



EFFICACY EVALUATION OF METALOSATE TROPICAL™ AS LIQUID FOLIAR FERTILIZER FOR MANGO

Abstract

Metalosate Tropical™, a foliar fertilizer formulation containing chelated macro and micronutrients B, Fe, Mg, Mo and Zn was evaluated on mango in Sariaya, Quezon, during the dry season of January 2015 to May 2015. Result of the study showed that application of Metalosate Tropical™ significantly increased yield of mango. Optimum rate was found to be in the range of 100mL to 150mL per 200L drum applied three times at bud break, pre-bloom and at fruiting setting as follow-up spray to the application of recommended rate of inorganic fertilizer.

INTRODUCTION

Mango (*mangifera indica* L.) is one of the most consumed tropical fruits in the world. This is mainly due to its fine taste and nutritional value. It is considered as the national fruit of the Philippines. Mango fruit industry has a significant contribution to the country's export industry. Philippine mango has established an international niche markets and ranks as third most important fruit crop of the country next to pineapple and banana based on value and volume.

Mangoes in general do not require intensive fertilization because they can survive in poor and infertile soils. However, proper fertilization and maintenance are necessary to stimulate early growth and rapid development of young trees.

To achieve high yield in mango, sufficient application of fertilizer inputs is needed to sustain the plant nutrition. Generally, basal application of fertilizer is subjected to great loss through leaching; denitrification; volatilization and other processes. Thus, alternative methods should be sought to increase percent recovery of the crops. The use of foliar sprays a method of supplying nutrients to some crops has gained popularity in recent years. This method is effective since the nutrients can penetrate rapidly and readily absorbed through plant leaves. Foliar application of fertilizer has been used principally for quick recovery from nutrient deficiency and efficacy.

Metalosate Liquid Foliar Fertilizer blends from Albion Plant Nutrition Inc., are designed for the plants to prevent or correct nutrient deficiencies that may limit crop growth and yields. Albion's unique patented manufacturing process and formulations use amino acids in their chelation technology that ensures the plants to get the most readily available and absorbable, highest quality nutrition elements. Since amino acids are the basic building blocks of protein found in all living organisms, the chelation of minerals with amino acids provides a tremendous advantage in the efficiency of absorption and translocation of minerals within plants.

Metalosate Tropical™ Liquid Foliar Fertilizer is a variant of the Metalosate Liquid Fertilizer product line. It is a blend of well-balanced nutrients containing 1.0 % B, 0.66% Fe, 0.5% Mg, 0.1% Mo,

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and 2.0% Zn. The formulation of this product is suited for the nutrient requirement for growing mango.

Jocanima Corporation, a leading Filipino owned agrochemical corporation in collaboration with Albion Plant Nutrition from Utah, USA, will register and introduce Metalosate Tropical™ liquid foliar fertilizer and its novel technology to the Filipino farmers. Therefore, this trial was established with the following objectives:

- 1) Evaluate the efficacy of Metalosate Tropical™ Liquid Foliar Fertilizer on Mango.
- 2) To compare the efficacy of Metalosate Tropical™ Liquid Foliar Fertilizer with the commercial inorganic fertilizers used;
- 3) Determine the effect of different application rates of Metalosate Tropical™ Liquid Foliar Fertilizer in combination with commercial inorganic fertilizers used;
- 4) Generate the bio-efficacy data to support the registration of
- 5) Metalosate Tropical™ Liquid Foliar Fertilizer Supplement with Fertilizer and Pesticide Authority (FPA)

MATERIALS AND METHOD

The study was conducted in Manggalang, Bantilan, Sariaya, Quezon from Jan 20-21, 2015 to May 2015. Area is a broad alluvial plane with excellent internal drainage and irrigation obtained from ground water. The soil is sandy loam belonging to Sariaya series derived from volcanic deposits. Soil sample was collected on November 2014 and laboratory analysis results is shown in Table 1.

Mango trees (Carabao or Manila Super Mango variety) aged 15 years, of uniform size and flowering intensity were used in the study, only treatment trees received the inorganic fertilizer of five (5) kilos of 14-14-14 fertilizer per tree. On Jan 20-21, 2015 the trees were sprayed with flower inducer (2% potassium nitrate [KNO₃]).

