FIELD EVELUATION OF ANTICA™ ORGANIC FUNGICIDE FOR THE CONTROL OF ANTHRACNOSE AND OTHER DISEASES OF 'CARABAO' MANGO[1]

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ABSTRACT

Antica™ organic fungicide was evaluated and compared with Amistar (as check fungicide) under field condition against anthracnose and other diseases of 'Carabao' mango.

Reduction on incidence of anthracnose infection on flower panicles at 22 and 28 DAFI (days after flower induction) on tress sprayed with Antica organic fungicide at 300 and 400ml/100 liters water were comparable to Amistar. While, scab incidence was lowest on Antica (400ml/100 li water) at 22 and 28 DAFI and severity of infection at 33 DAFI was lower (41 to 50%) on trees treated with Antica (200 to 400ml/100 li water) and Amistar. However at 60 and 80 DAFI, trees sprayed with Antica at 400ml/100 li water and Amistar had the lowest severity rating of 11 to 20 percent scab infection on fruits.

At fruit setting and retention stage, trees sprayed with Antica at 400ml/100 li water had protected the developing fruits and retained more with 0.48 per panicle but is comparable with Antica at 200 and 300ml/100 li water and Amistar sprayed trees. While, highest yield obtained from 25 randomly sampled panicles was recorded on Antica at 400ml/100 li water (14.50 pcs or 4.09 kgs) but did not vary from trees sprayed at 300 and 200ml/100 li water and Amistar.

Latent infection of anthracnose at 9 days after harvest was observed to be lowest on Antica at 400ml/100 li water and Amistar with 37.50 and 25 percent incidence and 1 to 10% severity rating. The rest of the treatments have more than 75% incidence with 11 to 20% infection. On the other hand, diplodia stem-end rot incidence and infection observed at 5 to 9 DAH were statistically the same in all treatments.

Phytotoxic effect on leaves, flowers and fruits of mango sprayed with Antica organic fungicides was not observed at different stages of flower and fruit development, as such it is safe to use.

Antica™ organic fungicide at higher rate (400 ml/100 li water) applied at flowering and fruiting stage of mango could minimize incidence and severity of scab and anthracnose on flower panicles and fruits under Guimaras condition. However, it is recommended that further study be conducted in terms of rate and frequency of application and at different mango growing areas of the country to further verify its potential in controlling anthracnose and scab on mango.

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INTRODUCTION

The competitive advantage of Philippine mango cannot be undermined. In fact, it is acclaimed as one of the world's best variety. As a commodity of great commercial value, 'Carabao' mango is extensively planted in different regions of the country. However, production is erratic, this could be attributed to several factors like poor adoption of appropriate production and post production technologies, high incidence of pests and diseases and indiscriminate use of pesticides to name a few.

Insects and diseases cause heavy toll to production and degrade fruit quality, resulting to high percentage rejects. Mango leaf hoppers, tip borers and thrips damage flowers at all stages of development. On the other hand, anthracnose and scab infect flowers particularly during continuous rains. Mango fruits are not also spared from pest damage. Younger fruits are prone to attack of helopeltis/cecid fly and seed borers which may persist even at advance stages of development. Fruit flies can also complicate the problem by destroying readily harvestable fruits.

Diseases attacking mango flowers and fruits are few but they significantly reduce yield and lower fruit quality. Anthracnose is a perennial disease problem of mango growers. It causes blighting of flowers which lead to total browning and eventually blackening. Fruits affected however, do not manifest early symptoms but do so after harvest (latent infection). Scab on the other hand, result to excessive droppings of young fruits and degrade quality at harvest. Like anthracnose, diplodia stem-end rot is a harvest disease and can result to 14% rejection of fruits.

To address the insect pests and diseases problem on mango production, proper crop management must be in-placed. Measures like appropriate cultural management, integrated pest management, biological control and proper usage of pesticides are some of the strategies to lessen pests damage on crop yields. It is unfortunate to note however, that mango farmers and growers are still dependent on the use of chemical pesticides rather than the integrated approach on controlling pests and diseases.

The dependence on chemical pesticides had lead to its high demand. In fact, each year several insecticides and fungicides are screened/tested to minimize if not totally control mango pests. These formulated chemicals have specific actions on target pests but can also affect the users, environment and non-target organisms.

With the advent of increasing demand for a healthy and consumer-friendly products in the market and awareness for environmental sustainability, production of agricultural crops with less or zero pesticides is gaining attention. While, biopesticides are already available in the market and are used by some rice and vegetable farmers to control insect pests and diseases, this is yet to be seen on mango production.

One of the organic pesticides that is now being used in rice, vegetable and banana farming is a lactic acid-based products. The use of this fungicide was proven to minimize diseases on rice and banana. However, this was not yet proven to control diseases of other fruit crops especially mango. Hence, this study was conducted.

OBJECTIVES

The study was conducted with the following objectives;

1. To evaluate Antica™ organic fungicide for the control of anthracnose and other diseases of 'Carabao' mango.

2. To determine any phytotoxicity of Antica™ organic fungicide sprayed on leaves, panicles and developing fruits.

3. To determine the effect of Antica™ organic fungicide on fruit quality (internal and external).

4. To evaluate its impact on non-target organisms endemic in mango orchard.

PLACE AND DURATION OF THE STUDY

The field experiment was conducted at the Satellite Station of DA/BPI-National Mango Research and Development Center in Piña, Buenavista, Guimaras from January 25 to June 25, 2011

REVIEW OF LITERATURE

Diseases affect every important part of mango tree (Ploetz and Prakash, 1997). They damage the seedlings, grafted plants in the nursery, decrease fruit set and retention and are important pre and post harvest problems of fruits. In many areas, diseases are important constraint to fruit production. In the Philippines, diseases of mango are mainly caused by fungi due to the prevailing wet condition in many growing areas (Golez, 1997).

Anthracnose caused by *Collectotrichum gloeosporioides* is the most important disease of mango (Cook, 1975; Lim and Khoo, 1985; Dodd et. al, 1997 and Ploetz and Prakash, 1997). The disease causes unsightly blemishes on fruit and is a major pre and post harvest problem of mango growers. It can also damage the young foliage and can be triggered by overcrowding of seedlings or trees, high temperature and moist conditions that cause serious problems in nurseries and young trees in orchards (Bose, et. al, 1973).

Flowers produced during off-season succumbed to anthracnose infection causing them to blacken and eventually fall. Golez (1997) refers this symptom as blossom blight. On small fruits, the disease develop as minute brown spots and aborts on early infection. On the other hand, some fruits may not show visible symptoms in the field but as they ripened, black necrotic spots spread affecting fruit quality.

