolerated the plants the impact of infection. The build-up of bioactive substances supplied by the macro and micronutrient contents of Antica directly feed to the leaves might have prevented the loss of leaves.

Antica therefore at 0.75 to 1.0Li/ha. can be used as an alternate product in Sigatoka control program of Cavendish banana.

INTRODUCTION

Sigatoka control in Cavendish banana production remains one of the major concerns in banana export industry. Thus search for cheaper and safer fungicides is a continuing effort of all plantations and growers. Environmental concern due to hazards of this pesticide is locally a growing controversy. While globally, the demand for pesticide-residue free and organic agricultural food products is getting popular and priced higher. Hence evaluation of new, organic fungicide is recently becoming a must and a trend in the industry.

ANTICA, an organic fungicide product of Ahcil Laboratories, a lactic acid extract from tropical fruits, previously found with fungicidal actions against Sigatoka pathogen, *Mycosphaerella fijiensis* under laboratory and field conditions is worth to be further evaluated. It is also known to contain some macro and micronutrients like potassium 51.5 mg, magnesium 6.21, calcium 27.8 and sodium 12.7 mg./Li. which are directly applied and feed on the leaves may form biofilm will boost the immune system of the plants to tolerate the damage of disease infection. Thus this semi-commercial trial of Antica to verify its efficacy against Sigatoka disease of Cavendish banana in a wider scale field trial.

MATERIALS AND METHODS

The semi-commercial efficacy evaluation of ANTICA at 0.75 Li./Ha. against black leaf streak (BLS) or Sigatoka disease of Cavendish banana was conducted in comparison with Standard spraying scheme in the plantation by aerial spray application in 26 has. of Line 1, Parcela 16, La Frutera Inc., Paglas Estate, Digal, Buluan, Maguindanao from January-March, 2010.

ANTICA was applied at 23 liters spray solution/Ha. mixed with Banole at 7 Li./Ha. and 1% Lutenzol for eight (8) straight cycles at six (6) days interval. While the Standard area used different fungicides and fungicide combinations with systemic and contact actions in the whole 8-cycle period, in the following sequence Opal/Mancoseb combination, Antracol, Tridemorph/Mancoseb, Mancoseb, Antracol, Baycor/Mancoseb, Mancoseb and Antracol. The interval of application was also usually 6 days except for 2 cycles with 8 and 10 days interval. Mixing of spray solutions and spray applications usually took place early in the mornings.

The ANTICA treated area was isolated by two (2) big canals at both sides measuring 100 meters long with about 5-8 meters wide, while one end along banana area is bounded by an area about 340 meters long and 10 meters wide manually sprayed for Sigatoka control to minimize spray drift.

Pre-treatment data in Table 2 were taken on YLVS (youngest leaf with visible streaks), YLS (youngest leaf-spotted), transition period (EVS-YLS), number of functional leaves at shooting and at harvest, % infected leaf/plant and % rate of leaf loss, the parameters used in this semi-commercial efficacy evaluation. These data were taken one (1) week after first application and weekly thereafter up to 2 and 3 weeks after last application. Source of data were taken from fifteen (15) sample plants/station at 5 plants/row from a total of 3 sampling stations throughout the trial area. Data were subjected to T-test analysis.

RESULTS AND DISCUSSIONS

The semi-commercial efficacy evaluation of ANTICA at 0.75 Li./Ha. + Banole at 7 Li./Ha.+ 1% Lutensol in comparison with the Standard spraying scheme of alternate use of different fungicides and their combinations against black leaf streak (BLS) or Sigatoka disease of Cavendish banana showed significant results.

Table 1 showed the averages of different Sigatoka parameters used in this evaluation between Antica versus the Standard with statistical differences except for one (1) parameter. The data showed the Standard with significantly higher leaf numbers with early visible streak (EVS) and with early spots (YLS) of 3.97 and 12.38 respectively against 3.88 and 11.34 of Antica. The higher leaf numbers in these parameters indicate better control of the disease. Furthermore, the transition period of the disease development from early visible streak to early spots symptoms took 59.34 days in the Standard which is significantly longer than 52 days of Antica. Again, the longer the transition period of the disease from early visible streak to early spots, the more efficient is the control. The Ave. % infected leaf/ plant is the only parameter with no significant difference from each other. Although Antica has numerically higher infection of 14.20% but statistically comparable with 12.90% of the Standard thus implies the efficacy of Antica is comparable with the Standard based on this parameter.

The ave. functional leaves at harvest surprisingly gave 6.70 for Antica, significantly higher than 6.17 of the Standard. The data suggest better performance of Antica against Sigatoka having tolerated the impact of the disease manifested on younger leaves with visible streaks and early spots, shorter transition period of EVS – YLS, and lower functional leaves at shooting. Being considered the most important and ultimate parameter to determine the efficacy of the product, Antica shows some unique action of tolerance on the plants against the damaging impact of the disease on the leaves. This is supported by statistically lower rate of leaf loss of 4.23% in Antica due to the disease against 5% of the Standard. Graph 4a strongly shows the increasing and higher number of functional leaves at harvest of Antica over the Standard even beyond after 8 cycles of its application. It is obvious that the residual activity of Antica on the leaves continuously influenced the increasing and higher number of functional leaves over the Standard even weeks after its last application. It is more obvious within 5 weeks after last application of Antica and beyond which remained higher over the Standard. Graph 4a further confirms that the number of functional leaves at harvest of Antica abruptly soared to 9.02 in Week 23 from only 7.78 in Week 22 after Antica was re-applied in Week 20. It is obvious that re-application of Antica strongly affect the sharp increase in the number of functional leaves at harvest. It is noted in Graphs 4 and 4a that increase in the functional leaves started 4 weeks after application of Antica, thus effect of Antica manifested at least 4 weeks after application. What it is in Antica that influenced the increase in the number of functional leaves at harvest over the Standard? The mineral nutrient element contents in Antica such as potassium, manganese, calcium and magnesium could be among the reasons why the leaves tolerated the damaging impact of the disease. It might have strongly boost the immune system of the plants hence retained their leaves up to harvest needed for its fruit development into the desired maturity and quality acceptable in the market.