The following standard treatments, as per FPA Guidelines, for Foliar Applied Liquid Fertilizer (Micronutrients) were used:

T ₁	No Fertilizer Control	
T ₂	Recommended rate of inorganic fertilizer	RRIF
T ₃	RRIF + ½ Recommended rate of MetalosateTropical™	RRIF + 0.5rr Tr
T ₄	RRIF + Recommended rate of MetalosateTropical™	RRIF + 1.0rr Tr
T ₅	RRIF + 1½ Recommended rate of MetalosateTropical™	RRIF + 1.5rr Tr
T ₆	Recommended rate of MetalosateTropical™	1.0rr Tr

The six (6) treatments were laid out in a randomized complete block design with 2 quadrant sample area per tree, replicated 4 times for a total of 12 trees. From each quadrant, sample of 20

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shoots were tagged. Ten (10) shoots were used for data gathering. The data were analyzed using the analysis of variance (ANOVA) technique for comparison of treatment means using the Duncan's Multiple Range Test (DMRT).

The foliar fertilizer was applied on the respective treatments using power sprayer (Picture 1). The rate and time of application were described in Table 2. The first application of foliar spray was made on Jan 30, 2015 at bud break and on Feb 12, 2015 at pre-bloom stage and at fruit setting on Feb 19, 2015.

Harvesting of mango fruits was done on May 14, 2015. All harvested fruits from each tree were placed separately in containers and kept away from direct sunlight prior to counting and weighing. Thirty (30) fruits were used as samples from the bulk harvested fruits for each treatment replicate. Each sample were weighed then averaged.

RESULTS AND DISCUSSION

Environmental conditions were generally favorable during the duration of the experiment. There were no adverse weather disturbances during the duration of the trial. The strategic location of the trial site including the physical improvements such as wind breaks protected the mango plants from occasional thunderstorms and strong winds during the reproductive stage. Likewise, pest and disease incidence were very minimal and was properly managed.

Fruit count and fruit weight per panicle

There was significant difference in fruit count and fruit weight per panicle among the treatments (Table 3, Figure 1, Figure 2).

Mango panicles applied with 1.5 recommended rate of Metalosate Tropical™ (Treatment 5) as follow-up spray to recommended rate of inorganic fertilizer gave the highest average number of fruits (2.78 fruits) and heaviest fruit weight per panicle (0.67 kg) while application of 1.0 recommended rate of Metalosate Tropical™ produced an average of 2.30 fruits per panicle and 0.51 kg fruit weight per panicle. Average fruit weight and fruit count per panicle for both treatments are significantly higher than those panicles applied only with recommended rate of inorganic fertilizer. Lowest fruit weight and fruit count per panicle was gathered from the untreated control.

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Fruit weight

Average fruit weight results show significant increase among different treatments (Table 4, Figure 3). Substantial increase in average fruit weight from treatments applied with different rates of Metalosate Tropical™ as follow up spray to the recommended rate of inorganic fertilizer (Treatments 3, 4 and 5) was observed when compared to the fruits applied only with the recommended rate on inorganic fertilizer. (Treatment 2). Treatment 5 (RRIF + 1.5 rr Metalosate Tropical™), has the highest average fruit weight at 0.24 kg/fruit while untreated control had the lowest fruit weight at 0.13 kg/fruit.

Marketable yield

Marketable yield (kg)/tree of all treatments were summarized in Table 4 and Figure 4. The resulting yield of all treatments show significant differences among treatments.

Application of recommended rate of Metalosate Tropical™ as follow-up spray to recommended rate of inorganic fertilizer (Treatment 4) produced an average marketable yield of 435 Kg/ tree which is significantly better than control (Treatment 1) and application of recommended rate of inorganic fertilizer only (Treatment 2). However, trees applied with 1.5 recommended rate of Metalosate Tropical™ as follow-up spray to recommended rate of inorganic fertilizer (Treatment 5) produced the highest average marketable yield at 604Kg/tree.

Increase in average yield per tree from different rates of Metalosate Tropical™ was tabulated in Table 5 to clearly compare yield advantages of treatments applied with Metalosate Tropical™ over the conventional practice. It was noted from the results that Metalosate Tropical™ used at recommended rate as follow up spray to the recommended rate of inorganic fertilizer increased yield by 40.1kg/tree or 10.1%. Application of one and a half recommended rate of Metalosate Tropical™ as follow up spray to the recommended rate of inorganic fertilizer increased the average yield per tree by 208.9 kg or a 51.84%. On the contrary, lower application rate of Metalosate Tropical™ as follow up spray to the recommended rate of inorganic fertilizer did not show increase in yield over recommended rate of inorganic fertilizer.

