

**TITLE: EFFICACY EVALUATION OF METALOSATE CROP-UP AS  
LIQUID FOLIAR FERTILIZER FOR CABBAGE****EUP : F-2257****PROPONENT :** JOCANIMA CORPORATION  
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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 CROP-UP® AS  
LIQUID FOLIAR FERTILIZER FOR CABBAGE**

**Abstract**

A study on the effects of Metalosate Crop-Up on cabbage was conducted at the BSU-CSAC Experiment Area in Talingguroy, Wangal, La Trinidad, Benguet from January to April, 2015.

Plants applied with varying rates of Metalosate Crop-Up Liquid Foliar Fertilizer at 15 and 25 Days After Transplanting (DAT) as follow up spray to the recommended rate of inorganic fertilizers (240-60-60 kg/ha of N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O) produced significantly higher yield compared to plants applied with commercial inorganic fertilizer only. The highest marketable yield [44.98 tons/ha] was obtained from cabbage plants applied with 150% of the recommended rate [750 ml/ha or 60 ml/16 liters of water] of Metalosate Crop Up as follow up spray to the recommended rate of inorganic fertilizers. Marketable yield of 43.31 and 38.93 tons/ha were respectively obtained from treatment plots that received the recommended rate of Metalosate Crop Up [500 ml/ha or 40 ml/16 liters of water] and 50% recommended rate of Metalosate Crop Up [250 ml/ha or 20 ml/16 liters of water] both as follow up spray application to the recommended rate of commercial inorganic fertilizer. The optimum application rate for Metalosate Crop-Up Liquid Foliar Fertilizer is 40 ml/16 liters of water or 500 ml/ha to be applied as follow up spray to the recommended rate of commercial 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.

It has been long proven that foliar mineral application in addition to major nutrient fertilization helps in improving growth and development of crops. The essential micronutrients 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 nutritional deficiencies should these micronutrients become 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 Crop-Up Liquid foliar Fertilizer contains well balanced nutrients specifically designed to support the growth and development of crops. The product contains 0.025 % B, 0.25% Cu, 0.25% Fe, 0.5% Mg, 2.5% Mn, and 1.25% Zn.

Metalosate Liquid Foliar Fertilizers from Albion Plant Nutrition are designed for foliar application on plants to prevent or correct nutrient deficiencies that may limit crop growth and yields. Albion's unique patented manufacturing process and formulations ensures that plants will get the most readily absorbable, highest quality nutrition available.

Albion's Metalosate lines use amino acids in their chelation technology. Chelation is the process of attaching a specific organic molecule to a mineral in two or more places to form a ring. The molecule holds the mineral like a claw to make it stable and readily absorbable. 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 Crop-Up® 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.

## I. Objectives

The study aimed to:

- 1) Evaluate the efficacy of Metalosate Crop-Up® Liquid Foliar Fertilizer on Cabbage;
- 2) Evaluate the effect of different rates of Metalosate Crop-Up® Liquid Foliar Fertilizer in combination with commercial inorganic fertilizers; and
- 3) Generate the bio-efficacy data to support the registration of MetalosateCrop-Up® Liquid Foliar Fertilizer Supplement with Fertilizer and Pesticide Authority (FPA)

## II. Materials and Methods

### 1. Time and Place of the Study

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



## 2. Treatments

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

T1 – Control (no fertilizer)

T2 – Recommended Rate of Commercial Inorganic Fertilizers (RRCF)

T3 – RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)

T4 – RRCF + RRMCU

T5 – RRCF + 1½ RRMCU

T6 – RRMCU

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 inorganic fertilizers:

The recommended fertilizer requirement for Cabbage (240-60-60 kg/ha N, P<sub>2</sub>O<sub>5</sub> AND K<sub>2</sub>O) was applied. Applications were done twice, that is, before planting and during hilling-up or 30 days after transplanting.

