EFFICACY EVALUATION OF METALOSATEMULTIMINERAL™ AS LIQUID FOLIAR FERTILIZER FOR MANGO

Abstract

Metalosate Multimineral™, a foliar fertilizer formulation containing chelated macro and micronutrients B, Cu, Fe, Mg, Mn, Zn and Mo 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 Multimineral™ significantly increased the yield of mango. Optimum rate was found to be 50mL per 200L drum applied two times at fruit development and fruit enlargement stage 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.

Adoracion T. Ilug

Metalosate Multimineral™ 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, O.50% Cu, 0.50% Fe, 1.0% Mg, 0.5% Mn, 0.50% Zn and 0.10% Mo. 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 Multimineral™ 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 Multimineral™ Liquid Foliar Fertilizer on Mango.
2) To compare the efficacy of Metalosate Multimineral™ Liquid Foliar Fertilizer with the commercial inorganic fertilizers used;
3) Determine the effect of different application rates of Metalosate Multimineral™ Liquid Foliar Fertilizer in combination with commercial inorganic fertilizers used;
4) Generate the bio-efficacy data to support the registration of Metalosate Multimineral™ 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 [KNO_3]).

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 MetalosateMultimineral™	RRIF + 0.5rr MM
T_4	RRIF + Recommended rate of MetalosateMultimineral™	RRIF + 1.0rr MM
T_5	RRIF + 1½ Recommended rate of MetalosateMultimineral™	RRIF + 1.5rr MM
T_6	Recommended rate of MetalosateMultimineral™	1.0rr MM

Adoracion T. Hug

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 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 March 11, 2015 at fruit development and at fruit enlargement on April 5, 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 all treatments (Table 3, Figure 1, Figure 2).

Mango panicles applied with 0.5 recommended rate of Metalosate Multimineral™ (Treatment 3) as follow-up spray to recommended rate of inorganic fertilizer gave the highest average number of fruits (1.90 fruits) and heaviest fruit weight per panicle (0.42 kg) while application of 1.0 recommended rate of Metalosate Multimineral™ produced an average of 1.25 fruits per panicle and 0.25 kg fruit weight per panicle. Average fruit weight and fruit count per panicle for 0.5 recommended rate of Metalosate Multimineral™ 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.

Adoracion T. Ilug

Fruit weight

Average fruit weight results summarized in Table 4 and Figure 3. Average fruit weight from treatments applied with different rates of Metalosate Multimineral™ as follow up spray to the recommended rate of inorganic fertilizer (Treatments 3 and 4) were similar when compared to the fruits applied only with the recommended rate of inorganic fertilizer (Treatment 2). Treatment 3 (RRIF + 0.5 rrMetalosate Multimineral™), has the highest average fruit weight at 0.22 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 ½ recommended rate of MetalosateMultimineral™ as follow-up spray to recommended rate of inorganic fertilizer (Treatment 3) produced an average marketable yield of 419.8 kg/ tree which is significantly better than all other treatments. Trees applied with recommended rate of and 1 ½ recommended rate Metalosate Multimineral™ as follow-up spray to recommended rate of inorganic fertilizer (Treatment 4 and 5) produced average marketable yield statistically greater than control without inorganic fertilizer (Treatment 1).

Increase in average yield per tree from different rates of Metalosate Multimineral™ was tabulated in Table 5 to clearly compare yield advantages of treatments applied with Metalosate Multimineral™ over the conventional practice. It was noted from the results that Metalosate Multimineral™ used at 0.5 recommended rate as follow up spray to the recommended rate of inorganic fertilizer increased yield by 24.5kg/tree or 6.18%. Application of one and a half recommended rate of Metalosate Multimineral™ as follow up spray to the recommended rate of inorganic fertilizer did not increase the average yield. On the contrary, recommended application rate of Metalosate Multimineral™ as follow up spray to increased in yield by 33.0kg/tree or 18.1% over the control treatment without inorganic fertilizer.