The above results consistently show that the application of Metalosate Tropical™ at 100mL to 150mL/200L drum as follow up spray with the recommended rate of inorganic fertilizer increased yield of mango.

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SUMMARY AND CONCLUSION

Follow up spray of Metalosate Tropical™ at recommended rate and one and a half recommended rate provided significantly higher number fruits per panicle and average fruit weight per panicle over the application of recommended rate of inorganic fertilizer only.

The treatment applied with recommended rate of Metalosate Tropical™ and with one and a half recommended rate as follow up spray to inorganic fertilizer yielded 435kg/tree and 604kg/tree respectively which is significantly higher than all other treatments.

In conclusion, Metalosate Tropical™ was found to increase yield of mango as follow up spray to the recommended rate of inorganic fertilizer. Effective rate was 100mL - 150mL per 200L drum of water applied at bud break, at pre-bloom stage and at fruit setting.

RECOMMENDATION

Based on the results of the field trial, it is hereby recommended that Metalosate Tropical™ to be granted registration approval on as foliar fertilizer for mango.

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ANNEX 1. TABLES AND FIGURES

Table 1. Soil fertility parameters of the soil in the experimental site.

Soil Property	Value
Total N	1.2%
Extractable P	1.9%
Exchangeable K	2.0%
Extractable S	Not detected
Exchangeable Ca	2.0%
Exchangeable Mg	0.71%
Extractable Fe	0.063%
Extractable B	0.012%
Extractable Co	0.030%

Table 2. Recommended Rate and Timing of Application for Albion Products on Mango.

Product	Recommended Rate (RR)	1 st Application	2 nd Application	3 rd Application
Tropical	0.5 mL per Liter of Water or 100 mL per 200 Liter Drum	Bud Break – around 10-14 Days After Flower Induction	Pre-Bloom – around 21-25 Days After Flower Induction	Fruit Setting – around 33-35 Days After Flower Induction (Optional)

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Table 3. Average number of fruits and weight per panicle at harvest affected by different fertilizer treatments.

Treatment		no. of fruits/pa		wt (kg)/pa	
T1	No Fertilizer Control	1.00	e	0.13	f
T2	With Fertilizer Control (RRIF)	1.35	d	0.24	e
T3	RRIF + 0.5rr Metalosate Tropical™	1.37	d	0.30	d
T4	RRIF + 1.0rr Metalosate Tropical™	2.30	b	0.51	b
T5	RRIF + 1.5rr Metalosate Tropical™	2.78	a	0.67	a
T6	rr Metalosate Tropical™	1.72	c	0.35	c

RRIF = Recommended rate of Inorganic Fertilizer

rr = Recommended rate of Metalosate Tropical™

Table 4. Average fruit weight (kg) and marketable yield per tree at harvest as affected by different fertilizer treatments.

Treatment		wt/pc (kg)		marketable yield (kg)/tree	
T1	No Fertilizer Control	0.13	d	182.2	e
T2	With Fertilizer Control (RRIF)	0.18	c	395.3	c
T3	RRIF + 0.5rr Metalosate Tropical™	0.22	b	391.7	c
T4	RRIF + 1.0rr Metalosate Tropical™	0.22	b	435.4	b
T5	RRIF + 1.5rr Metalosate Tropical™	0.24	a	604.2	a
T6	rr Metalosate Tropical™	0.20	bc	346.7	d

RRIF = Recommended rate of Inorganic Fertilizer

rr = Recommended rate of Metalosate Tropical™

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Table 5. Average Increase in yield (kg) per tree at harvest as affected by different rates of Metalosate Tropical™ fertilizer application.