Stem-end rot are caused by a number of fungi particularly *Lasiodiplodia theabromae* and *Dothiorella dominicande* (Johnson et. al, 1992). The symptom starts around the base of the harvested fruit with lesions enlarging rapidly with time, forming circular brownish-black areas of water soaked tissues. Affected fruits bloat producing bad smelling fluid. In the Philippines, 10 to 15 percent damage of harvested fruits is due to stem-end rot.

Mango scab caused by *Elsinoe mangiferae* is prevalent among trees grown in areas with high relative humidity. In Australia, it is a problem among young seedlings but in the Philippines, the disease is very damaging on young developing fruits causing them to fall prematurely. The symptoms are characterized by grayish, brown lesions with dark irregular margins. The damage expands as the fruit matures, producing brown cracked and corky fissures which cover the entire fruit (Golez, 1997).

Sooty molds on the other hand, are saprophytic epiphytes and are not parasitic on their hosts. They obtain their nourishment from honeydew secreted by mealybugs, scales and hoppers. According to Lim and Khoo (1985), fruits affected form black, effuse and thin skin with stain pattern starting from pedicel to the fruit apex. The fungus affects fruit quality, reducing export potentials.

As mango production continue to spread in the different regions, so too with the scope and type of disease problems that confronts growers. It is therefore important that an integrated approach to control diseases be done. These include cultural, mechanical, biological and plant resistance. Hopefully, new, safe and effective chemicals will be developed in the near future. Reducing the number of fungicidal applications and usage of organic and biopesticides to control mango diseases are ways on how disease management might be rationalized in the future.

METHODOLOGY

Experimental Treatments. Thirty-five grafted 'Carabao' mango trees (25-year old) were induced to flower with the application of 2 percent commercial flower inducer (Potassium Nitrate, KNO_3). A total of 24 trees were selected with more than 50 percent flowering intensity. Trees were divided into four blocks and those with similar sizes were assigned in each block. Treatment used, time and rate of application is presented in Table 1. Treatments were applied in tank-mix along with commonly used insecticides and fungicides at their respective recommended rate. The six treatments were further reassigned per block at random.

Spray application of the treatments utilized a power sprayer with regulated nozzle for thorough spray coverage. Trees were sprayed up to the "point of run-off" delivering a volume of about 40-60 liters per tree depending on tree size.

Table 1. Treatments, concentration and time of application.

Treatments	Product Rate (ml)/100 liters water	Time of Application (DAFI**)				
		1st (14 DAFI)	2nd (24 DAFI)	3rd (35 DAFI)	4th (45 DAFI)	5th (65 DAFI)
Untreated (water)	-	√	√	√	√	√
Antica	100	√	√	√	√	√
Antica	200	√	√	√	√	√
Antica	300	√	√	√	√	√
Antica	400	√	√	√	√	√
Amistar	80	√	√	√	√	√

*Spray volume per tree = 50 liters (average). There were 35 trees induced.
**DAFI- days after flower induction

Re-induction of Trees. A follow-up spray of 2 percent flower inducer was done at 2 DAFI since rain was experienced in the area 4 to 5 hours after induction. This was done to insure high flowering intensity of induced trees.

Tagging of Sample Panicles. At 10-14 days after flower induction (DAFI), 25 panicles were tagged at random on each tree. These served as sample panicles for some parameters (panicle size, classification, fruit set and retention, number of fruits harvested).

Care and Maintenance of Experimental Trees. Experimental trees were subjected to proper cultural management such as insect pest monitoring and control, field sanitation and underbrushing. Flowers and fruits were protected from insect pests through a need-based application of insecticides.

All fruits of experimental trees as well as extra trees were bagged at 60 DAFI except for sample fruits for scab infection. This will ensure protection of the fruits from insects and physical damage.

Parameters Used for Evaluation. The following data were gathered to determine the effects of ANTICA organic fungicide on flowering, fruit setting, yield and fruit quality of 'Carabao' mango.

Percent flowering/flushing. Flushing and flowering intensity were monitored at 15 and 25 DAFI, using quadrant method. The tree was divided into 8 quadrants (east-west and north-south direction). Each quadrant was evaluated in percent (%) and the average per tree was determined.

Panicle size. Length and width of panicles were determined using a ruler. In the case were sample panicle is multiple, the biggest panicle was used. This was measured from the longest and the widest portion of panicle using the 25 randomly tagged panicles at 22 and 28 DAFI.

Panicle classification. Single and multiple panicles were determined using the 25 randomly tagged panicles at 25 DAFI. The former were those with one panicle while the latter were those with several panicles per shoot.

Number of fruit set and retention. The number of young fruits that set was counted from 25 randomly selected panicles at 45 DAFI. Fruit retention was determined at succeeding stages of development (55, 65 and 75 DAFI).

Yield at harvest. Fruits were harvested at 118 DAFI. Maturity of the fruits prior to harvest was counterchecked by determining the total soluble solids (TSS) taken at random using a refractometer. A 7 ^{o}Brix reading indicated that fruits are mature and ready for harvest. Using a bamboo pole with catching net, the fruits were harvested individually. The number of fruits per treatment from 25 tagged panicles were counted and weighed. Harvested fruits were classified as to marketable and non-marketable, while the cause(s) of non-marketability were noted.

Phytotoxic effects of chemicals. Any phytotoxic effect(s) observed on leaves, flowers and fruits were assessed three days after each treatment application. Evaluation of phytotoxicity was done using the following scales: 1 – No visible phytotoxicity symptoms; 3 – 1 to 10% injury; 5 – 11 to 20% injury; 7 – 21 to 40% injury; and 9 – 41 to 50% injury. Rating was done using 25 sampled flower panicles and fruits and 50 sampled leaves.

Disease incidence. Anthracnose damage was taken at random from 50 leaves and 25 flower panicles at 22, 28 and 33 DAFI. Two parameters were considered, a) percent incidence (total number of infected leaves/flowers divided by the number of samples multiplied by 100) and b) degree of infection/severity which was considered affected by the disease using the following rating scale; 1= 0 infection, 3 = 1 to 10 % infection, 5 = 11 to 20 % infection, 7 =21 to 30 % infection, 9 = 31 to 40 % infection, 11 = 41 to 50 % infection and 13 = greater than 50 % infection. Values were expressed as averages.

Scab infection was rated on mango flowers using similar procedures for anthracnose. On fruits, scab was recorded at 60, 80, 100 DAFI and at harvest.

Latent infection brought about by anthracnose and diplodia stem-end rot were recorded at 3, 5, 7 and 9 days after harvest (DAH) while degree of infection were rated using the similar scale used on flowers and leaves.

Fruit quality. Fruit quality (internal and external) of mango trees applied with different treatments was evaluated using the National Seed Industry Council (NSIC) and PHTRC, UPLB standards.