### b. Metalosate Crop-Up® Liquid Foliar Fertilizer

Metalosate Crop-Up® Liquid Foliar Fertilizer was applied twice based on the recommended rate of 0.5 L/ha or diluted at 40 ml/16L knapsack sprayer. The



first application was 15 days after transplanting (DAT), and the 2<sup>nd</sup> application was at 25 DAT where plants had vigorous vegetative growth.

#### 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

Significant differences were observed on the marketable yield of cabbage as affected by the application of the different treatments (Table 1). All plots that received varying rates of Metalosate Crop-Up Liquid foliar Fertilizer as follow up spray applications to the recommended rate of inorganic fertilizer produced marketable yield significantly higher than those applied with only the recommended rate of commercial inorganic fertilizer.

The application of 150% of the recommended rate of Metalosate Crop-Up Liquid Foliar Fertilizer [750 ml/ha or 60 ml/16 liters of water] as follow up spray to the recommended rate of commercial inorganic fertilizers (Treatment 5) produced the highest marketable yield of 44.98 t/ha which did not differ significantly from the yield obtained from plants that received the recommended rate of Metalosate Crop-Up Liquid Foliar Fertilizer (40 ml/16 liters of water) as follow up spray to the recommended rate of commercial inorganic fertilizer (Treatment 4) with marketable yield of 43.31 t/ha. Similarly, marketable yield of 41.93 t/ha was obtained from plots applied with 50% of the recommended rate of Metalosate Crop-Up Liquid Foliar Fertilizer (20 ml/16 liters of water) as follow up spray to the recommended rate of commercial inorganic fertilizers (Treatment 3). Marketable yield from all of the above treatments are statistically greater than the yield from plots applied with only the recommended rate of inorganic fertilizers (Treatment 2). However, spray application of Metalosate Crop Up alone is not sufficient to sustain the nutritional requirements of the cabbage plant. The results consistently indicates that the application of Metalosate Crop Up as follow up spray compliments to the applied recommended rate of commercial inorganic fertilizer.



Lowest marketable yield was obtained from the untreated control plots.

### Non-Marketable Yield

The weight of non-marketable yield of cabbage was significantly affected by the different treatments as shown in Table 1. The control significantly produced the highest non-marketable yield while lowest non-marketable yields were observed from plants applied with recommended and increased rates of Metalosate Crop-Up Liquid Foliar Fertilizer as follow up treatment to the recommended rate of commercial inorganic fertilizers.

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 <sub>1</sub> – Control	18.19 e	4.38 a
T <sub>2</sub> – RR of Inorganic Fertilizer (RRIF)	38.93 c	3.16 b
T <sub>3</sub> – RRIF + ½ RR Metalosate Crop-Up (RRMCU)	41.93 b	2.54 b
T <sub>4</sub> – RRIF + RRMCU	43.31 ab	1.79 c
T <sub>5</sub> – RRIF + 1½ RRMCU	44.98 a	1.57 c
T <sub>6</sub> – RRMCU	21.49 d	2.50 b

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

### Nutrient Deficiency Symptoms

Plants in the control (no fertilizers) and those that were applied only with Metalosate Crop-Up Liquid Foliar Fertilizers were smaller and have lighter green leaves as



compared to bigger plants with dark green leaves for those applied with Metalosate Crop-Up Liquid Foliar Fertilizer as combination treatments with commercial inorganic fertilizers.

### 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 Crop-Up 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 month 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

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Pest and Disease Incidence

The major pest 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 of the plots was done to at least minimize the effects of clubroot.