The effects of rainfall and number of rainy days on the trends of the different parameters are presented in Graphs 1 to 6. With relatively lower rainfall and number of rainy days the effect are not strong and distinct. However, there are indications that at higher and increasing rainfall, Antica seemed to weaken efficacy with increased infection and shorter transition period over the Standard as shown in Graphs 2, 5 and 6 particularly in Weeks 9, 10 and 11.

SUMMARY AND CONCLUSION

The semi-commercial efficacy evaluation of Antica at 0.75 Li./Ha. was conducted in comparison with the Standard spraying scheme of the plantation consists of different fungicides and their combinations against black sigatoka disease of Cavendish banana by aerial application in 26 hectares of Line 1, Parcela 16, La Frutera, Inc., Paglas Estate, Digal, Buluan, Maguindanao from January – March, 2010.

Based from this trial, Antica showed some unique performance against Sigatoka disease different from the conventional systemic and protectant fungicides. It has tolerated the impact of infection and retained more functional leaves at harvest which is the ultimate parameter for an effective Sigatoka control. Being an organic fungicide, it may not possess quick and direct action against the fungal pathogen but by direct application to the leaves it builds-up bioactive substances which boost the immune system of the plants to tolerate the damage of infection. Hence plants retained the functional leaves at harvest which is the most important end result in controlling Sigatoka disease in Cavendish banana, for the full development of fruits into its desired quality acceptable in the market. The macro and micronutrient contents of Antica such as potassium, manganese, calcium and sodium maybe the factors which helped boost the immune system of the plants.

Antica therefore in this semi-commercial trial performed effectively against Sigatoka disease in Cavendish banana in containing the disease and maintaining the desired number of functional leaves at harvest.

RECOMMENDATIONS

Antica is recommended as an alternate product for use in the spraying program for Sigatoka control in Cavendish banana at 0.75 during low disease pressure and 1.0 Li/Ha. at high disease pressure.

It is also recommended to verify further the booster effect of Antica in containing the disease and retention of the number of functional leaves at harvest in another site.

**SEMI - COMMERCIAL TRIAL OF ANTICA AGAINST BLACK LEAF STREAK/SIGATOKA
DISEASE IN CAVENDISH BANANA**

(LA FRUTERA INC., PAGLAS ESTATE, DIGAL, BULUAN, MAGUINDANAO)
(January–March, 2010)

Table 1. AVERAGE SIGATOKA PARAMETERS OF ANTICA VS. STANDARD

<u>PARAMETERS</u>	<u>ANTICA</u>	<u>STANDARD</u>
EARLY VISIBLE STREAK (EVS) (Leaf Number)	3.88	3.97*
TRANSITION PERIOD (EVS-YLS) (No. of Days)	52	59.34*
YOUNGEST LEAF-SPOTTED (YLS) (Leaf Number)	11.34	12.38*
NO. OF FUNCTIONAL LEAVES (At Shooting)	12.62	13.50*
INFECTED LEAF/PLANT (Percent)	14.20 ^{ns}	12.9
NUMBER OF FUNCTIONAL LEAVES (At Harvest)	6.70*	6.17
RATE OF LEAF LOSS (Percent)	4.23	5.00*