Other pertinent information. Effects of chemicals on non-target organisms were noted. Daily weather data on rainfall, relative humidity and atmospheric temperature during the conduct of the study were determined. These data were sourced-out from the Agromet Station of BPI-NMRDC.

Experimental Design and Analysis. The experiment was conducted in a Randomized Complete Block Design (RCBD), replicated 4 times (1 tree per treatment). Data gathered were analyzed using the analysis of variance (ANOVA) for RCBD. Significant differences among treatment means were compared using the Least Significant Difference (LSD) at 5% level of significance.

RESULTS AND DISCUSSIONS

Response of 'Carabao' mango to flower induction. The selected trees responded well to application of Potassium Nitrate (KNO_3) as flower inducer. Bud break was observed at 8 days after flower induction (DAFI). Experimental trees have an average flowering intensities of 50.00 to 82.50 percent at 10 DAFI using the quadrant method (East-West and North-South direction) (Table 2). This gave an ample chance to select panicles as samples for data collection in each treatment. In some instances, flushing was also observed several days upon induction. In this experiment, flushing intensity ranged from 5.00 to 12.00 percent.

Table 2. Response of 'Carabao' mango to application of KNO_3 at 10 days after flower induction (DAFI).

Treatment	Flowering Intensity (%)	Flushing Intensity (%)
Control (water)	50.00[ns]	5.00 [ns]
Antica (100 ml/100 li water)	67.50	12.00
Antica (200 ml/100 li water)	71.25	7.50
Antica (300 ml/100 li water)	65.00	8.75
Antica (400 ml/100 li water)	75.00	5.00
Amistar (80 ml/100 li water)	82.50	7.50

[1]Average of 8 quadrants per tree taken at 10 DAFI.

ns- not significant

Relative efficiency of fungicidal treatments on anthracnose in leaves and flowers. Anthracnose infection was not observed at 22, 28 and 33 DAFI on 50 randomly tagged leaves of each treatment having no incidence of infection and a severity rating of 1 (no infection). Basically, anthracnose infects new flushes or young leaves. According to Pordisemo (1979), despite the absence of infection, the inocula are still present on twigs, branches and leaves of mango and remain inactive until favorable condition allows for its growth. In the field, rain splashes is the primary factor for dissemination and subsequent germination of spores (Table 3).

On the other hand, incidence and severity of anthracnose on flowers are imminent. Signs include blighting and blackening of individual florets. In severe cases, excessive dropping in

Table 3. Incidence and severity of anthracnose infection on leaves of 'Carabao' mango applied with different treatments of fungicide.

Treatment	22 DAFI		28 DAFI		33 DAFI	
	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]
Control (water)	0.00 [ns]	1.00	0.00 [ns]	1.00	0.00 [ns]	1.00
Antica (100 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00
Antica (200 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00
Antica (300 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00
Antica (400 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00
Amistar (80 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00

[1]Disease severity was evaluated using the following scale:

1 - no infection
3 - presence of 1 to 10% infection on leaves
5 - presence of 11 to 20% infection on leaves
7 - presence of 21 to 30% infection on leaves
9 - presence of 31 to 40% infection on leaves
11 - presence of 41 to 50% infection on leaves
13 - presence of greater than 50% infection on leaves

ns - not significant

DAFI - days after flower induction

mass of florets is observed leaving the peduncle which turns black in succeeding days. At 22 DAFI, from the 25 tagged panicles observed, 49.00 percent on control trees were infected with the disease which is higher compared to ANTICA and Amistar treated trees. It was noted further that 300 and 400 ml/100 li water ANTICA dilution were comparable to Amistar in reducing the incidence of infection on flower panicles. Average severity rating in all treatments ranged from 1.07 to 2.04 having 1 to 10 percent infection. Analysis showed that trees sprayed with higher concentrations of ANTICA (300 and 400 ml/100 li H_2O) have the same effect with the check fungicide (Amistar) and have lower severity rating compared to lower concentrations of ANTICA and control. The same trend was observed at 28 DAFI, however, incidence and severity also increased. During these stages, treatment applications were done 6 and 2 days before collection of data, respectively.

Observation done at 33 DAFI revealed that all sampled panicles have incidence of anthracnose infection (Table 4). This could be attributed to the heavy rainfall that coincides during the full bloom to late bloom stages that favors disease development. In terms of disease severity infection, the rating reached up to more than 50 percent per flower panicle except for those trees treated with Amistar having a severity of 41 to 50 percent infection per panicle.

Relative efficiency of fungicidal treatments on scab in leaves, flowers and fruits. The presence of scab on leaves was not observed on this experiment (Table 5), however infection is prevalent on flowers at 22, 28 and 33 DAFI (Table 6). The fungus infects the axis and peduncle of the inflorescence. Scab form numerous, slightly raised, gray and oval to elliptical lesions on affected parts. The application of fungicidal treatments at 16 DAFI did not hinder the development of the disease as observed at 22 DAFI. However, ANTICA at 400 ml/100 li water dilution had lower percentage (87%) of scab incidence compared to untreated trees and lowest dose of ANTICA. Statistical analysis also showed that the percent incidence of scab on flowers sprayed with highest dose of ANTICA was comparable to those trees sprayed with ANTICA at 200 and 300 ml/100 li water and Amistar. In terms of infection severity per inflorescence at 22 DAFI, ANTICA at 400 ml and Amistar have an average rating of 1 to 10 percent infection on flower panicle. The rest of the treatments have 11 to 20 percent infection.

Observation done at 28 DAFI on flowers revealed that percent incidence of the disease was almost the same. The trees were already sprayed twice with fungicidal treatments at 16 and 26 DAFI. Severity rating increased ranging from 3.04 to 3.73 but still fall between 11 to 20 percent infection per inflorescence.

Since the climatic condition favors, none of the sampled panicles were devoid of the presence of scab infection having 100 percent incidence at 33 DAFI. However, it was observed that severity of infection per panicle was less in trees treated with Amistar (31-40% infection) and ANTICA 400, 300 and 200 ml/100 li water dilution (41-50% infection). Highest rating was observed on control and trees treated with lowest rate of ANTICA (100 ml/100 li water) with more than 50 percent infection per panicle.

Presence of scab infection on fruits was also observed at 60 DAFI up to harvest (118 DAFI) as presented in Table 7. Black and scabby lesions were observed and as the fruit grows, scar tissue develops around the black lesions, making them unmarketable due to blemishes. At 60 DAFI, fruits of trees applied with Amistar and ANTICA at 400 ml/100 li water have lower incidence of

Table 4. Incidence and severity of anthracnose infection on flowers of 'Carabao' mango applied with different treatments of fungicide.

