

**TITLE: EFFICACY EVALUATION OF METALOSATE
MULTIMINERAL AS LIQUID FOLIAR FERTILIZER
FOR CABBAGE**

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FPA Accreditation No.: PNT-147

DURATION OF THE STUDY: Four (4) Months

STUDY SITE: BSU-CSAC Experiment Area
Talingguroy, Wangal
La Trinidad, Benguet

**EFFICACY EVALUATION OF METALOSATE MULTIMINERAL® AS
LIQUID FOLIAR FERTILIZER FOR CABBAGE**

Abstract

Efficacy trial using Metalosate Multiminerall Liquid Foliar Fertilizer either applied alone and as follow up spray to inorganic fertilizers was conducted at the BSU-CSAC Experiment Area in Talingguoy, Wangal, La Trinidad, Benguet from January to April, 2015.

The highest marketable yields were obtained from cabbage plants applied with 150% of the recommended rate of Metalosate Multiminerall Liquid Foliar Fertilizer and 100% of the recommended rate of Metalosate Multiminerall Liquid Foliar Fertilizer both as follow up spray to the recommended rate of commercial inorganic fertilizers (240-60-60 kg/ha N, P₂O₅ and K₂O) with 22.25% and 21.96% increase in yield, respectively. The optimum application rate for Metalosate Multiminerall for cabbage is 40 ml/16 liters of water or 500 ml product per hectare to be applied at 45, 55 and 65 Days after Transplanting (DAT) as follow up spray to the recommended rate of inorganic fertilizer.



I. Background

Crop growth and development are dependent on several factors; soil, water supply and biotic and abiotic stresses among others. Thus, growers have to address and follow various requirements to achieve optimum growth and yield on their crops.

Metalosate Multimineral® Liquid Foliar Fertilizer contains well balanced nutrients specifically designed to support the growth and development of crops. The product contains 1.0 % Ca, 0.5% Cu, 0.5% Fe, 1% Mg, 0.5% Mn, 0.1% Mo, and 0.5% Zn. Throughout the years, it has been proven that foliar mineral application in addition to major nutrient fertilization helps in improving growth and development of crops. These essential nutrients, contrary to the major nutrient elements, NPK, are required in minute amounts but functions as equally important given their general role in plant physiological and chemical processes especially in photosynthesis and metabolism. Specific symptoms manifest for specific deficiency should these nutrients be scarce during the growing period. Most deficiencies can be detrimental to the plant and can lead to serious losses if not corrected at an early stage.

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.

Jocanima Corporation, a leading Filipino owned agrochemical Corporation in collaboration with Albion Plant Nutrition from Utah, USA, will introduce Metalosate



Multimineral® Liquid Foliar Fertilizer and its novel technology to the Filipino farmers. This will help farmers meet the soaring standards for crop production by improving crop growth, development and yield.

II. Objectives

The study has the following objectives:

- 1) To evaluate the efficacy of Metalosate Multimineral® Liquid Foliar Fertilizer on Cabbage;
- 2) To evaluate the effect of different rates of Metalosate Multimineral® Liquid Foliar Fertilizer in combination with commercial inorganic fertilizers used; and
- 3) To generate the bio-efficacy data to support the registration of Metalosate Multimineral® Liquid Foliar Fertilizer Supplement with Fertilizer and Pesticide Authority (FPA)



III. Materials and Methods

1. Time and Place of the Study

The study was conducted at BSU-CSAC Experiment Area, Talinguero, Wangal, La Trinidad, Benguet from January to April 2015. The soil in the experiment area was analyzed to very strongly acidic with a pH value of 5.0; with moderate organic matter content (2.24%); and moderate contents of available phosphorous content (20.0 ppm) and exchangeable potassium (95.30 ppm).

2. Treatments

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

T1 – Control (no fertilizer)

T2 – Recommended Rate of Commercial Fertilizers (RRCF)

T3 – RRCF + ½ Recommended Rate of Metalosate Multimineral® (RRMMM)

T4 – RRCF + RRMMM

T5 – RRCF + 1½ RRMMM

T6 – RRMMM

An area of 180 square meters with plots measuring 1 x 10 meters was prepared. The treatments were laid-out following the Randomized Complete Block Design with 3 replications. The data were analyzed using the Analysis of Variance (ANOVA) and comparisons among treatment means by Least Significant Difference (LSD).