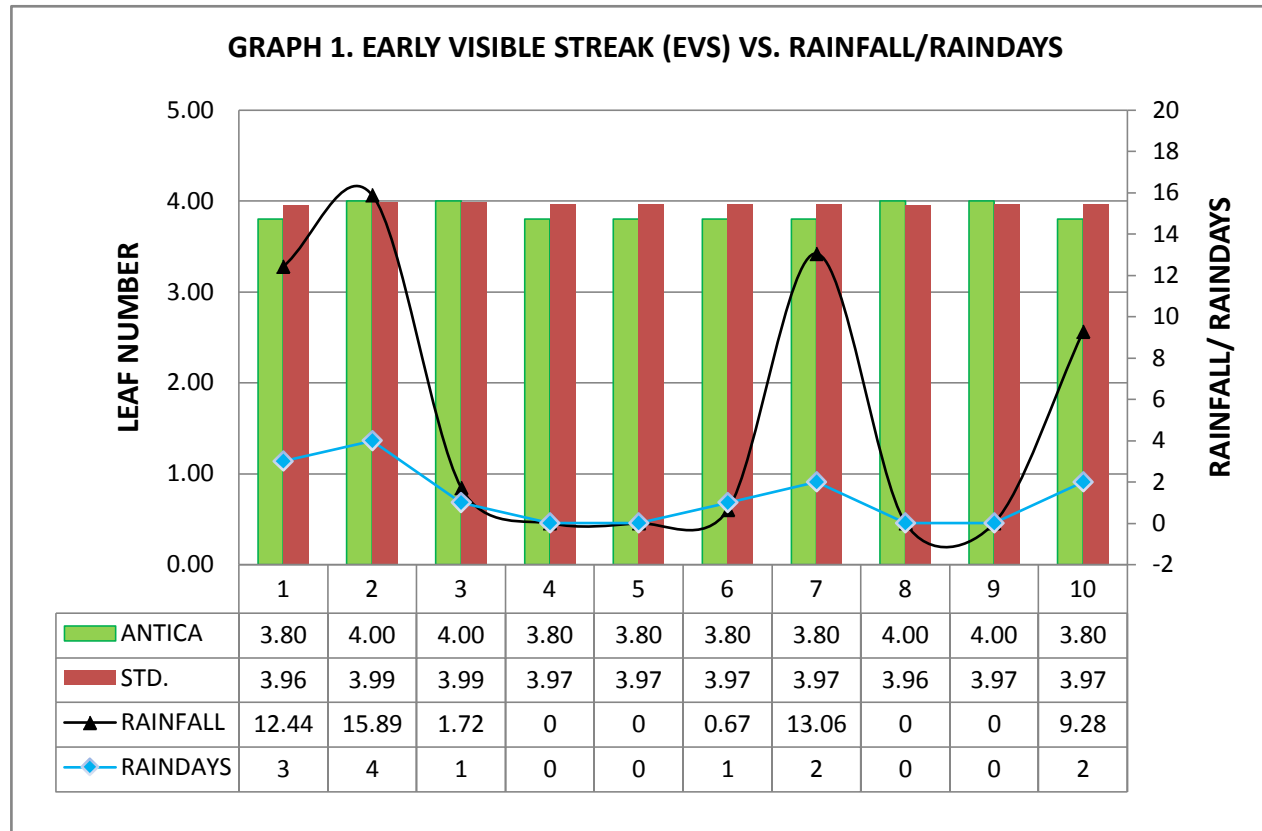
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Table 2. PRE-TREATMENT DATA

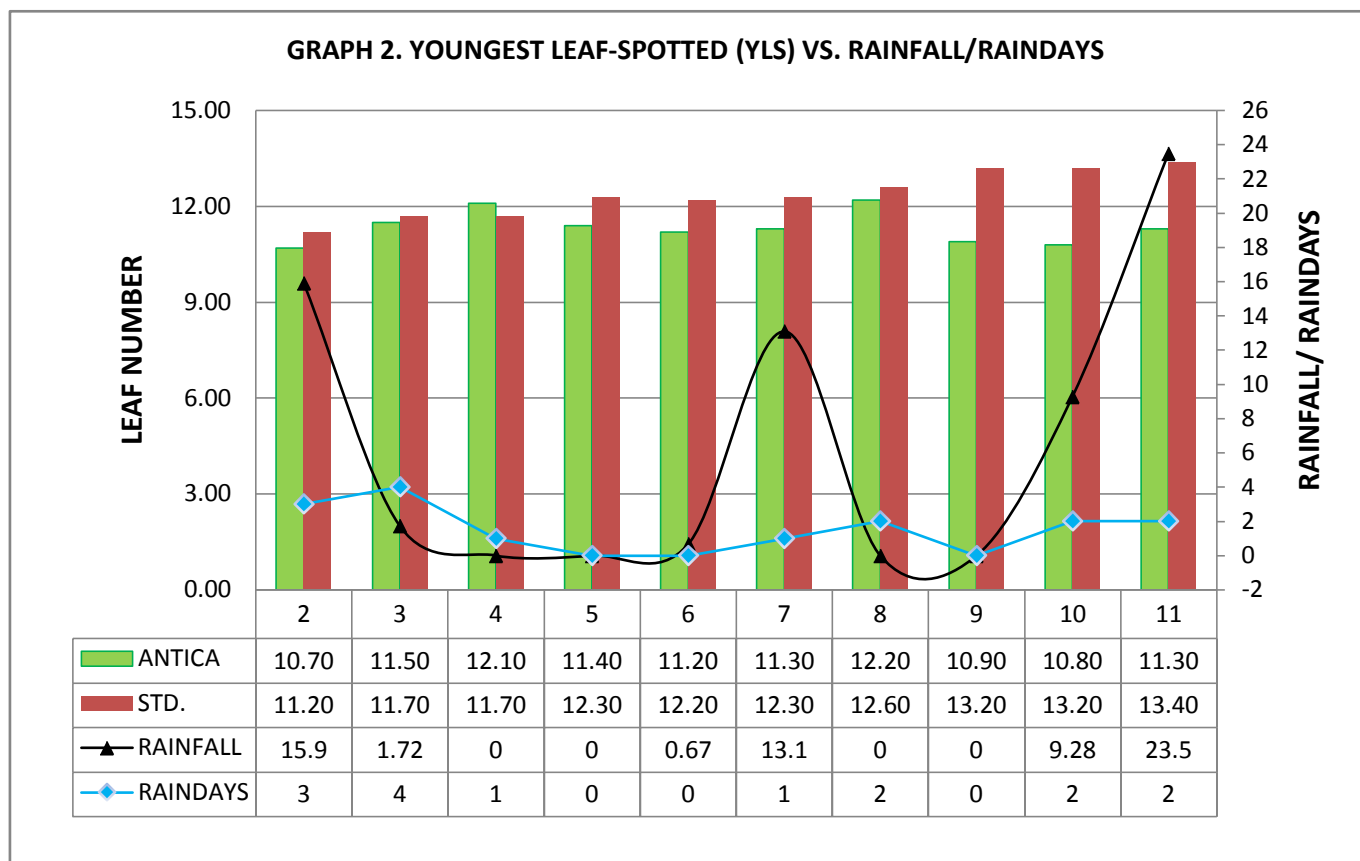
<u>PARAMETERS</u>	<u>ANTICA</u>	<u>STANDARD</u>
1. Early Visible Streak (EVS)	3.80	3.97
2. Youngest Leaf Spotted (YLS)	11.00	11.19
3. % Infected Leaf/Plant	13.00	16.00
4. Transition Period (EVS-YLS)	47.37	48.97
5. No. of Functional Leaves at Shooting	12.80	13.41
6. No. of Functional Leaves at Harvest	6.60	6.03
7. Rate of Leaf Loss (%)	1.16	5.49