The above results consistently show that the application of Metalosate Multimineral™ at 50mL/200L drum as follow up spray with the recommended rate of inorganic fertilizer increased yield of mango.

Adoracion T. Ilug

SUMMARY AND CONCLUSION

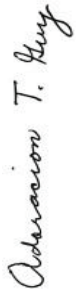
Follow up spray of Metalosate Multimineral ™at one half recommended rate provided significantly higher number fruits per panicle and average fruit weight per panicle over the application of recommended rate of inorganic fertilizer only.

The treatment applied with one half recommended rate of Metalosate Multimineral™ as follow up spray to inorganic fertilizer yielded 419.8kg/tree which is significantly higher than all other treatments.

In conclusion, Metalosate Multimineral™ was found to increase yield of mango as follow up spray to the recommended rate of inorganic fertilizer. Effective rate was at 50mL per 200L drum of water applied at fruit development stage and at fruit enlargement stage.

RECOMMENDATION

Based on the results of the field trial, it is hereby recommended to grant registration approval on Metalosate Multimineral™ as foliar fertilizer for mango.



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)	1st Application	2nd Application
Multimineral	0.5 mL per Liter of Water or 100 mL per 200 Liter Drum	Fruit Development – around 45-55 Days After Flower Induction	Full Fruit Development – around 75-80 Days After Flower Induction

Adoracion T. Reyes

Table 3. Average number of fruits and weight per panicle at harvest as affected by different of Metalosate Multimineral™ fertilizer application.

Treatment		no. of fruits/pa		wt (kg)/pa	
T1	No Fertilizer Control	1.00	d	0.13	d
T2	With Fertilizer Control (RRIF)	1.35	bc	0.26	b
T3	RRIF + 0.5rr Metalosate Multimineral™	1.90	a	0.42	a
T4	RRIF + 1.0rr Metalosate Multimineral™	1.25	c	0.25	b
T5	RRIF + 1.5rr Metalosate Multimineral™	1.42	b	0.20	c
T6	rr Metalosate Multimineral™	1.00	d	0.14	d

RRIF = Recommended rate of Inorganic Fertilizer

rr = Recommended rate of Metalosate Multimineral™

Table 4. Average weight of single fruit (kg) and marketable yield per tree at harvest as affected by different of Metalosate Multimineral™ fertilizer application.

Treatment		wt/pc (kg)		marketable yield (kg)/tree	
T1	No Fertilizer Control	0.133	b	182.2	e
T2	With Fertilizer Control (RRIF)	0.190	a	395.3	b
T3	RRIF + 0.5rr Metalosate Multimineral™	0.220	a	419.8	a
T4	RRIF + 1.0rr Metalosate Multimineral™	0.198	a	336.4	c
T5	RRIF + 1.5rr Metalosate Multimineral™	0.140	b	223.2	d
T6	rr Metalosate Multimineral™	0.140	b	215.2	d