Treatment	22 DAFI		28 DAFI		33 DAFI	
	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]
Control (water)	49.00 [a]	2.04	61.25 [a]	2.71	100.00 [ns]	12.36
Antica (100 ml/100 li water)	22.00 [b]	1.42	26.00 [b]	2.23	100.00	11.70
Antica (200 ml/100 li water)	14.00 [bc]	1.28	17.00 [b]	1.58	100.00	11.83
Antica (300 ml/100 li water)	8.00 [cd]	1.14	18.50 [b]	1.34	100.00	11.87
Antica (400 ml/100 li water)	6.00 [cd]	1.08	7.00 [c]	1.30	100.00	10.83
Amistar (80 ml/100 li water)	4.00 [d]	1.07	9.00 [c]	1.21	100.00	11.09

[1]Disease severity was evaluated using the following scale:

1 - no infection on flowers
3 - presence of 1 to 10% infection on flowers
5 - presence of 11 to 20% infection on flowers
7 - presence of 21 to 30% infection on flowers
9 - presence of 31 to 40% infection on flowers
11 - presence of 41 to 50% infection on flowers
13 - presence of greater than 50% infection on flowers

Data were transformed to square root of (x+0.50)

ns- not significant

In column, means having similar superscripts are not significant at 5% level using LSD.

DAFI - days after flower induction

Table 5. Incidence and severity of scab infection on leaves of 'Carabao' mango applied with different treatments of fungicide.

Treatment	22 DAFI		28 DAFI		33 DAFI	
	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]
Control (water)	0.00 [ns]	1.00	0.00 [ns]	1.00	0.00 [ns]	1.00
Antica (100 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00
Antica (200 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00
Antica (300 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00
Antica (400 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00
Amistar (80 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00

[1]Disease severity was evaluated using the following scale:

1 - no infection
3 - presence of 1 to 10% infection on leaves
5 - presence of 11 to 20% infection on leaves
7 - presence of 21 to 30% infection on leaves
9 - presence of 31 to 40% infection on leaves
11 - presence of 41 to 50% infection on leaves
13 - presence of greater than 50% infection on leaves

ns - not significant

DAFI - days after flower induction

Table 6. Incidence and severity of scab infection on flowers of 'Carabao' mango applied with different treatments of fungicide.

Treatment	22 DAFI		28 DAFI		33 DAFI	
	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]
Control (water)	99.00 [a]	3.72	99.00 [a]	3.73	100.00 [ns]	11.59
Antica (100 ml/100 li water)	99.00 [a]	3.63	99.00 [a]	3.70	100.00	11.14
Antica (200 ml/100 li water)	98.00 [ab]	3.10	98.00 [ab]	3.48	100.00	10.70
Antica (300 ml/100 li water)	97.00 [ab]	3.12	97.00 [ab]	3.26	100.00	10.07
Antica (400 ml/100 li water)	87.00 [b]	2.82	88.00 [b]	3.04	100.00	9.03
Amistar (80 ml/100 li water)	92.00 [ab]	2.86	92.00 [ab]	3.04	100.00	8.01

[1]Disease severity was evaluated using the following scale:

1 - no infection on flowers
3 - presence of 1 to 10% infection on flowers
5 - presence of 11 to 20% infection on flowers
7 - presence of 21 to 30% infection on flowers
9 - presence of 31 to 40% infection on flowers
11 - presence of 41 to 50% infection on flowers
13 - presence of greater than 50% infection on flowers

ns- not significant

In column, means having similar superscripts are not significant at 5% level using LSD.

DAFI - days after flower induction

Table 6. Incidence and severity of scab infection on fruits of 'Carabao' mango applied with different treatments of fungicide.

Treatment	60 DAFI		80 DAFI		100 DAFI		At harvest (118 DAFI)	
	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]
Control (water)	97.50 [a]	3.87	100.00 [a]	4.38	100.00 [a]	5.60	100.00 [ns]	6.63
Antica (100 ml/100 li water)	77.50 [b]	3.83	90.00 [ab]	4.10	100.00 [a]	4.90	100.00	6.00
Antica (200 ml/100 li water)	82.50 [ab]	3.24	95.00 [a]	3.80	100.00 [a]	5.10	100.00	6.25
Antica (300 ml/100 li water)	97.50 [a]	3.74	97.50 [a]	4.10	100.00 [a]	5.15	100.00	6.05
Antica (400 ml/100 li water)	52.50 [c]	2.38	75.00 [cb]	3.25	100.00 [a]	3.70	100.00	4.00
Amistar (80 ml/100 li water)	45.00 [c]	1.94	60.00 [c]	2.35	80.00 [b]	3.05	90.00	3.45

[1]Disease severity was evaluated using the following scale:

1 - no infection on fruits
3 - presence of 1 to 10% infection on fruits
5 - presence of 11 to 20% infection on fruits
7 - presence of 21 to 30% infection on fruits
9 - presence of 31 to 40% infection on fruits
11 - presence of 41 to 50% infection on fruits
13 - presence of greater than 50% infection on fruits

ns- not significant

In column, means having similar superscripts are not significant at 5% level using LSD.

DAFI - days after flower induction

scab with 45.00 and 52.50 percent, respectively compared with the rest of the treatments. The rest have higher than 77.00 percent scab incidence. This holds true with the severity of fruit's infection. Amistar and highest rate of ANTICA have 1 to 10 percent infection per fruit, while the rest have 11 to 20 percent infection. At 80 DAFI, the trend was somewhat the same, such that incidence and severity also increases even though 5th application of fungicidal treatment was done at 65 DAFI.

Data collected at 100 DAFI showed that almost all the sample fruits have incidence of scab infection except for trees treated with Amistar having an incidence of 80.00 percent scab infection. Severity rating on individual fruit had 11 to 20 percent infection per fruit on trees treated with Amistar at 80, ANTICA at 400 and 100 ml/100 li water dilution. The rest have severity of 21 to 30 percent scab infection per fruit.

At harvest (118 DAFI), the same trend on scab incidence was observed. On the other hand, severity of scab infection per fruit increases. Amistar and ANTICA at 400 ml/100 li water have lowest and comparable severity rating of 11 to 20 percent scab infection per fruit while the rest of the treatments have 21 to 30 percent scab infection.

Phytotoxic effects of the fungicides. Table 8 presents the result of phytotoxic evaluation on leaves, flowers and fruits of mango 3 days after each treatment applications. Based on these data, the different rates of ANTICA and the check fungicide used in the study did not manifest any phytotoxic symptoms on leaves, flowers and fruits of mango. This suggests that 100 to 400 ml of ANTICA per 100 li of water dilution is safe for use on mango.

Panicle size and classification. To monitor the side effects of the different treatments used on developing flowers, width and length of panicles were measured at different growth stages (Table 9). Panicles started to elongate at 11 DAFI as shown by the extension of the main stalk called axis, however measurement was done at 22 DAFI where panicles are at its post-emergence and bud elongation stage and at 28 DAFI where full bloom occurs and the panicles are on its maximum growth. Data gathered at 22 DAFI revealed that the width and length of panicles were almost the same with each other having a range of 4.98 to 7.77 cm and 16.69 to 22.23 cm, respectively.