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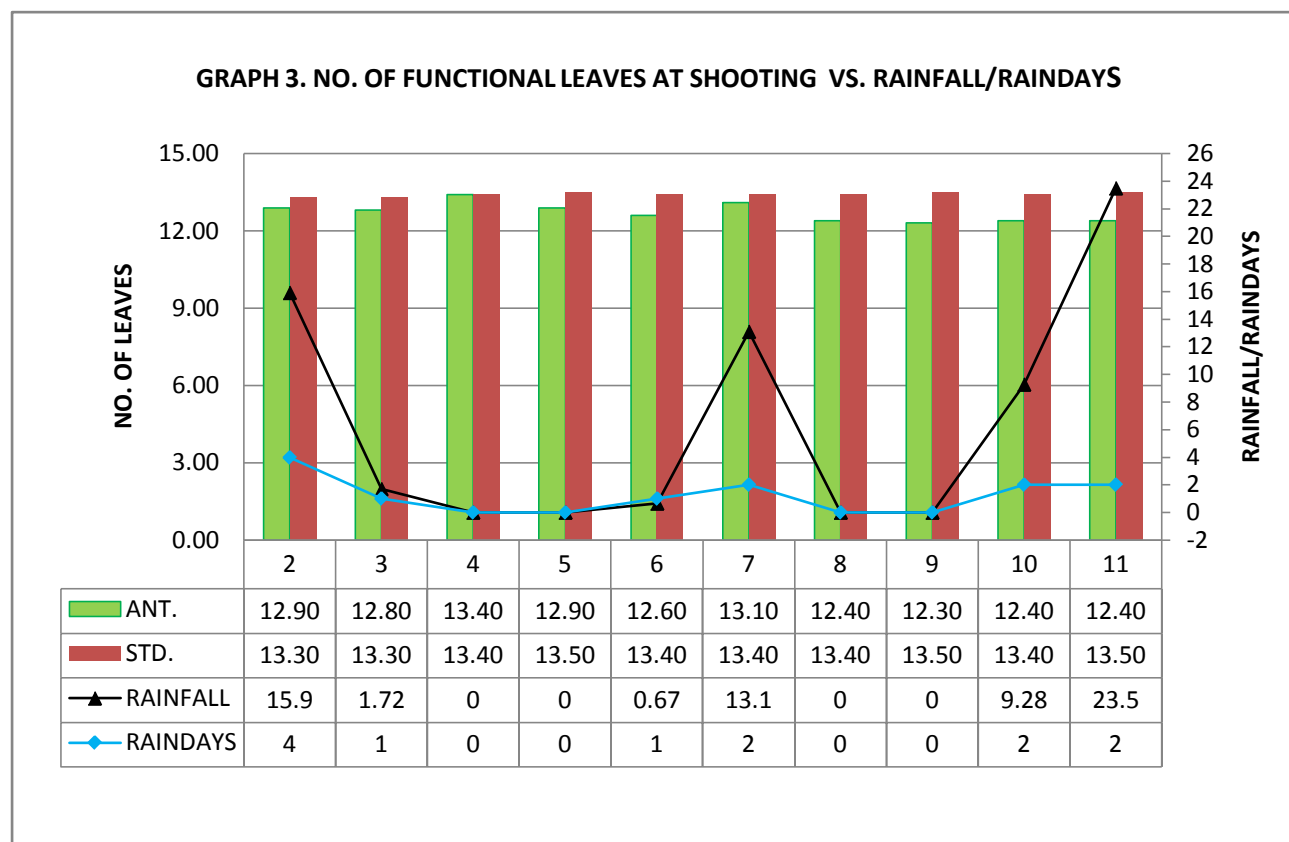
CYCLE NO.	1	2	3	4	5	6	7	8
ANTICA (A)	A	A	A	A	A	A	A	A
STANDARD	Opal/Manco	Antra	Tride/Manco	Manco	Antra	Baycor/Manco	Manco	Antra