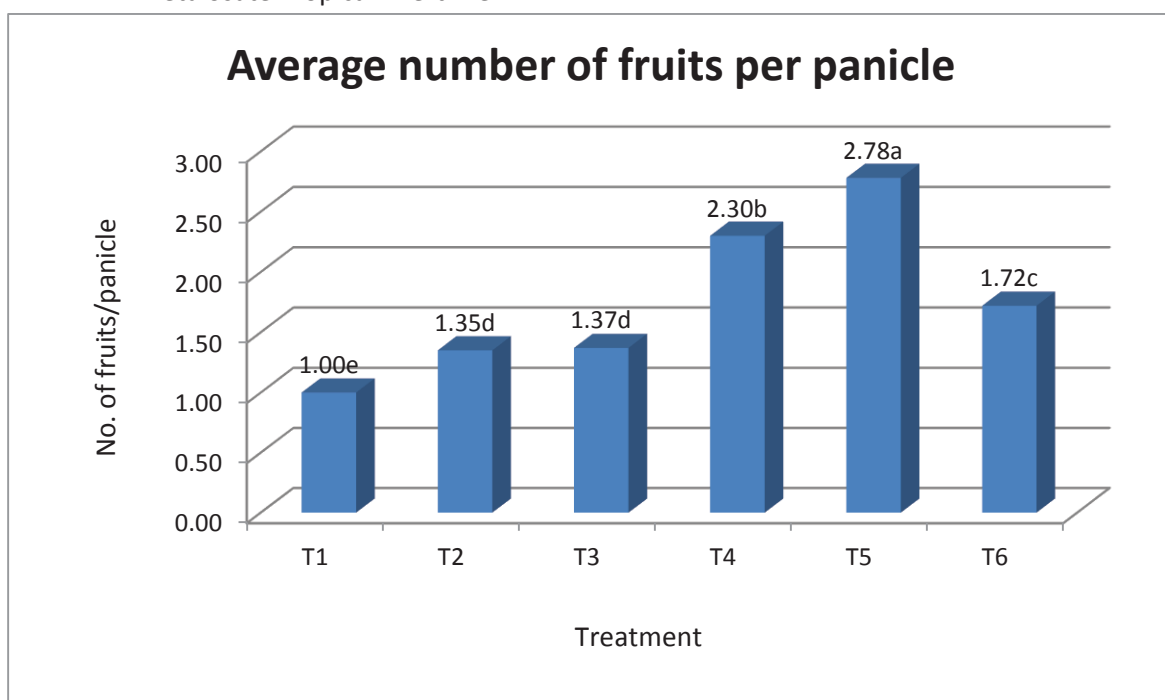
Treatment		Yield/tree		Increase in yield (kg)	Increase in yield (%)
Comparison of RRIF with Different Rates of Metalosate Tropical™ + RRIF	RRIF + 0.5rr Metalosate Tropical™	391.70	c	-	-
	RRIF + 1.0rr Metalosate Tropical™	435.40	b	40.1	10.14
	RRIF + 1.5rr Metalosate Tropical™	604.20	a	208.90	51.84
	RRIF	395.30	c	-	-
Comparison of control with Application of Recommended Rate of Metalosate Tropical™	rr Metalosate Tropical™	346.70	d	164.50	90.28
	Control (No Fertilizer)	182.20	e		

RRIF = Recommended rate of Inorganic Fertilizer

rr = Recommended rate of Metalosate Tropical™

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Figure 1. Average number of fruits per panicle at harvest as affected by different treatments of Metalosate Tropical™ fertilizer.



Legend: T1 – Control

T2 – Recommended Rate of Inorganic Fertilizer (RRIF)