Growth stabilizes at full bloom stage (28 DAFI) where 80 to 90 percent of the florets had opened. Width and length of the panicles treated with different rates of ANTICA, check fungicide and control have no significant difference having a range of 12.01 to 17.51 cm and 24.17 to 32.18 cm, respectively. Data showed that the treatments have no significant effects on the development of flowers.

Panicles were further classified as to single or multiple. Terminal flower with one main stalk or axis was considered single panicle. This type of panicles is more abundant (73.0 to 94.0%) compared to multiple panicles (6.0 to 27.0%). The latter consisted of 2 or more panicles which developed on the tip of the shoots. The longest panicles were observed in the center while the shorter developed on the sides. Panicle classification did not vary significantly among treatment means on both single and multiple (Table 10).

Table 8. Phytotoxicity effect on leaves, flowers and fruits of 'Carabao' mango applied with different treatment of fungicide.

Treatment	Leaves		Flowers		Fruits		
	19 DAFI	29 DAFI	19 DAFI	29 DAFI	38 DAFI	48 DAFI	68 DAFI
Control (water)	1.00 ns	1.00 ns	1.00 ns	1.00 ns	1.00 ns	1.00 ns	1.00 ns
Antica (100 ml/100 li water)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Antica (200 ml/100 li water)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Antica (300 ml/100 li water)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Antica (400 ml/100 li water)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Amistar (80 ml/100 li water)	1.00	1.00	1.00	1.00	1.00	1.00	1.00

[1]Phytotoxic effect was evaluated using the following scale:

1 - no visible phytotoxicity
3 - 1 to 10% injury
5 - 11 to 20% injury
7 - 21 to 40% injury
9 - 41 to 50% injury

ns- not significant

DAFI - days after flower induction

Table 9. Panicle size of 'Carabao' mango applied with different treatments of fungicide.

Treatment	22 DAFI		28 DAFI	
	Width (cm)	Length (cm)	Width (cm)	Length (cm)
Control (water)	4.98 ns	16.69 ns	12.01 ns	24.17 ns
Antica (100 ml/100 li water)	6.92	20.72	17.51	30.06
Antica (200 ml/100 li water)	5.99	18.87	14.77	28.78
Antica (300 ml/100 li water)	6.17	17.98	13.88	26.71
Antica (400 ml/100 li water)	7.39	20.18	15.86	29.70
Amistar (80 ml/100 li water)	7.77	22.23	16.57	32.18

ns - not significant

DAFI - days after flower induction

Table 10. Panicle classification of 'Carabao' mango applied with different treatments of fungicide.

Treatment	Single (%)	Multiple (%)
Control (water)	80.00 ns	20.00 ns
Antica (100 ml/100 li water)	73.00	27.00
Antica (200 ml/100 li water)	91.00	9.00
Antica (300 ml/100 li water)	90.00	10.00
Antica (400 ml/100 li water)	94.00	6.00
Amistar (80 ml/100 li water)	90.00	10.00

ns- not significant

Fruit set and retention. Fungicides play an important role in minimizing fruit drop by protecting the fruits from disease infection. Other factors like water availability, nutrition and weather conditions have also to be considered. Occasional rainfall was experienced throughout the conduct of the study due to slight La Niña phenomenon experienced by the country. At full bloom stage, pollinators were observed on each tree and ranged from 11.31 to 12.06 pollinators counted per quadrant (East-West and North-South direction) per tree (Table 11). These include wasps, bees, moths and flies. Spray application of foliar fertilizers also increased fruit retention, however at 45 DAFI fruit setting was quite low, ranging from 0.13 to 0.63 fruitlet per panicle. This could be attributed to the heavy rainfall experienced during full bloom to fruit setting stage (see Appendix 1) and high incidence of anthracnose on flowers. Based on statistical analysis, ANTICA (400 ml/100 li water) treated trees had the highest fruit setting (0.63 fruit per panicle) which is comparable to all other treated trees except for control. However, lower dose of ANTICA (300, 200 and 100 ml/ 100 li water) and Amistar were not significantly different compared to untreated trees.

Retention of the fruits at 55 DAFI was almost the same. Fruits were as size of chicken's egg and the trend did not vary.

At 65 DAFI, fruits continue to enlarge. Fruit retention of trees sprayed with ANTICA 400 ml/100 li water slightly decreased to 0.60 fruits per panicle wherein variations compared to ANTICA 300 and 200 ml/100 li water and Amistar sprayed trees were not significant. Moreover, all treated trees except the highest dose of ANTICA were comparable with the untreated trees having the lowest fruit retention of 0.13 fruit per panicle. The same trend and observation was noted on fruit retention at 75 DAFI.

Yield from 25 tagged panicles. Table 12 presents the average number, weight and quality of harvested fruits from 25 randomly selected panicles. Trees applied with ANTICA at 400 ml/100 li water had the highest number of fruits (14.50 pcs) harvested in 25 randomly tagged panicles. This number of fruits harvested was comparable to the next two higher doses of ANTICA and Amistar but higher to the lowest dose of ANTICA and control. In terms of weight, ANTICA at 400 ml/100 li water has the highest yield of harvested fruits at 4.09 kg and was significantly different from untreated trees (1.07 kg/25 panicles) but not on trees sprayed with other treatments.

Fruit quality classification revealed that percentage of marketable fruits was higher than non-marketable. Trees sprayed with Amistar had the highest marketable fruits (93.22%) which were comparable with the different doses of ANTICA, however trees applied with ANTICA 300 and 100 ml/100 li water were not significantly different compared to untreated trees (42.50%).

Trees sprayed with ANTICA at 400 ml/100 li water gave the highest marketable fruits at 3.72 kg compared to control and lowest rate of ANTICA but not on the other treatments applied. Control trees has the lowest marketable fruits (0.83 kg) comparable to lower rates of ANTICA.

Non-marketable fruits on the other hand, ranged from 6.79 to 57.50 percent and weighed between 0.09 to 0.60 kg. Analysis of variance showed no significant differences among the treatment means. Non-marketability was due to undersized, deformed, mechanical damage and insect infestations.

Table 11. Pollinators observed at full bloom stage, fruit setting and retention of 'Carabao' mango applied with different treatments of fungicide.

