Unifrutti Tropical Philippines, Inc.
Manila Office:
Room 220 Narra Building, 2276 Pasong Tamo Extension, Makati City, Philippines
Telephone No. (63) 2 867-2517 Facsimile No. (63) 2 894-2143
Davao Office:
Door 10, ILAIECO Building, Tefasco Wharf, Bo. Ilang, Davao City, Philippines
Telephone No. (63) 82 226-9000 Facsimile No. (63) 82 226-9001

March 18, 2019

Bioefficacy Test of Antica for the Control of Banana Black Sigatoka and Freckle Leaf Disease of Cavendish Banana

AF Peñalosa and MD Viaje
UTPI–BRSD-Plant Pathology
MKAVI-1 Compound, Patag, Alanib
Lantapan, Bukidnon

Keywords: Antica, Lactic acid bacteria and 2-Hydropropanoic, Black Sigatoka, Freckle and Malayan Leaf Spot

Abstract

Antica (Active ingredients: Lactic acid and 2-Hydropropanoic acid) is manufactured and distributed by AHCIL Laboratories Inc. based in Cebu City, Philippines. A second - Small plot experiment was set-up after the single plant trial in Patag Alanib, Lantapan, Bukidnon at the Biotechnology and Research Services trial area from April to July 2018. Randomized Complete Block Design with six (6) treatments replicated four times was used. Treatments were as follows: T1- Untreated control, T2- Daconil 720SC (1.4L/ha), T3-Antica alone (1.0L/ha), T4-Banole+Lutensol alone (5.0L/ha +0.05L/ha), T5-Dithane 600 OS (2.5L/ha)+ Banole (5.0L/ha) + Lutensol (0.05L/ha) and T6- Antica (1.0L/ha) + Banole (5.0L/ha) + Lutensol (0.05L/ha).

Results showed that Antica application alone cannot control the three leaf diseases evaluated. Though its efficacy can somehow increase when Banole and Lutensol were added, in which it was comparable in effect to the standard Daconil 702SC, but only for controlling Sigatoka. In terms of controlling Freckle and Malayan leaf spot, it was inferior with Daconil 720SC; and for all the three diseases evaluated, it was inferior when compared with the standard Dithane 600 OS. In addition, the standard Dithane 600OS produced significantly higher total functional leaves compared to all treatments.

In view of the results obtained from the Small Plot Bioefficacy trial, Antica cannot be recommended further for the semi-commercial trial.

BACKGROUND

Antica (Lactic acid and 2-Hydropropanoic acid) is a contact fungicide with CAS No. 50-21-5 (racemic mixture). It is formulated by AHCIL Laboratories, Inc. which contains Lactic Acid Bacteria (LAB) and Fruit acid that can destroy the cell membrane of the microorganism causing death to the fungus. It is also capable of dissolving lipids structures of fungal and bacterial membranes when lactic acids or Alpha Hydroxy Acid (AHA) come in contact with the said organism (AHCIL, Undated). The product was compared to contact fungicides because of no specific target site on the organism cell structure.

Antica was already introduced sometime in 2009 to Unifrutti and there was four (4) bioassays conducted already against *Mycosphaerella fijiensis*-Sigatoka and *Phyllosticta musarum*-Freckles (UTPI, 2009; 2011-2012; 2016; 2018). Bioassay consistent results are the inferior percent germ tube reduction of *M. fijiensis* with Antica compared to standard contact fungicide (Dithane 600 OS and Daconil 720SC) in all test concentrations. On the other hand, there was comparable percent germ tube reduction observed on *P. musarum* but only on higher concentrations of 5 and 10ppm (UTPI, 2016; 2018). Generally, direct contact of Antica to the pathogen had no considerable potential effect compared to standard contact fungicide *in vitro*. The product was also initially tested on field using Single plant experiment. Results showed that under field condition, Antica without Banole cannot control three (3) leaf diseases of banana. Antica mixed with Banole and Lutensol increases its efficacy but comparable only to Daconil 720 SC against Sigatoka but inferior against Freckles. The product was inferior to Dithane 600 OS against all three leaf diseases (UTPI, 2012).

However since the product was reformulated , it was then subjected to small plot bioefficacy trial for validation of its efficacy against the 3 leaf diseases of banana.