T3 – RRIF + 0.5 rr Tropical™

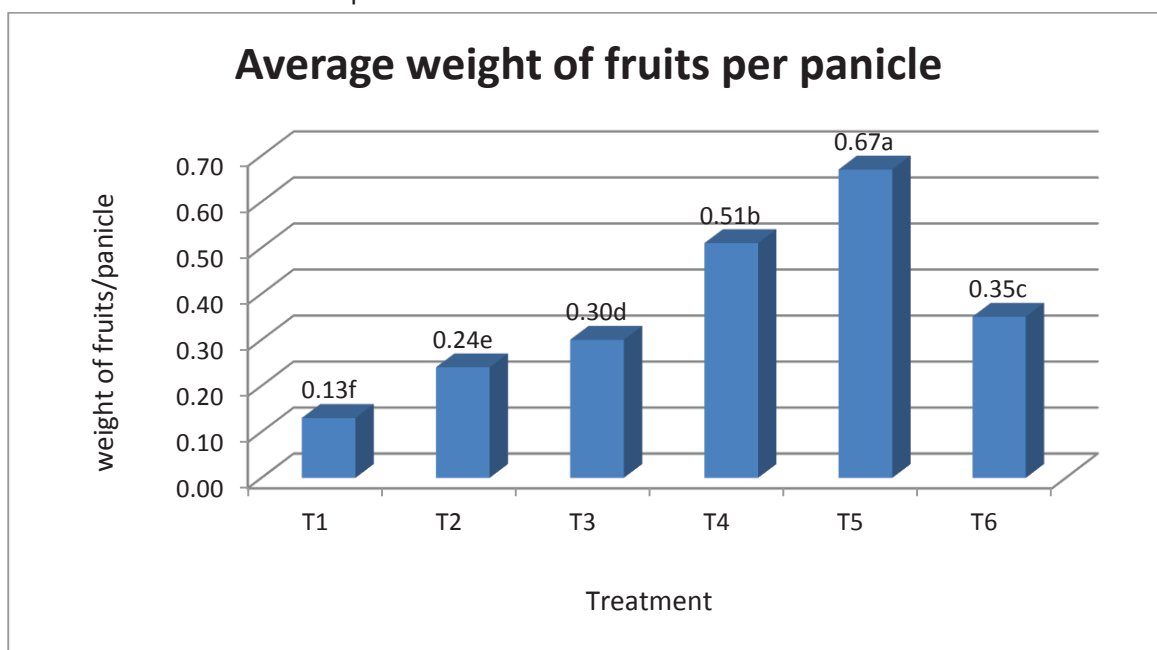
T4 – RRIF + 1.0 rr Tropical™

T5 – RRIF + 1.5 rr Tropical™

T6 – 1.0 rr Tropical™

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Figure 2. Average weight (kg) of fruits per panicle at harvest as affected by different treatments of Metalosate Tropical™ fertilizer.



Legend: T1 – Control

T2 – Recommended Rate of Inorganic Fertilizer (RRIF)