Treatment	No. of Pollinators	Fruit Setting (45 DAFI)	Fruit Retention		
			55 DAFI	65 DAFI	75 DAFI
Control (water)	11.31 [ns]	0.13 [b]	0.13 [b]	0.13 [b]	0.13 [b]
Antica (100 ml/100 li water)	11.38	0.22 [ab]	0.22 [ab]	0.22 [b]	0.21 [b]
Antica (200 ml/100 li water)	11.56	0.62 [ab]	0.56 [ab]	0.36 [ab]	0.25 [ab]
Antica (300 ml/100 li water)	12.06	0.31 [ab]	0.30 [ab]	0.29 [ab]	0.27 [ab]
Antica (400 ml/100 li water)	12.00	0.63 [a]	0.62 [a]	0.60 [a]	0.48 [a]
Amistar (80 ml/100 li water)	11.69	0.33 [ab]	0.33 [ab]	0.33 [ab]	0.33 [ab]

Data were transformed to square root of (x + 0.50)

ns - not significant

In column, means having similar superscripts are not significant at 5% level using LSD.

DAFI - days after flower induction

Table 12. Average number, weight and quality of harvested fruits from 25 randomly tagged panicles of 'Carabao' mango applied with different treatments of fungicide.

Treatment	Total fruits harvested		Marketable					Non-marketable	
	No. (pcs)	Weight (kg)	No. (%)	Weight (kg)	Small (190-240g) (%)	Medium (241-289g) (%)	Large (290g - up) (%)	No. (%)	Weight (kg)
Control (water)	3.75 [c]	1.07 [b]	42.50 [b]	0.83 [c]	27.27 [ns]	54.55 [ns]	18.18 [ns]	57.50 [ns]	0.25 [ns]
Antica (100 ml/100 li water)	6.00 [bc]	1.96 [ab]	75.80 [ab]	1.54 [bc]	53.13	26.34	20.54	24.22	0.42
Antica (200 ml/100 li water)	9.25 [abc]	2.84 [ab]	85.00 [a]	2.39 [abc]	38.33	21.67	40.00	15.00	0.45
Antica (300 ml/100 li water)	7.25 [abc]	2.59 [ab]	77.23 [ab]	1.99 [abc]	31.79	13.93	54.29	22.77	0.60
Antica (400 ml/100 li water)	14.50 [a]	4.09 [a]	84.92 [a]	3.72 [a]	18.95	36.54	46.51	15.09	0.37
Amistar (80 ml/100 li water)	11.75 [ab]	3.29 [ab]	93.22 [a]	3.20 [ab]	22.16	59.95	17.89	6.79	0.09

Data were transformed to square root of (x + 0.50)

ns- not significant

In column, means having similar superscripts are not significant at 5% level using LSD.

Size classification (small, medium and large) was done on marketable fruits and expressed as percentage. Fruits weighing 190-240 grams were considered small, while those that weighed 241-289 grams and 290 grams and higher were classified as medium and large size, respectively. Analysis showed that variations among treatment means were not significant. Small, medium and large fruits ranged from 18.95 to 53.13, 13.93 to 59.95 and 17.89 to 54.29 percent, respectively.

Effects of pre-harvest application of different fungicides on the latent infection of post-harvest diseases. Table 13 presents the latent infection of anthracnose (incidence and severity) developed on the surface of harvested mango fruits. Signs of anthracnose manifested on several fruits at 3 days after harvest (DAH). Infected fruits, showed small, pinhead to circular black lesions of about 0.5 mm in diameter. It was observed only on fruits from control and ANTICA at 200 ml/100 li water sprayed on trees.

Anthracnose becomes prominent on the fruits surfaces at 5 DAH. Circular black spots coalesced to form bigger spots. Moreover, several fruits were infected and new lesions started to appear. This symptom was observed more on fruits harvested from control trees (40.0%) which were comparable to fruits harvested from ANTICA sprayed trees. However, fruits coming from trees sprayed with Amistar have no observed sign of incidence. Severity of infection per fruit also showed that fruits from Amistar applied trees had no infection (rating of 1). Though higher severity rating of 2.5 (1 to 10 % infection per fruit) was observed on fruits from control trees the rest of the treatments have the same infection rating. The same trend was observed at 7 DAH but incidence and severity also increases.

The typical symptoms of anthracnose infection one sees in the market appeared at 9 DAH. This is so because the fruit losses its actual resistance upon ripening. Fruits of trees sprayed with ANTICA at 400 ml/100 li water and Amistar have lower incidence of 37.50 and 25.00 percent, respectively. The rest of the treatments have comparable results ranging from 75.00 to 80.00 percent incidence. The trend on severity was the same, such that fruits from ANTICA (400 ml/100 li water) and Amistar treated trees had lesser severity of 1 to 10 percent infection, while the rest of the treatments have 11 to 20 percent infection.

Incidence and severity of infection of diplodia stem-end rot on fruits was not observed at 3 DAH (Table 14). Sign of infection was observed at 5 DAH and its incidence and severity was very low with 0 to 7.50 percent and 1.00 to 1.20 rating (0 to 10% infection), respectively. The trend was somewhat the same at 7 DAH, however, incidence of fruit infection have slight increase that ranged from 0 to 10.00 percent.

At 9 DAH, diplodia stem-end rot incidence increased ranging from 17.50 to 35.00 percent. None of the treatments have shown to reduce the incidence of the disease. Based on severity rating, fruits harvested from all treated trees including the control have 1 to 10 percent infection per fruit.

Fruit evaluation (external and internal). Fruit characteristics evaluation (external and internal) done at 9 DAH were shown on Table 15. External characteristics showed that peel color at harvest were pale green while on table ripe stage were yellow to orange yellow.

Internal characteristics evaluation revealed that flesh of table ripe fruits have yellow to orange yellow color. On the other hand, total soluble solids (TSS) and edible portion ranged from 15.39 to 17.58 ^{o}Brix and 70.36 to 74.01 percent, respectively. Data showed that the variations on fruit characteristics were almost similar. This suggests that the fungicides used in this study have no significant effects on the quality of harvested fruits both on external and internal attributes.

Table 13. Incidence and severity of latent infection of anthracnose developed on the surface of harvested mango fruits.

Treatment	3 DAH		5 DAH		7 DAH		9 DAH	
	Incidence (%)	Severity[1]	Incidence[2] (%)	Severity[1]	Incidence[2] (%)	Severity[1]	Incidence (%)	Severity[1]
Control (water)	5.00 [ns]	1.10	40.00 [a]	2.45	47.50 [a]	3.25	80.00 [a]	4.65
Antica (100 ml/100 li water)	0.00	1.00	37.50 [a]	1.80	50.00 [a]	2.35	77.50 [a]	3.80
Antica (200 ml/100 li water)	2.50	1.05	30.00 [a]	1.65	40.00 [ab]	2.45	80.00 [a]	4.35
Antica (300 ml/100 li water)	0.00	1.00	17.50 [ab]	1.35	32.50 [ab]	1.90	75.00 [a]	3.55
Antica (400 ml/100 li water)	0.00	1.00	17.50 [ab]	1.40	27.50 [ab]	1.90	37.50 [b]	1.95
Amistar (80 ml/100 li water)	0.00	1.00	0.00 [b]	1.00	10.00 [b]	1.20	25.00 [b]	1.50

[1]Disease severity was evaluated using the following scale:

1 - no infection on fruits
3 - presence of 1 to 10% infection on fruits
5 - presence of 11 to 20% infection on fruits
7 - presence of 21 to 30% infection on fruits
9 - presence of 31 to 40% infection on fruits
11 - presence of 41 to 50% infection on fruits
13 - presence of greater than 50% infection on fruits

[2]Data were transformed to square root of (x + 0.50)

ns- not significant

In column, means having similar superscripts are not significant at 5% level using LSD.