RRIF = Recommended rate of Inorganic Fertilizer

rr = Recommended rate of Metalosate Multimineral™

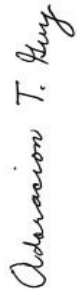


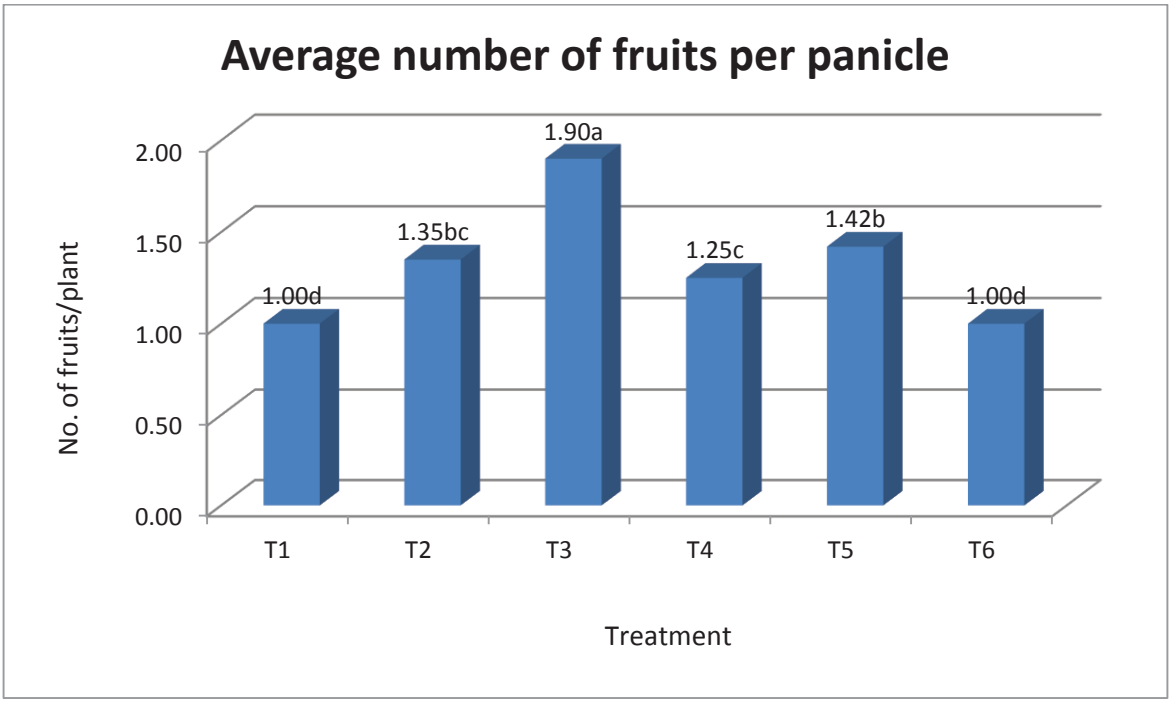
Table 5. Increase in yield (kg) per tree at harvest as affected by different of Metalosate Multimineral™ fertilizer application.

Treatment		Yield/tree		Increase in yield (kg)	Increase in yield (%)
Comparison of RRIF with Different Rates of Metalosate Multimineral™ + RRIF	RRIF + 0.5rr Metalosate Multimineral™	419.80	a	24.50	6.18
	RRIF + 1.0rr Metalosate Multimineral™	336.40	c	-	-
	RRIF + 1.5rr Metalosate Multimineral™	223.20	d	-	-
	RRIF	395.30	b	-	-
Comparison of control with Application of Recommended Rate of Metalosate Multimineral™	rr Metalosate Multimineral™	215.20	d	33.0	18.11
	Control (No Fertilizer)	182.20	e	-	-