SEMI-COMMERCIAL TRIAL OF ANTICA AGAINST BLACK LEAF STREAK / SIGATOKA DISEASE IN CAVENDISH BANANA



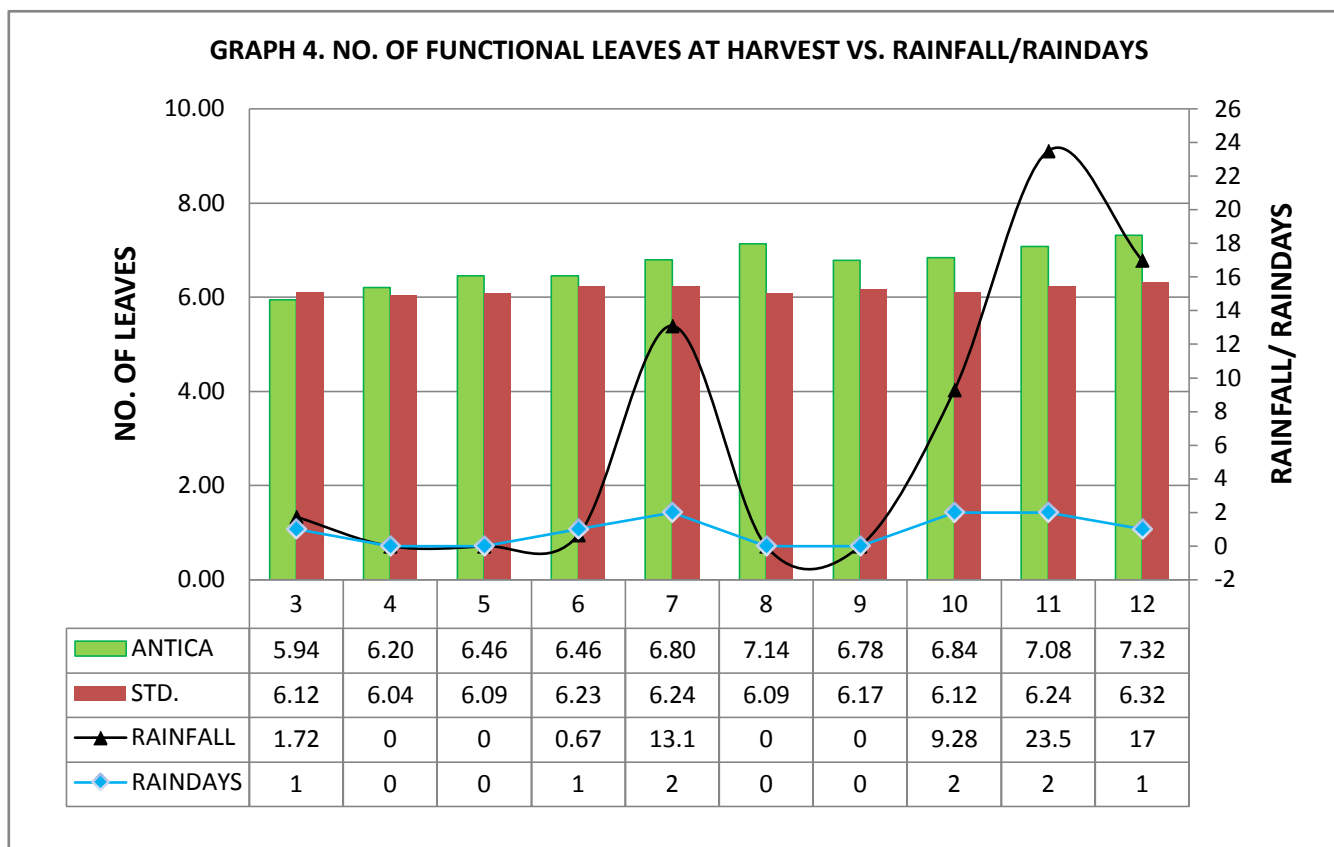
CYCLE NO.	1	2	3	4	5	6	7	8
ANTICA (A)	A	A	A	A	A	A	A	A
STANDARD	Opal/Manco	Antra	Tride/Manco	Manco	Antra	Baycor/Manco	Manco	Antra