DAH - days after harvest

Table 14. Incidence and severity of latent infection of stem-end rot developed on the surface of harvested mango fruits.

Treatment	3 DAH		5 DAH		7 DAH		9 DAH	
	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]	Incidence (%)	Severity[1]
Control (water)	0.00 [ns]	1.00	7.50 [ns]	1.20	7.50 [ns]	1.50	20.00 [ns]	2.55
Antica (100 ml/100 li water)	0.00	1.00	0.00	1.00	0.00	1.00	22.50	2.95
Antica (200 ml/100 li water)	0.00	1.00	5.00	1.10	5.00	1.20	35.00	2.85
Antica (300 ml/100 li water)	0.00	1.00	0.00	1.00	2.50	1.05	30.00	2.45
Antica (400 ml/100 li water)	0.00	1.00	5.00	1.15	2.50	1.45	17.50	1.85
Amistar (80 ml/100 li water)	0.00	1.00	5.00	1.10	10.00	1.65	22.50	2.00

[1]Disease severity was evaluated using the following scale:

1 - no infection on fruits
3 - presence of 1 to 10% infection on fruits
5 - presence of 11 to 20% infection on fruits
7 - presence of 21 to 30% infection on fruits
9 - presence of 31 to 40% infection on fruits
11 - presence of 41 to 50% infection on fruits
13 - presence of greater than 50% infection on fruits

ns- not significant

DAH - days after harvest

Table 15. External and internal characteristics of 'Carabao' mango applied with different treatment of fungicide.

Treatment	External Characteristics		Internal Characteristics		
	Peel Color		Flesh color	TSS (^{o}Brix)	Edible Portion (%)
	At harvest	Table ripe stage			
Control (water)	2.10	3.65	3.75	17.58 ^{ns}	71.69 ^{ns}
Antica (100 ml/100 li water)	1.15	3.80	3.95	16.11	73.83
Antica (200 ml/100 li water)	1.20	3.60	3.70	16.29	74.01
Antica (300 ml/100 li water)	1.25	3.85	3.85	15.39	72.33
Antica (400 ml/100 li water)	1.35	3.80	3.80	16.28	73.58
Amistar (80 ml/100 li water)	1.15	3.90	4.20	17.17	70.36

Rating:

Peel color at harvest (PHTRC, UPLB)

1-2 - pale green
3-4 - green
5 - dark green

Peel color at ripe stage and flesh color (NSIC)

1-2 - pale yellow
3-5 - yellow to orange yellow

ns - not significant

TSS - total soluble solids

SUMMARY AND CONCLUSION

Based on the observed data gathered, flowering intensity of trees used in this study were high (50.00 to 82.50%). This allowed ample number of panicles as samples for data collections.

Anthracnose infection on leaves was not observed, however, sign of infection was observed on the flowers. Early observations (22 and 28 DAFI) showed that the two highest rate of ANTICA (300 and 400 ml/100 li water) were comparable to Amistar in reducing the incidence and severity of anthracnose infection on flower panicles. However, protection of flowers at 33 DAFI was not maintained by the different rates of ANTICA and Amistar having a 100 percent incidence of infection in all sampled panicles. Moreover, severity of infection showed that all the treatments used have a rating of more than 50 percent per panicle except on Amistar treated trees having a rating of 41 to 50 percent anthracnose infection per panicle.

The inflorescence and fruits were more susceptible to scab than on leaves. Presence of scab on leaves was not observed at 22, 28 and 33 DAFI. Application of fungicidal treatments on flowering trees at 16 and 26 DAFI did not spared the inflorescence to scab infection, but ANTICA at 400 ml/100 li water treated trees had the lowest incidence at 88.00 percent. Disease severity rating per panicle falls between 11 to 20 percent infections in all treatments used. Though, flower panicles were 100 percent infected with scab at 33 DAFI, severity of infection per panicle was low (41 to 50% infection) on trees treated with ANTICA at 200 to 400 ml/100 li water and Amistar compared to untreated trees and lowest rate of ANTICA (> 50% infection).

At fruiting stage, twice fungicidal treatments application were done (45 and 65 DAFI) yet, presence of scab infection was observed at 60 DAFI up to harvest (118 DAFI). At 60 and 80 DAFI, ANTICA at 400 ml/100 li water and Amistar sprayed trees maintained a lower incidence and severity of scab infection. However, at 100 and 118 DAFI, effects of the different treatments were no longer potent, thus incidence reached to as high as 90 to 100 percent of the sampled fruits. On the other hand, Amistar and ANTICA at 400 ml/100 li water sprayed trees had the lowest severity rating of 11 to 20 percent scab infection per fruit while the rest of the treatments had an infection of 21 to 30 percent per fruit.

Phytotoxic rating done on leaves, flowers and fruits of mango 3 days after each treatment application showed no signs of any phytotoxic symptoms. In addition, panicle size (length and width) gathered at different stages of flower development had no significant variations. Data further revealed that fungicides tested have no significant effect on leaves and fruit development, thus, safe to use for mango.

Fruit set and retention are controlled by different factors other than fungicides, i.e. edaphic, environmental and biological. In this study, pollinators were abundant ranging from 11.31 to 12.06 per quadrant (taken at East-West and North-South direction) per tree. Foliar fertilization was applied twice during flower and fruit development to increase fruit retention. Despite of the proper management, effect of rainfall during full bloom to fruit setting triggered the development of anthracnose disease affecting fruit setting. At 75 DAFI, trees sprayed with ANTICA at 400 ml/100 li water protected the developing fruits and retained more fruits (0.48) per panicle which was comparable to ANTICA at 300 and 200 ml/100 li water and Amistar sprayed trees.

The highest yield obtained from 25 randomly sampled panicles was on ANTICA at 400 ml/100 li water sprayed trees (14.50 pcs with 4.093 kg). This yield did not vary to the yield of trees applied with Amistar and ANTICA at 300 and 200 ml/100 li water.