MATERIALS AND METHODS

Location and Trial duration

The study was conducted in Unifrutti Tropical Philippines Inc.- Biotechnology and Research Services Department (UTPI-BRSD) experimental area, MKAVI-1 Compound at Lantapan, Bukidnon, Mindanao Philippines (870 m a.s.l, 8.0258^{O} N, 124.972^{O} E) from April-July 2018 (Annex III).

Plot Preparation, Treatment application and Data collection and Management

The study was laid out in Randomize Complete Block Design (RCBD) with a total of six (6) treatments and replicated four (4) times with 10 data plants per replication. All preparations, experimental procedures, data collection and test plant management were based on the standard practices and approved protocol of Unifrutti (UTPI, 2018). Data were analyzed using STAR version 2.0 (IRRI, 2013). Treatments were as follows:

Treatment	Rate/Ha
T1- Untreated Control	
T2- Daconil 720 SC	1.40 L
T3- Antica Alone	1.0 L
T4- Banole + Lutensol	5.0 L + 0.05 L
T5- Dithane 600 OS + Banole + Lutensol	2.5 L + 5.0 L + 0.05 L
T6- Antica + Banole + Lutensol	1.0 L + 5.0 L + 0.05 L

RESULTS AND DISCUSSION

Weather Condition

The trial was initiated from week 35 to week 47 of 2015 with 13 weeks period of disease assessment. Weather graphical presentation of the weekly average temperature was 27-28^{0}C and rainfall ranges from 0 to 179mm (Figure 1-3, 6, 8-9). These environmental factors relatively contributed to the development of foliar diseases particularly Black Sigatoka (Annex I).

Stability Test

All treatments of Antica alone and mixed with Banole was miscible and had stable physical appearance. Antica mixed with Banole was noticeably less foamy compared to Banole with Lutensol (Annex II).

I. Black Sigatoka (*Mycosphaerella fijiensis,* Morelet)

Observation and data collection procedures and parameters were based on UTPI standard procedures and protocols (UTPI, 2015).

a. Early Visible Streak (EVS)

Figure 1 illustrates the weekly average with EVS where untreated started showing separation of path in youngest leaf position with EVS on week 20 while the rest of the treatment on week 22-23. On statistical analysis results, ANOVA shows highly significant difference (P<0.05) among treatment mean with coefficient of variation of 2.8%. It shows that T5 and T6 were slightly comparable while T6 was slightly comparable to T4. Treatment 4 was slightly comparable to T2 and the later was slightly comparable to T3 as well (Table 1-2).

b. Youngest Leaf Spot (YLS)

On the graphical results in Figure 2, treatments 5 showed separation of trend from the other treatment after 5th application. ANOVA presented a highly significant difference (P<0.05) among treatment mean with coefficient of variation of 2.8%. Data showed that T5 had superior effect on YLS leaf position compared to all treatment. This was followed by T6 with no

significant difference to T4 and T2. However, T3 was very inferior where mean was comparable to T1 (Table 3-4).

c. Matured Spot (MS)

Weekly trend of youngest leaf position with MS had almost of the same trend with YLS where T6 had superior YLP with MS. In Table 5, data showed highly significant difference of T5 from the rest of the treatments ($P<0.05$). Treatment 6 was only slightly comparable to T2 and T4 but T3 was very inferior that almost comparable to T1. ANOVA in Table 6 treatments mean had highly significant difference with coefficient of variation of 3.79%.

d. Sigatoka Severity of Infection and Percent Control

Figure 4 presents the data of Sigatoka percent infection of different treatment mean. Data showed that T5 had lowest percent infection followed by T6 and T4 with slightly comparable means. Highest infection was observed on T1 and this was followed by T2 and T3, respectively. ANOVA in Table 8 treatments mean had highly significant difference with coefficient of variation of 3.76%. Furthermore, percent control of treatment presented in table 9 showed no significant difference among treatment mean at $P<0.05$ but highest numeric value was observed in T5 with 5.59% followed by T2. ANOVA in Table 10 treatment mean had highly significant difference with coefficient of variation of 30.91%.

e. Black Sigatoka Development (Modified Single Leaf Test)

Figure 5 presented the data of Incubation Period and Transition Period where total disease development (TDD) of Sigatoka was the sum of IP and TP as shown on each bar of the graph. Longest IP was observed in T5 with 24 days followed by T2 and T4 with 23 days while T3 and T6 had 22 days whereas untreated control had only 21 days. The same results presented in Table 11 that T5 had superior days in IP followed by T2 and T were statistically comparable at $P<0.05$. ANOVA of IP in Table 12 treatment mean had highly significant difference with coefficient of variation of 1.40%. However, Table 13 shows that T6 had longest TP, and that T5 was slightly comparable at $P<0.05$. ANOVA in Table 14 treatment mean had highly significant difference with coefficient of variation of 7.07%.