3. Fertilizers

a. Commercial or reference fertilizers:

The recommended fertilizer requirement for Cabbage (240-60-60 kg/ha N, P₂O₅ AND K₂O) was applied. Applications were done twice; before planting and during hilling-up (30 days after transplanting).

b. Metalosate Multimineral® Liquid Foliar Fertilizer

Metalosate Multimineral® Liquid Foliar Fertilizer was applied three times based on the recommended rate of 0.5 L/ha or diluted at 40 ml/16L knapsack sprayer. The first application was at initial head formation or 45 days after transplanting (DAT), 2nd application at 55 DAT and another application at 65 DAT.



4. Cultural Practices

The recommended cultural practices in the care of plants including pest and disease control and irrigation were followed.

5. Data gathered

- a. Crop yield data (marketable and non-marketable yield)
- b. Soil Fertility Data
- c. Nutrient Deficiency Symptoms, if any
- d. Phytotoxicity, if any
- e. Weather Conditions
- f. Pest and Disease Incidence



RESULTS AND DISCUSSIONS

Marketable Yield

Table 1 shows the weight of marketable yield of cabbage as affected by the application of the different treatments. The result shows that cabbage plants applied with Metalosate Multiminerall Liquid Foliar Fertilizer as follow up spray to the recommended rate of commercial inorganic fertilizers significantly produced higher marketable yield than those plants applied only with the recommended rate of commercial inorganic fertilizers (Treatment 2). Plants that were applied with 150 % of the recommended rate of Metalosate Multiminerall Liquid Foliar Fertilizer (750 ml/ha) as follow up spray to the recommended rate of commercial inorganic fertilizer (Treatment 5) produced the highest marketable yield of 47.59 t/ha, however, it did not differ significantly from those plants treated with the recommended rate of Metalosate Multiminerall Liquid Foliar Fertilizer as follow up spray to the recommended rate of commercial inorganic fertilizer (Treatment 4) that gave 47.48 t/ha marketable yield. Compared to plants treated with only the recommended rate of inorganic fertilizer, Treatment 5 and Treatment 4 showed significant increases of 22.25% and 21.96%, marketable yield, respectively.

On the other hand, significantly lower yield were obtained from the control (Treatment 1) and those plants that were applied only with the recommended rate of Metalosate Multiminerall Liquid Foliar Fertilizer (Treatment 6).

Non-Marketable Yield

The weight of non-marketable yield of cabbage was significantly affected by the different treatments as shown in Table 1. Plants applied with Metalosate Multiminerall Liquid Foliar Fertilizer in combination with the recommended rate of commercial inorganic



fertilizers significantly produced lower non-marketable yields. The control significantly produced the highest non-marketable yield.

Table 1. Weight of marketable and non-marketable yield of cabbage as affected by the different treatments

TREATMENT	YIELD (t/ha)	
	Marketable	Non-marketable
T ₁ – Control	18.03 c	4.41 a
T ₂ – RR of Inorganic Fertilizer (RRIF)	38.93 c	3.52 b
T ₃ – RRCF + ½ RRMMM	40.31 b	2.42cd
T ₄ – RRCF + RRMMM	47.48 a	2.19de
T ₅ – RRCF + 1½ RRMMM	47.59 a	1.84 e
T ₆ – RRMMM	19.42 C	2.71 c

Means with the same letter/s are not significantly different at 5% level by LSD

Nutrient Deficiency Symptoms

Plants in Treatment 1 and Treatment 6 were smaller and have lighter green leaves as compared to bigger plants with dark green leaves for Treatments 3, 4 and 5.



Crop Phytotoxicity

No phytotoxicity was observed in cabbage plants as an effect of the applications of the different treatments. Those plants that were applied with Metalosate Multimineral at various rates, from the lowest to the highest rates, did not show any phytotoxicity when applied at various growth stages of the test crops.

Weather Conditions During the Trial

Cabbage plants were affected by extreme weather conditions during the conduct of the trial. During the first month, plants showed partial wilting of leaves because plots easily dried up after irrigation because of the high temperature during daytime. This has been aggravated by the very minimal rainfall during the months of January and February. Likewise, in April, strong rains were observed especially in the afternoon, but somehow these favored the growth and development of the crops.

MONTH	TEMPERATURE (°C)		RELATIVE HUMIDITY (%)	RAINFALL (mm)
	MIN	MAX		
January	11.4	21.0	83.0	0.2
February	12.0	22.3	83.0	0.1
March	12.0	24.0	82.0	3.0
April	15.0	25.0	83.0	4.0

Pest and Disease Incidence

The major insect pests that attacked the cabbage plants were cutworm and larvae of cabbage butterfly. These were controlled mechanically and with the application of green-labeled pesticides.