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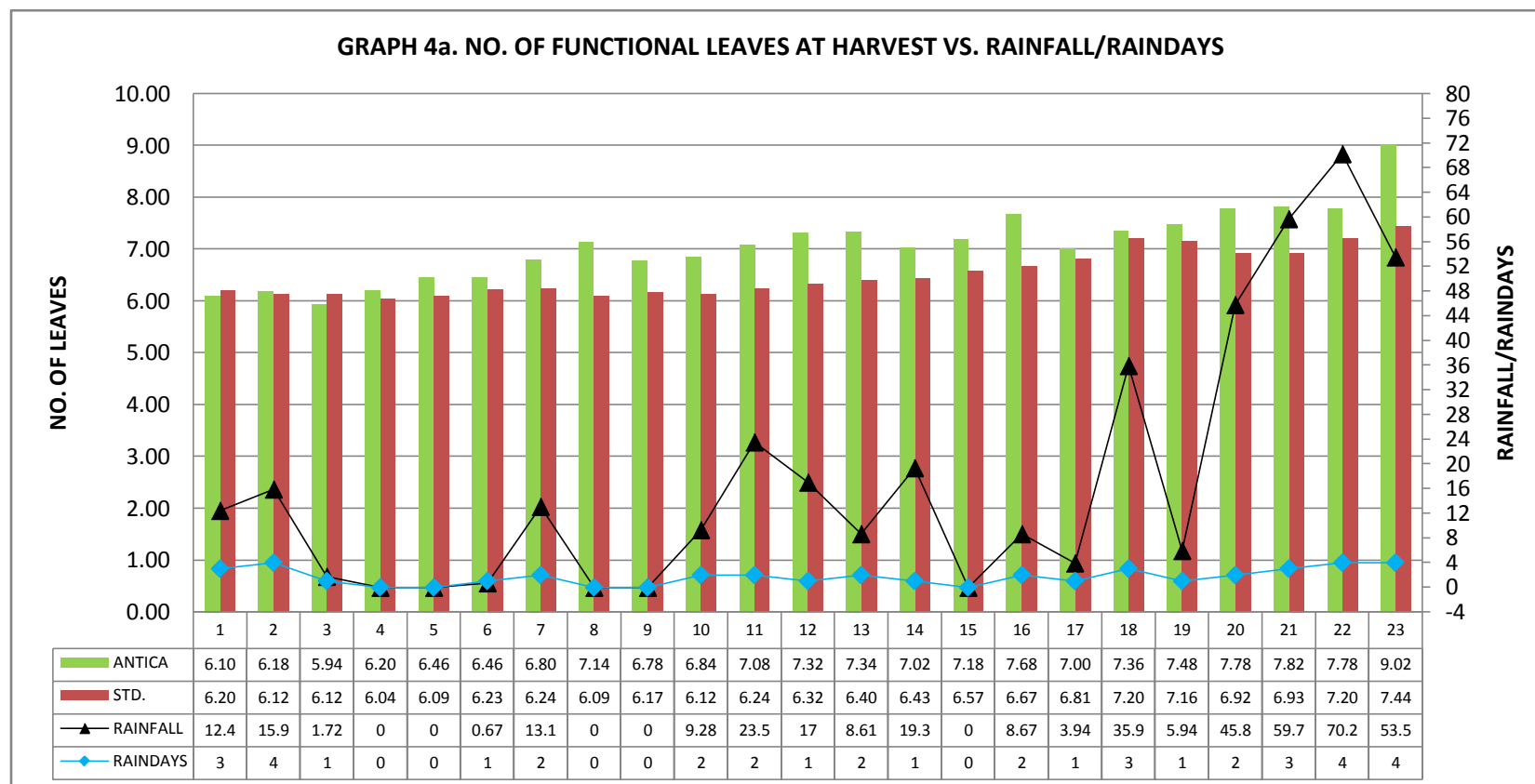
CYCLE NO.	1	2	3	4	5	6	7	8
ANTICA (A)	A	A	A	A	A	A	A	A
STANDARD	Opal/Manco	Antra	Tride/Manco	Manco	Antra	Baycor/Manco	Manco	Antra

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IN CAVENDISH BANANA**



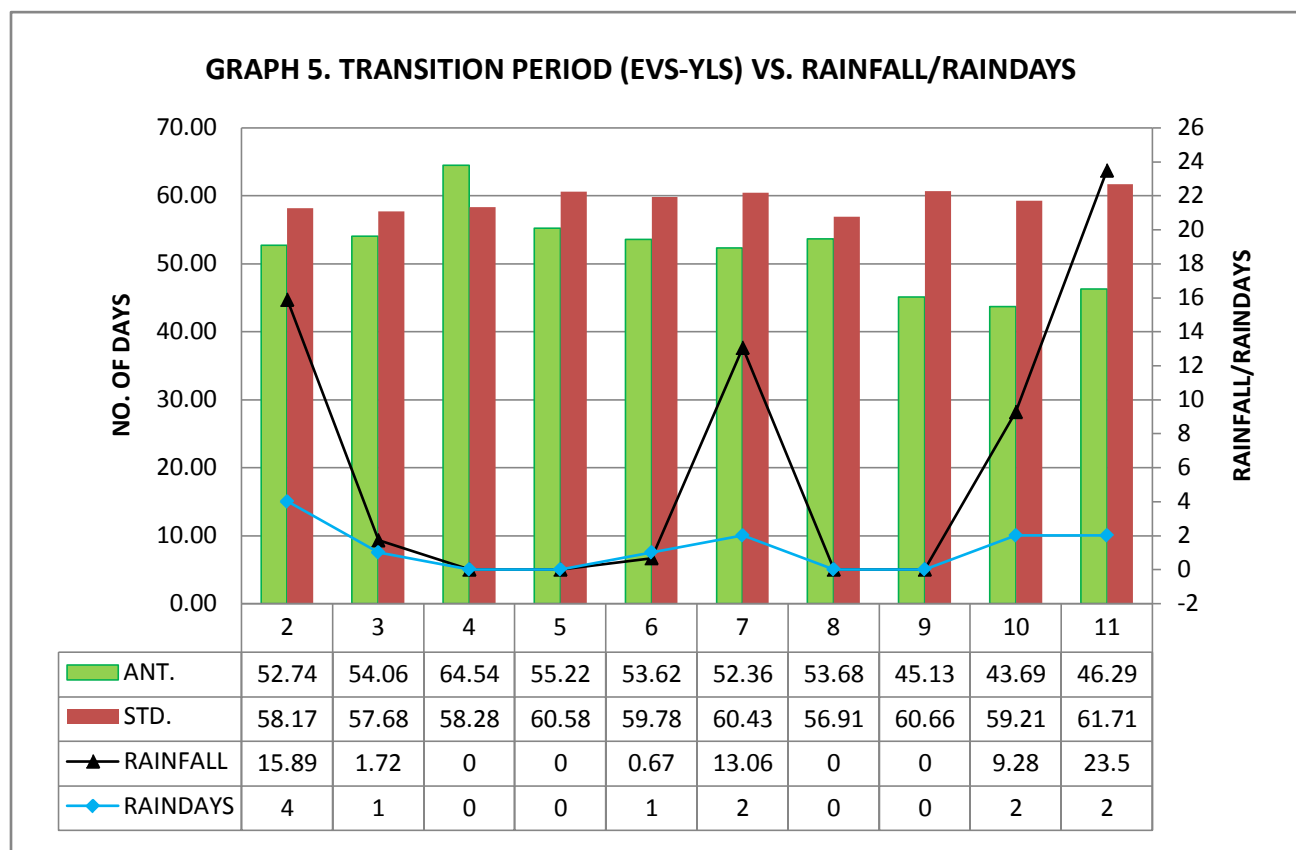
CYCLE NO.	1	2	3	4	5	6	7	8
ANTICA (A)	A	A	A	A	A	A	A	A
STANDARD	Opal/Manco	Antra	Tride/Manco	Manco	Antra	Baycor/Manco	Manco	Antra