TDD of Sigatoka aim is to select product rate that can effectively delay the disease development and therefore have higher total functional leaves prior to fruit development. In this study, data showed in Table 15 that T5 had longer TDD but T5, T2, T3 had slightly comparable effect to T5 at $P<0.05$. ANOVA of TDD in Table 16 treatment mean had highly significant difference with coefficient of variation of 3.17%.

II. Freckle Disease

a. Leaf Position with Freckles

Graphical presentation of weekly average leaf position (Figure 6) had distinct weekly trend observed on T5 with highest leaf position and T3 next to T1 with lowest leaf position with freckle. Table 17 showed that T5 were highly significantly different compared to all treatments

but T2, T4 and T6 had comparable effect at $P<0.05$. Untreated control had no significant difference to T3. ANOVA of YLP with Freckle in Table 18 treatment mean had highly significant difference with coefficient of variation of 3.78%.

b. Severity of Freckle Percent Infection and Control

In Table 19 and 20 presented the results in Freckle disease severity of infection and percent control. Data showed that T2 had the lowest severity of infection and in effect, had the highest percent control of 25%. This was followed by T5 with slightly comparable mean of infection as well as control and T6 had slight effect compared to T5 in both parameters at $P<0.05$. ANOVA of the two parameters had coefficient of variation of 13.14% on Freckle percent infection and 21.13% in percent control (Table 20 and 22).

III. Malayan leaf Spot (MLS) Disease

Weekly trend of MLS had highest youngest leaf position on T5 while T3 position at the lowest in almost the same trend of T1 (Figure 8). The same observation presented on Table 23 that T5 was highly significantly different from other treatment means. Treatment 2 was comparable to T6 and T4 while T3 was comparable to untreated control at $P<0.05$. ANOVA of MLS in Table 24 treatments mean had highly significant difference with coefficient of variation of 2.47%.

IV. Total Functional Leaves (TFL)

Total vegetative functional leaves in a weekly basis had clear trend on Figure 9 where T5 had highest numeric value of TFL with 11.2 as presented in Table 25. This was followed by T6 and T4 that showed slightly comparable at $P<0.05$. The rest of the treatment had slightly comparable numbers on TFL. ANOVA of TFL in Table 26 treatment mean had highly significant difference with coefficient of variation of 6.74%.

CONCLUSION

Antica at the rate of 1.0L/ha alone failed to control the diseases in almost all parameters, and significantly failed on YLS, MS, IP, Freckles, Freckle infection and MLS. However if Antica was mixed with oil, it showed potential efficacy but that effect is credited to the mineral oil since Banole is known for its fungistatic effect. Antica with oil was only comparable to Daconil 720SC against Sigatoka but not to Freckle control. These results consistently correlates from the single plant study (UTPI, 2012) therefore, Antica product is not recommended to undergo further semi-commercial test based on *in vivo* and *in vitro* results against 3 diseases of banana.

Literature cited

AHCIL. Undated. Technical Information and Product label.

Unifrutti Tropical Phil. Inc. 2018. Protocol: Bioefficacy Test of Antica (Lactic acid) for the Control of Banana Black Sigatoka and Freckle Leaf Disease of Cavendish Banana

Unifrutti Tropical Phil. Inc. 2009; 2011-2012. Antica Bioassay against *Mycosphaerella fijiensis* and *Phyllosticta musarum.* Unpublished.

Unifrutti Tropical Phil. Inc. 2016; 2018. Antica Bioassay against *Mycosphaerella fijiensis* and *Phyllosticta musarum.* Unpublished.

International Rice Research Institute of Technology. 2013. Software of Statistical Tool for Agricultural Research (STAR) version 2.

Bioefficacy Test of Antica for the Control of Banana Black Sigatoka and Freckle Leaf Disease of Cavendish Banana

Data Prepared by:

MD Viaje Date _____
CPS Field Supervisor

Report Prepared by:

AF Peñalosa Date _____
CPS Superintendent

Approved by:

SM Chavez Date _____
UTPI-BRSD Head