RRIF = Recommended rate of Inorganic Fertilizer

rr = Recommended rate of Metalosate Multimineral™

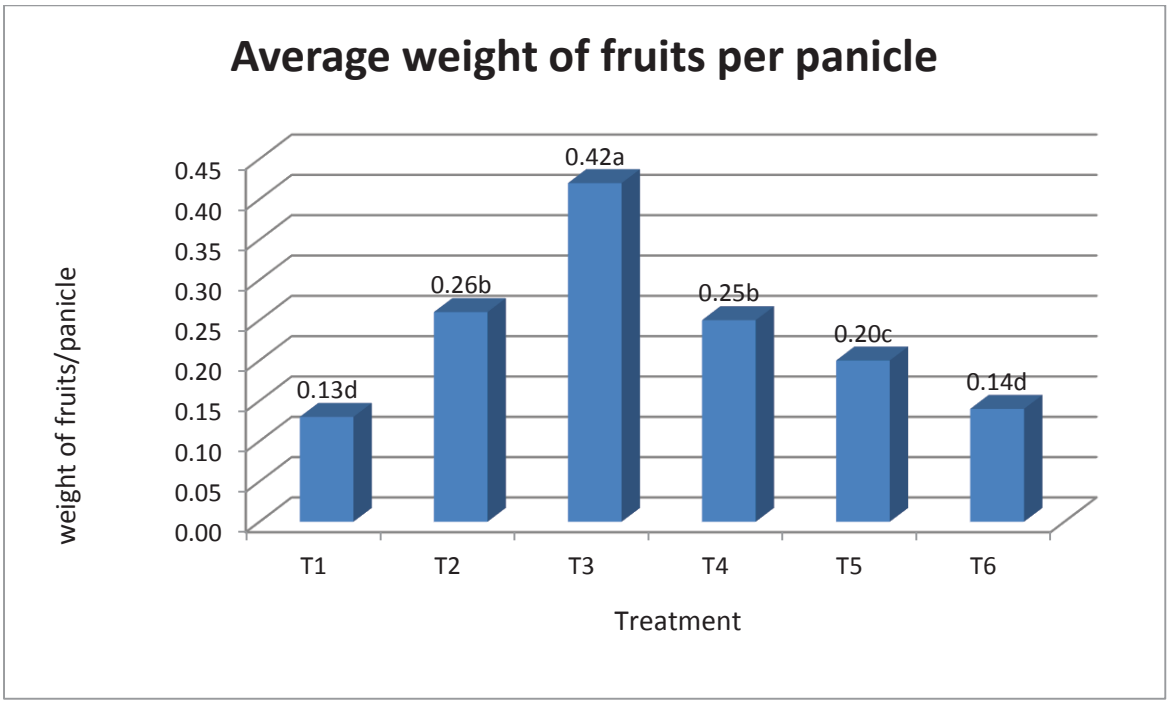
Figure 1. Average number of fruits per panicle at harvest as affected by different treatments of Metalosate Multimineral™ fertilizer.