SEMI-COMMERCIAL TRIAL OF ANTICA AGAINST BLACK LEAF STREAK / SIGATOKA DISEASE IN CAVENDISH BANANA



CYCLE NO.	1	2	3	4	5	6	7	8	9	10	11	12
ANTICA (A)	A	A	A	A	A	A	A	A	Sico/Manco	Manco	Manco	Manco
STANDARD	Opal/Manco	Antra	Tride/Manco	Manco	Antra	Baycor/Manco	Manco	Antra	Manco	Manco	Antra	Manco
CYCLE NO.	13	14	15	16	17	18	19	20	21	22	23	
ANTICA (A)	Tride/Manco	Manco	Manco	Manco	Antra	Sico/Manco	Manco	A	Antra	Baycor/Manco	Manco	
STANDARD	Tride/Manco	Manco	Manco	Antra	Sico/Manco	Manco	A	A	Baycor/Manco	Manco	Antra	

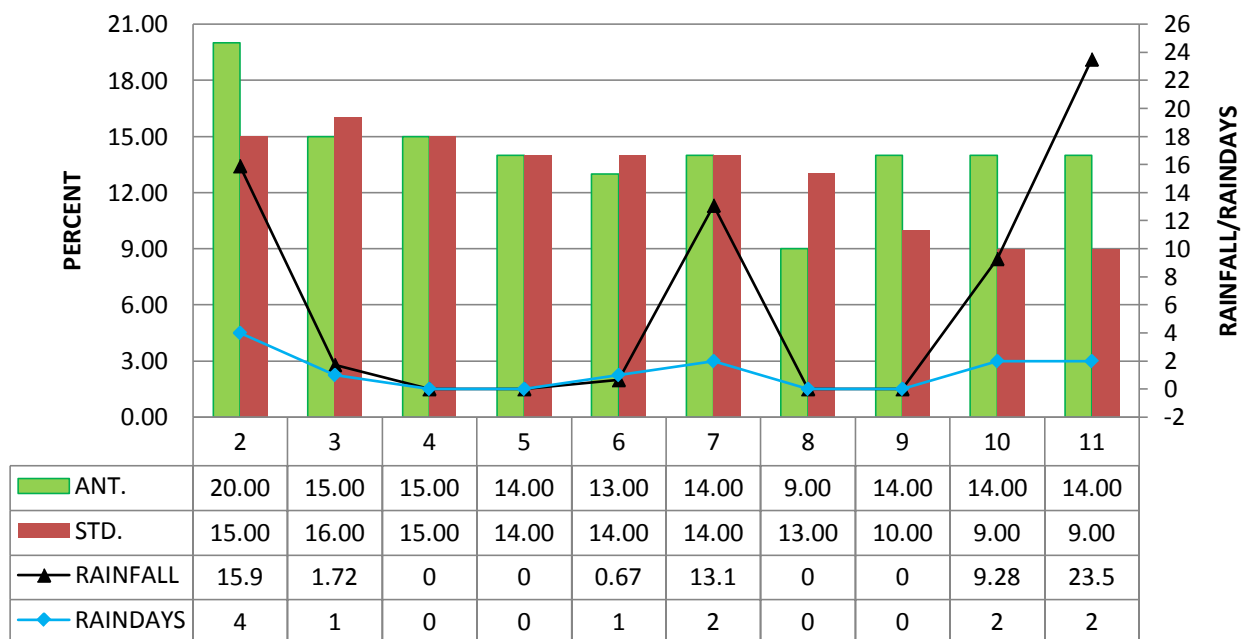
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CYCLE NO.	1	2	3	4	5	6	7	8
ANTICA (A)	A	A	A	A	A	A	A	A
STANDARD	Opal/Manco	Antra	Tride/Manco	Manco	Antra	Baycor/Manco	Manco	Antra

SEMI-COMMERCIAL TRIAL OF ANTICA AGAINST BLACK LEAF STREAK / SIGATOKA DISEASE IN CAVENDISH BANANA

GRAPH 6. INFECTED LEAF/PLANT VS. RAINFALL/RAINDAYS



CYCLE NO.	1	2	3	4	5	6	7	8
ANTICA (A)	A	A	A	A	A	A	A	A
STANDARD	Opal/Manco	Antra	Tride/Manco	Manco	Antra	Baycor/Manco	Manco	Antra

Appendix 1. EARLY VISIBLE STREAK (Leaf Number)

STD (x_1)	ANT (x_2)	x_1	x_2				
3.96	3.80	15.68	14.44				
3.99	4.00	15.92	16.00				
3.99	4.00	15.92	16.00	n	10		
3.97	3.80	15.76	14.44	X ave.	3.972	Y ave.	3.88
3.97	3.80	15.76	14.44	Sx	0.0001	Sy	0.0107
3.97	3.80	15.76	14.44				
3.97	3.80	15.76	14.44	t-com	2.803*	t-tab	2.101
3.96	4.00	15.68	16.00				
3.97	4.00	15.76	16.00				
3.97	3.80	15.76	14.44				
Total Ave.	39.72 3.972	38.80 3.880	157.77 150.64				