T3 – RRIF + 0.5 rr Tropical™

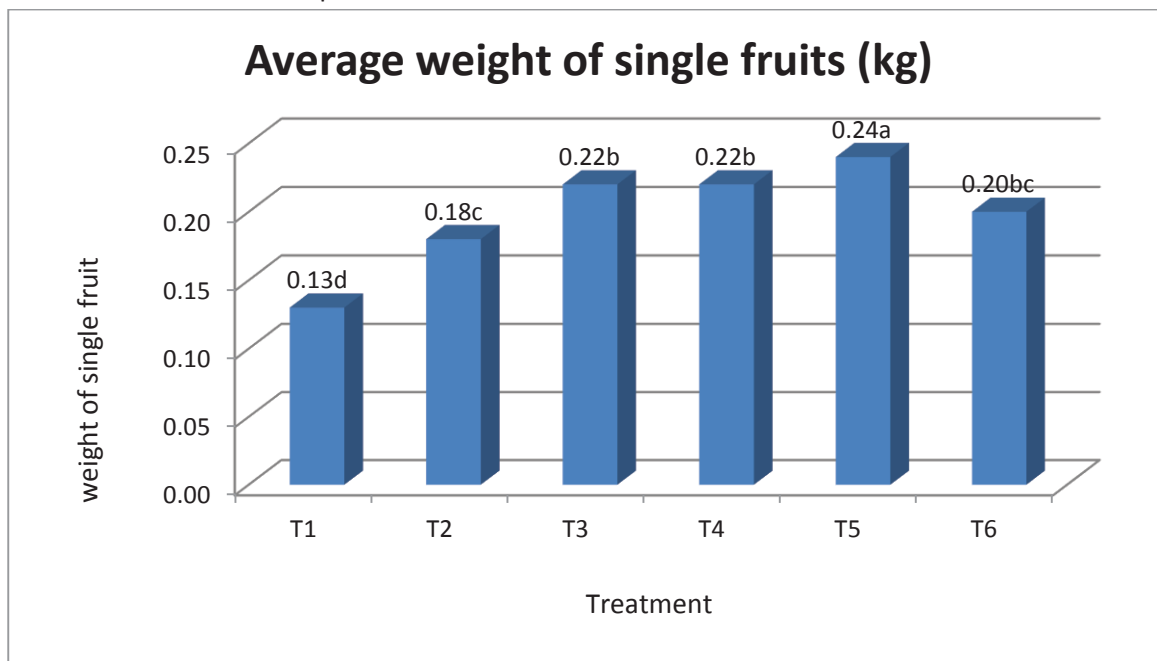
T4 – RRIF + 1.0 rr Tropical™

T5 – RRIF + 1.5 rr Tropical™

T6 – 1.0 rr Tropical™

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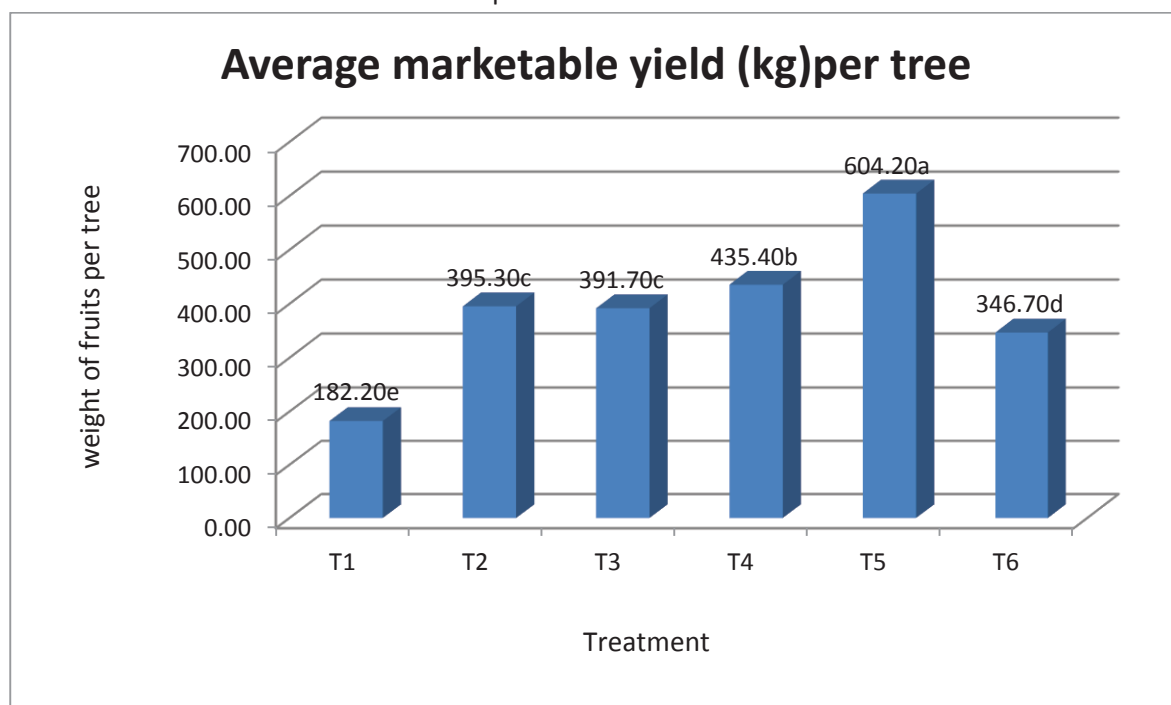
Figure 3. Average weight of single fruit (kg) at harvest as affected by different treatments of Metalosate Tropical™ fertilizer.



- Legend: T1 – Control
T2 – Recommended Rate of Inorganic Fertilizer (RRIF)
T3 – RRIF + 0.5 rr Tropical™
T4 – RRIF + 1.0 rr Tropical™
T5 – RRIF + 1.5 rr Tropical™
T6 – 1.0 rr Tropical™

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Figure 4. Average Marketable Yield of mango (kg/tree) at harvest as affected by different treatments of Metalosate Tropical™.



- Legend:
- T1 – Control
 - T2 – Recommended Rate of Inorganic fertilizer (RRIF)
 - T3 – RRIF + 0.5 rr Tropical™
 - T4 – RRIF + 1.0 rr Tropical™
 - T5 – RRIF + 1.5 rr Tropical™
 - T6 – 1.0 rr Tropical™

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PICTURES



Picture 1. Power Spraying



Picture 2. Bud elongation stage



T1 – Control (No Fertilizer)



T2 – Recommended Rate of Inorganic Fertilizer (RRIF)



T3 – RRIF + ½ Recommended rate of MetalosateTropical™



T4 - RRIF + Recommended rate of MetalosateTropical™



T5 - RRIF + 1½ Recommended rate of MetalosateTropical™



T6 - Recommended rate of MetalosateTropical™