Clubroot was likewise observed in some plots but the occurrence was just minimal. Flooding plots was done to at least minimize its effects on cabbage.

SUMMARY AND CONCLUSION

1. The spray applications of Metalosate Multiminerall Liquid Foliar Fertilizer at various growth stages of cabbage did not show any phytotoxicity.
2. The control plants (Treatment 1) produced the lowest marketable yield of cabbage which is comparable with those plants applied with the recommended rate of Metalosate Multiminerall Liquid Foliar Fertilizer (Treatment 6);
3. The marketable yield of cabbage increased with the application of recommended and increased application rates of Metalosate Multiminerall Liquid Foliar Fertilizer as follow up spray to commercial inorganic fertilizers;
4. Highest marketable yields were obtained from plants applied with 150% recommended rate [750 ml/ha] of Metalosate Multiminerall Liquid Foliar Fertilizer (60 ml/16 liters of water) as follow up spray to the recommended rate of commercial inorganic fertilizer (240-60-60 kg/ha) that resulted in 22.25% increase of marketable yield. Plants applied with the recommended rate of Metalosate Multiminerall Liquid Foliar Fertilizer (40 ml/16 liters of water) as follow up treatments to the recommended rate of commercial inorganic fertilizer (240-60-60 kg/ha) provided statistically similar result with 21.96% increase in yield;
5. The optimum application rate for Metalosate Multiminerall for cabbage is 40 ml/16 liters of water or 500 ml product per hectare to be applied as follow up

CPD

spray application at 45, 55 and 65 DAT to the recommended rate of inorganic fertilizer.

RECOMMENDATION

The application of 40 ml/16 liters of water (500 ml product per hectare) of Metalosate Multimineral as follow up spray application at 45, 55 and 65 DAT to the recommended rate of commercial inorganic fertilizers is recommended for cabbage production to attain higher marketable yield. It is therefore recommended to grant registration approval to Metalosate Multimineral as liquid foliar fertilizer for cabbage.



APPENDICES

Appendix Table 1. Marketable yield of cabbage as affected by the application Metalosate Multimineral and commercial inorganic fertilizer (t/ha)

Treatments	Replication I	Replication II	Replication III	total	Mean
T1	19.50	16.68	17.90	54.08	18.03
T2	39.0	38.20	39.60	116.80	38.93
T3	39.38	41.05	40.50	120.93	40.31
T4	48.83	46.20	47.40	142.43	47.48
T5	48.73	46.95	47.10	142.78	47.59
T6	18.0	20.55	19.70	58.25	19.42
total	213.44	209.63	212.2	635.27	35.29

ANALYSIS OF VARIANCE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean of Squares	F Value	F Probability
Block	2	1.259	0.629	0.45	
Treatment	5	2665.039	533.008	381.68**	<.001
Error	10	13.965	1.396		
Total	17	2680.263			

**-Highly Significant

CV= 3.3%

LSD VALUE = 2.150

Fisher's protected least significant difference test

Treatl	Mean	
5	47.59	a
4	47.48	a
3	40.31	b
2	38.93	b
6	19.42	c
1	18.03	c



Appendix Table 2. Non-marketable yield of cabbage as affected by the application of Metalosate Multimineral and commercial inorganic fertilizer (t/ha)

Treatments	Replication I	Replication II	Replication III	total	Mean
T1	4.75	4.0	4.50	13.25	4.41
T2	3.63	3.75	3.20	10.58	3.52
T3	2.63	2.13	2.50	7.26	2.42
T4	2.0	2.38	2.21	6.59	2.19
T5	1.88	1.75	1.90	5.53	1.84
T6	2.88	2.75	2.50	8.13	2.71
total	17.77	16.76	16.81	51.34	2.85

ANALYSIS OF VARIANCE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean of Squares	F Value	F Probability
Block	2	0.10801	0.977	0.51	
Treatment	5	13.67104	370.102	194.21**	<.001
Error	10	0.64586	1.906		
Total	17	1871.520			

**-Highly Significant

CV= 8.9%

LSD VALUE = 0.4623

Fisher's protected least significant difference test

Treat1	Mean	
1	4.417	a
2	3.527	b
6	2.710	c
3	2.420	cd
4	2.197	de
5	1.843	e





T1- control



T2 – RR Inorganic Fertilizers



T3 – RR Inorganic Fertilizers + ½ RR Metalosate Multimineral



T4 – RR Inorganic Fertilizer + RR Metalosate Multimineral



T5 – RR Inorganic Fertilizers + 1 ½ Metalosate Multimineral



T6 – RR Metalosate Multimineral

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