Note: 2-11 Weeks

Appendix 2. YOUNGEST LEAF SPOTTED (Leaf Number)

STD (x_1)	ANT (x_2)	x_1	x_2				
11.2	10.70	125.44	114.49				
11.7	11.50	136.89	132.25				
11.7	12.10	136.89	146.41	n	10		
12.3	11.40	151.29	129.96	X ave.	12.38	Y ave.	11.34
12.2	11.20	148.84	125.44	Sx	0.5329	Sy	0.2516
12.3	11.30	151.29	127.69				
12.6	12.20	158.76	148.84	t-com	3.713*	t-tab	2.101
13.2	10.90	174.24	118.81				
13.2	10.80	174.24	116.64				
13.4	11.30	179.56	127.69				
Total Ave.	123.8 12.38	113.40 11.34	1537.44 1288.22				

Note: 3-12 Weeks

Appendix 3. NO. OF FUNCTIONAL LEAVES AT SHOOTING

STD (x_1)	ANT (x_2)	x_1	x_2				
13.30	12.90	176.89	166.41				
13.30	12.80	176.89	163.84	n	10		
13.40	12.40	179.56	153.76	X ave.	13.41	Y ave.	12.62
13.50	12.90	182.25	166.41	Sx	0.0054	Sy	0.0796
13.40	12.60	179.56	158.76				
13.40	13.10	179.56	171.61	t-com	8.569*	t-tab	2.101
13.40	12.40	179.56	153.76				
13.50	12.30	182.25	151.29				
13.40	12.40	179.56	153.76				
13.50	12.40	182.25	153.76				
Total	134.10	126.20	1798.33	1593.36			
Ave.	13.41	12.62					

Note: 3-12 Weeks

Appendix 4. NUMBER OF FUNCTIONAL LEAVES AT HARVEST (10 Weeks Old Fruits)

STD (x_1)	ANT (x_2)	x_1	x_2				
6.12	5.94	37.45	35.28	n	10		
6.04	6.20	36.48	38.44				
6.09	6.46	37.09	41.73	X ave.	6.166	Y ave.	6.702
6.23	6.46	38.81	41.73	Sx	0.0078	Sy	0.1890
6.24	6.80	38.94	46.24				
6.09	7.14	37.09	50.98	t-com	-3.82*	t-tab	2.101
6.17	6.78	38.07	45.97				
6.12	6.84	37.45	46.79				
6.24	7.08	38.94	50.13				
6.32	7.32	39.94	53.58				
Total	61.66	67.02	380.27	450.87			
Ave.	6.166	6.702					

Note: 4-13 Weeks

Appendix 5. TRANSITION PERIOD (Number of Days) EVS-YLS

STD (x ₁)	ANT (x ₂)	x ₁	x ₂	
58.17	52.74	3383.75	2781.51	
57.68	54.06	3326.98	2922.48	
58.28	64.54	3396.56	4165.41	
60.58	55.22	3669.94	3049.25	
59.80	53.62	3576.04	2875.10	
60.43	52.36	3651.78	2741.57	
56.91	53.68	3238.75	2881.54	
60.66	45.13	3679.64	2036.72	
59.21	43.69	3505.82	1908.82	
61.71	46.29	3808.12	2142.76	
Total	593.43	521.33	35237.38	27505.16
Ave.	59.343	52.133		

Note: 3-12 Weeks

n	10		
X ave.	59.343	Y ave.	52.133
Sx	2.3852	Sy	36.2964
t-com	3.666*	t-tab	2.101

Appendix 6. INFECTED LEAF/PLANT (PERCENT)

STD (x ₁)	ANT (x ₂)	x ₁	x ₂	
15.00	20.00	225.00	400.00	
16.00	15.00	256.00	225.00	
15.00	15.00	225.00	225.00	
14.00	14.00	196.00	196.00	
14.00	13.00	196.00	169.00	
14.00	14.00	196.00	196.00	
13.00	9.00	169.00	81.00	
10.00	14.00	100.00	196.00	
9.00	14.00	81.00	196.00	
9.00	14.00	81.00	196.00	
Total	129.00	142.00	1725.00	2080.00
Ave.	12.90	14.20		

n	10		
X ave.	12.9	Y ave.	14.2
Sx	6.7667	Sy	7.0667
t-com	1.105 ^{NS}	t-tab	2.101

Note: 3-12 Weeks

Appendix 7. RATE (1-2) (Percent Rate of Leaf Loss)

STD (x₁)	ANT (x₂)	x₁	x₂				
5.37	5.01	28.84	25.10				
5.68	4.19	32.26	17.56				
5.44	3.67	29.59	13.47	n	10		
5.33	4.24	28.41	17.98	X ave.	5.002	Y ave.	4.231
4.30	4.25	18.49	18.06	Sx	0.6900	Sy	0.1077
5.42	4.26	29.38	18.15				
5.30	4.32	28.09	18.66	t-com	2.73*	t-tab	2.101
5.07	4.15	25.70	17.22				
5.23	4.13	27.35	17.06				
2.88	4.09	8.29	16.73				
Total	50.02	42.31	256.41	179.98			
Ave.	5.002	4.231					

Note: 3-12 Weeks