## SUMMARY AND CONCLUSION

1. The spray application of Metalosate Crop Up Liquid fertilizer at various stages of cabbage did not show any phytotoxicity to the crop;
2. The untreated control plots produced the lowest marketable yield of cabbage compared with the yield obtained from plots that received only the recommended rate of Metalosate Crop-Up Liquid Foliar Fertilizer;
3. The marketable yield of cabbage increased with the combined treatment application of Metalosate Crop-Up Liquid Foliar Fertilizer (applied at 15 and 25 DAT) and commercial inorganic fertilizers as compared to plots applied only with the recommended rate of commercial inorganic fertilizer;
4. Highest marketable yield of cabbage were obtained from the plots that received 150% recommended rate of Metalosate Crop-Up Liquid Foliar Fertilizer (60 ml/16 liters of water or 750 ml/ha) as follow up spray application to the recommended rate of commercial inorganic fertilizer (240-60-60 kg/ha N, P<sub>2</sub>O<sub>5</sub> ) with an increase of 15.54%. This is statistically similar to the marketable yield obtained from plots applied with recommended rate of Metalosate Crop-Up Liquid Foliar Fertilizer (40 ml/16 liters of water or 500 ml/ha) with 11.25% yield increase.
5. Marketable yield obtained from plots that received the recommended rate (40 ml/16 liters of water or 500 ml/ha) and 50% recommended rate (20 ml/16 liters of water or 250 ml/ha) of Metalosate Crop-Up Liquid Foliar Fertilizer as follow up spray application to the recommended rate of commercial inorganic fertilizers did not significantly vary.

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6. The optimum application rate for Metalosate Crop Up as follow spray to the recommended rate of commercial inorganic fertilizer is 40 ml/16 liters of water or 500 ml/ha.

### RECOMMENDATION

The application of 40 ml/16 liters of water (500 ml product per hectare) of Metalosate Crop Up as follow up spray application at 15 and 25 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 Crop Up as liquid foliar fertilizer for cabbage.



## APPENDICES

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

Treatments	Replication I	Replication II	Replication III	total	Mean
T1	19.50	16.68	18.40	54.58	18.19
T2	39.0	38.20	39.60	116.80	38.93
T3	42.20	42.0	41.60	125.80	41.93
T4	44.43	42.0	43.50	129.93	43.31
T5	45.78	44.25	44.90	134.93	44.98
T6	19.68	23.50	21.30	64.48	21.49
total	210.59	206.63	209.3	626.52	34.80

## ANALYSIS OF VARIANCE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean of Squares	F Value	F Probability
Block	2	1.360	0.680	0.44	
Treatment	5	2090.406	418.081	271.62**	<.001
Error	10	15.392	1.539		
Total	17	2107.158			

\*\* - Highly Significant  
CV = 3.6%

LSD VALUE = 2.257

Treat1	Mean	
5	44.98	a
4	43.31	ab
3	41.93	b
2	38.93	c
6	21.49	d
1	18.19	e

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

Treatments	Replication I	Replication II	Replication III	total	Mean
T1	4.75	4.0	4.40	13.15	4.38
T2	3.63	2.75	3.10	9.48	3.16
T3	2.88	2.25	2.50	7.63	2.54
T4	1.63	1.95	1.80	5.38	1.79
T5	1.25	1.88	1.60	4.73	1.57
T6	2.13	2.88	2.50	7.51	2.50
total	16.27	15.71	15.90	47.88	2.66

## ANALYSIS OF VARIANCE

Source of Variation	Degrees of Freedom	Sum of Squares	Mean of Squares	F Value	F Probability
Block	2	0.027	0.0135	0.10	
Treatment	5	15.548	3.1097	22.53**	<.001
Error	10	1.380	0.1380		
Total	17	16.9556			

\*\*-Highly Significant  
CV= 14.0%

LSD VALUE = 0.6759

Treat1	Mean	
1	4.383	a
2	3.160	b
3	2.543	b
6	2.503	b
4	1.793	c
5	1.577	c





T1- Control



T2 – RR Inorganic Fertilizers



T3 – RR Inorganic Fertilizers + ½ RR Metalosate Crop-Up



T4 – RR Inorganic Fertilizer + RR Metalosate Crop-Up



T5 – RR Inorganic Fertilizers + 1 ½ Metalosate Crop-Up



T6 – RR Metalosate Crop-Up



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