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

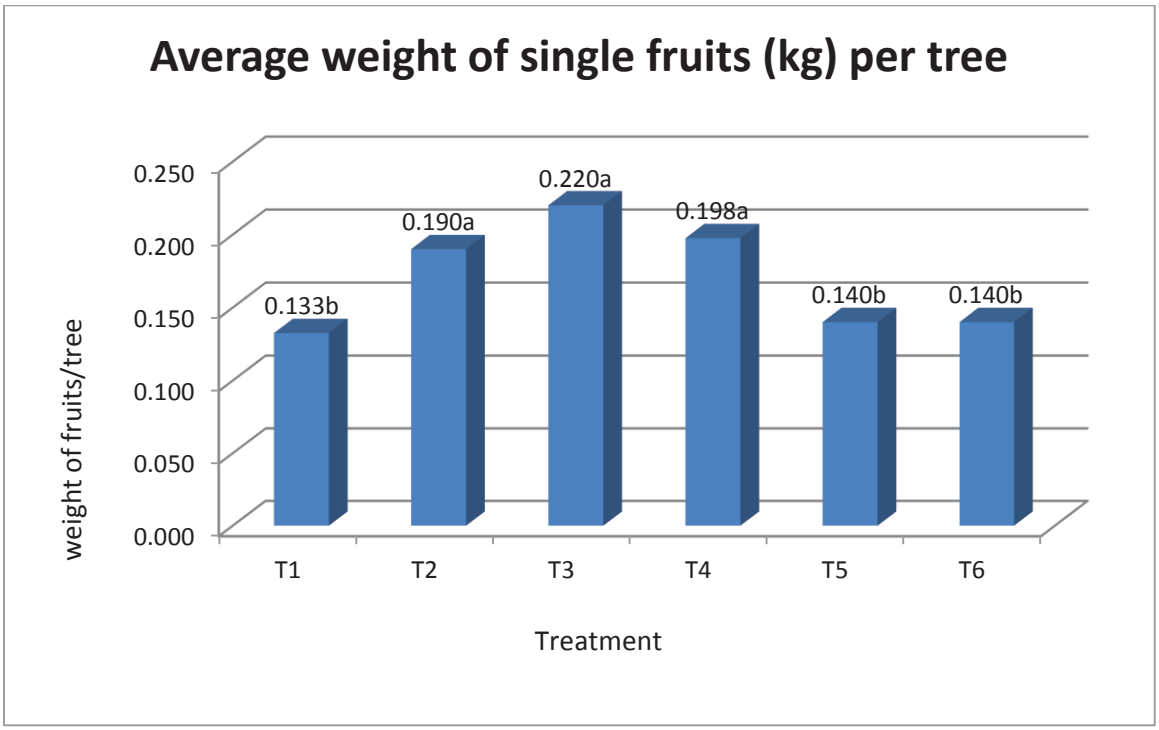
Adoracion T. Ilag

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



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

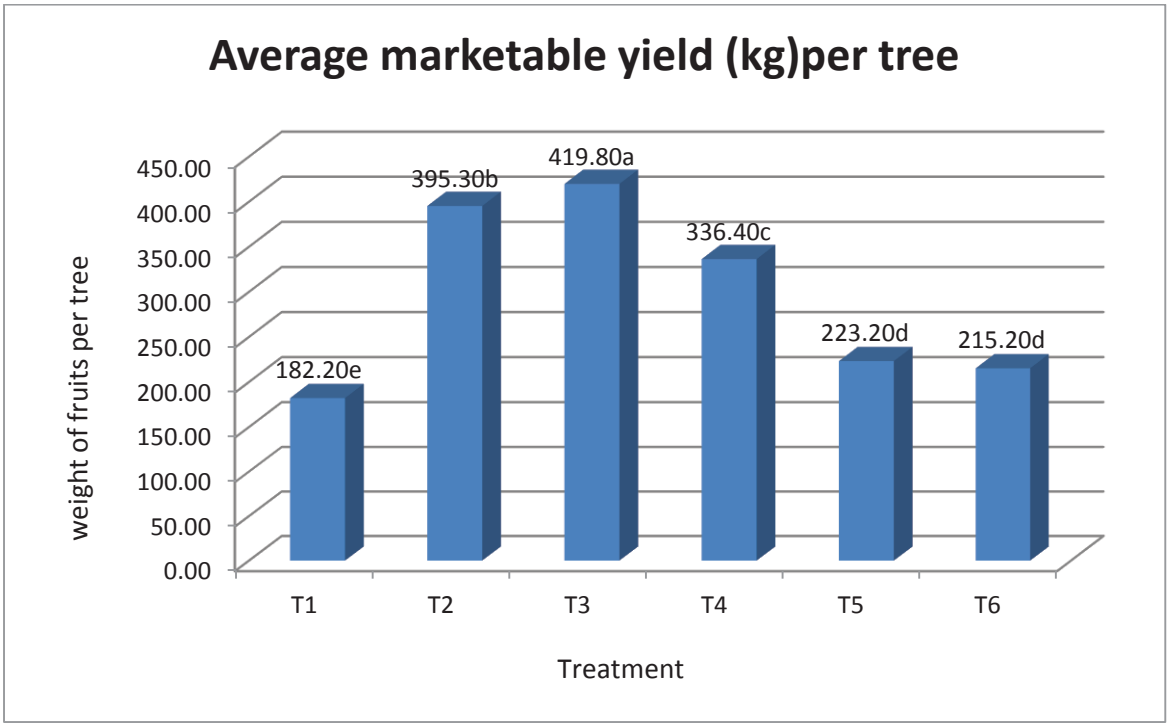
Figure 3. Average weight of single fruit (kg) at harvest as affected by different treatments of Metalosate Multimineral™ fertilizer.



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

Adoracion T. Ruiz

Figure 4. Average MarketableYield of mango (kg/tree) application as affected by different treatments of Metalosate Multimineral™.



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

Adoracion T. Hug

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 Metalosate Multimineral ™

T4 - RRIF + Recommended rate of Metalosate Multimineral ™

T5 - RRIF + 1½ Recommended rate of Metalosate Multimineral™

T6 - Recommended rate of Metalosate Multimineral ™