Trees sprayed with Amistar produced more marketable fruits (93.22%) which were comparable with the different rates of ANTICA. Untreated trees had the lowest marketable fruits (42.50%) which did not vary from trees sprayed with ANTICA at 300 and 100 ml/100 li water.

Weight of marketable fruits from trees sprayed with ANTICA (400 ml/100 li water) were higher (3.725 kg) compared to control and lowest rate of ANTICA but not on other treatments used. Size classification of marketable fruits as to small, medium and large did not have any significant variations.

Non-marketable fruits on the other hand also gave comparable results in terms of percentages and weights. Causes of non-marketable fruits were undersized, deformed, mechanical damage and fruits infested with insects.

Latent infection of anthracnose diseases manifested as early as 3 DAH. Disease incidence and severity progressed as the fruits ripens and losses its resistance. At 9 DAH, trees sprayed with highest rate of ANTICA and Amistar had the lowest incidence (37.50 and 25.00%) and severity rating (1 to 10 % infection per fruit). The rest of the treatments have more than 75.00 percent incidence and severity rating per fruit of 11 to 20 percent infection.

Diplodia stem-end rot incidence and severity of infection manifested at 5 DAH. The percentage of incidence up to 9 DAH were statistically the same in all treatments (17.5 to 35.00%) having a severity of 1 to 10 percent infection per fruit.

Fruit evaluation done (external and internal) at 9 DAH revealed that fruit characteristics were almost similar.

From the result of the study, it can be concluded that higher rate of ANTICA (400 ml/100 li water) was comparable to Amistar at recommended rate in minimizing the incidence and severity of anthracnose and scab on mango. It is recommended further that ANTICA at 400 ml can be applied to flowering and fruiting mango without affecting their development and growth. Beneficial insects like pollinators were also not deterred by the chemicals used to attract on flowers during full bloom stage. Further studies should also be carried out in terms of frequency of application to maximize its effect on the target diseases.

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APPENDICES

Appendix 1. Average temperature, relative humidity, total rainfall and number of rainy days (January to June, 2011).

Month	Average Temperature (^{o}C)		Average Relative Humidity (%)	Total Rainfall (mm)	Total Number of Rainy Days	Remarks
	Minimum	Maximum				
January	22.93	26.84	92.58	205.40	10	
February	23.50	28.33	70.95	54.50	7	
March	23.86	27.98	92.29	262.40	16	
April	24.83	30.07	87.86	6.00	1	
May	25.42	29.54	91.96	379.60	15	
June*	25.51	29.49	93.77	358.90	19	

*Data as of June 23, 2011.

Appendix 2. Flowering trees used in the experiment.

Untreated (control)

Antica (100 ml/100 li. water)

Antica (200 ml/100 li. water)

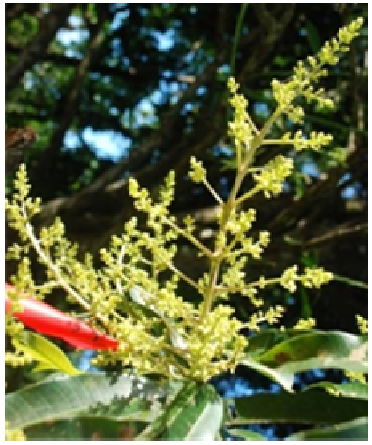
Antica (300 ml/100 li. water)

Antica (400 ml/100 li. water)

Amistar (80 ml/100 li. water)

Appendix 3. Flower panicle of experimental trees applied with different treatment of fungicides.

Untreated (control)



Antica (100 ml/100 li. water)

Antica (200 ml/100 li. water)

Antica (300 ml/100 li. water)

Antica (400 ml/100 li. water)

Amistar (80 ml/100 li. water)

Appendix 4. Infection of scab on flower panicles at 26 days after flower induction (DAFI).

Untreated (control)

Antica (100 ml/100 li. water)

Antica (200 ml/100 li. water)

Antica (300 ml/100 li. water)

Antica (400 ml/100 li. water)

Amistar (80 ml/100 li. water)

Appendix 5. Anthracnose infection on flower panicles of experimental trees after a heavy rainfall during full bloom stage.

Untreated (control)

Antica (100 ml/100 li. water)

Antica (200 ml/100 li. water)

Antica (300 ml/100 li. water)

Antica (400 ml/100 li. water)

Amistar (80 ml/100 li. water)

Appendix 6. Fruit setting on different treatment.

Untreated (control)

Antica (100 ml/100 li. water)

Antica (200 ml/100 li. water)

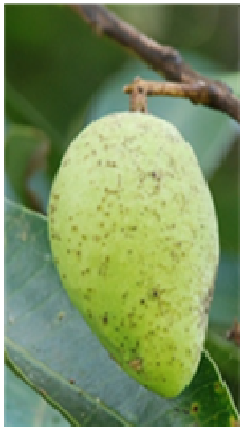
Antica (300 ml/100 li. water)

Antica (400 ml/100 li. water)

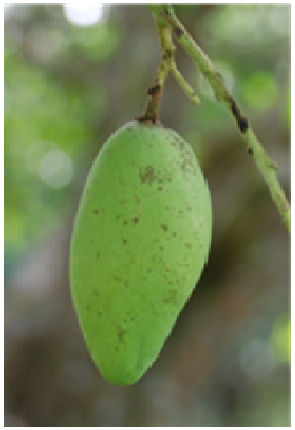
Amistar (80 ml/100 li. water)

Appendix 7. Scab infection on fruits (80 DAFI) of 'Carabao' mango applied with different treatment of fungicides.

Untreated (control)

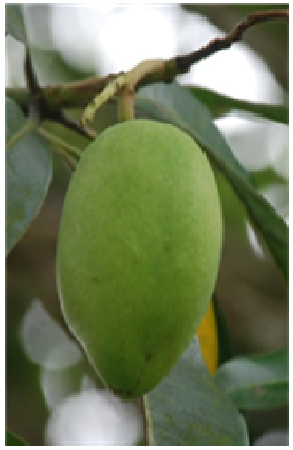


Antica (100 ml/100 li. water)



Antica (200 ml/100 li. water)

Antica (300 ml/100 li. water)



Antica (400 ml/100 li. water)

Amistar (80 ml/100 li. water)

Appendix 8. Harvested fruits of trees applied with different treatment of fungicides.

Untreated (control)

Antica (100 ml/100 li. water)

Antica (200 ml/100 li. water)

Antica (300 ml/100 li. water)

Antica (400 ml/100 li. water)

Amistar (80 ml/100 li. water)

Appendix 9. Anthracnose and stem-end rot infection on fruits at table ripe.

Untreated (control)

Antica (100 ml/100 li. water)

Antica (200 ml/100 li. water)

Antica (300 ml/100 li. water)

Antica (400 ml/100 li. water)

Amistar (80 ml/100 li. water)