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Balchem® Plant Nutrition Research Paper

TERMINAL REPORT

Efficacy Evaluation of Metalosate Crop-Up® as Liquid Foliar Fertilizer for Rice

Funding Agency: **JOCANIMA CORPORATION**
#42 Mahogany Road, Pilar Village
Las Piñas City, Metro Manila 1750
Philippines

Research, Extension and Training
CENTRAL LUZON STATE UNIVERSITY
Science City of Munoz, Nueva Ecija, Philippines

February to May 2015

Efficacy Evaluation of Metalosate Crop-Up® as Liquid Foliar Fertilizer for Rice

Constancia C. Dacumos [1] and Belinda G. Elming [2]

ABSTRACT

The field trial was conducted at the Research Experimental Station, RET-CLSU, Science City of Munoz during dry season cropping of rice from February to May 2015 to determine the effect of Metalosate Crop-Up® as foliar fertilizer for rice.

Grain yield obtained from the follow up spray application of Metalosate Crop-Up at the rate of 40ml/16L water or 500 ml/ha (Treatment 4) to the recommended rate of commercial granular fertilizer blend is statistically greater than the application of recommended rate of commercial granular fertilizer blend alone (Treatment 2).

Follow up spray application of 1 ½ RR Metalosate Crop-Up® Liquid Foliar Fertilizer at the rate of 60 ml/16 liter spray load (750 ml/ha) (Treatment 5) applied at 30 and 45 DAT to recommended rate of conventional granular fertilizer (100-10-10) NPK produced the tallest plants at harvest, highest number of tillers at harvest, highest number of panicle at harvest, heaviest weight of fresh straw and grain yield.

Therefore, the recommended rate for Metalosate Crop as follow up spray to commercial granular fertilizer blend at 30 and 45 DAT is 500 ml to 750 ml product per hectare.

[1] Project Leader and Researcher, CLSU, Science City of Muñoz, Nueva Ecija, Philippines

[2]Research Assistant, CLSU, Science City of Muñoz, Nueva Ecija, Philippines

I. RATIONALE

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

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 uses natural amino acids to chelate the minerals, they are rapidly absorbed, translocated and metabolized by plants.

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, O.25% Cu, 0.25% Fe, 0.5% Mg, 2.5% Mn, and 1.25% 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 nutrients – 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.

JOCANIMA Corporation, a leading Filipino owned agrochemical Corporation in collaboration with Albion Plant Nutrition from Utah, USA, introduced Metalosate Crop-Up® liquid foliar fertilizer and its novel technology to the Filipino farmers to help farmers meet the soaring standards for crop production by improving crop growth, development and yield.

II. OBJECTIVES

1) Evaluate the efficacy of Metalosate Crop-Up®Liquid Foliar Fertilizer on rice;
2) Evaluate the effect of different application rates of Metalosate Crop-Up® Liquid Foliar Fertilizer in combination with commercial fertilizers used; and

3) Generate the bioefficacy data to support the registration of Metalosate Crop-Up® Liquid Foliar Fertilizer Supplement with Fertilizer and Pesticide Authority (FPA).

III. METHODOLOGY

1) Time and place of test

The study was started in February and ended May 2015. The experiment was conducted at the Research Experimental Station of the Research, Extension and Training, Central Luzon State University, Science City of Munoz, Nueva Ecija. Field plots measuring 4 m x 5 m were prepared after thorough land preparation under irrigated lowland conditions. Respective treatments were established on these plots with three replications following the Randomized Complete Block Design (RCBD). The data were analysed using the analysis variance (ANOVA) technique. Differences among treatment means were compared using the Duncan's Multiple Range Test (DMRT).

2) Treatments

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

T1 – Control (no fertilizer)

T2 – Recommended Rate of Conventional Fertilizer (RRCF)

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

T4 – RRCF + RRMCU

T5 – RRCF + 1½ RRMCU

T6 – RRMCU

3) Crop: Rice Variety: NSIC 216

4) Fertilizers

a. Conventional or reference fertilizers:

The recommended nutrient requirement for rice was applied based on actual field practice. The recommended rate of conventional or reference fertilizer for the experimental area based on Soil Test Kit (STK) was 120-10-10 kg NPK/ha. Sources of conventional fertilizer materials were complete fertilizer (14-14-14) and Urea (46-0-0). Application was done basal and at 35 days after transplanting.

b. Metalosate Crop-Up® was applied at the recommended rate (RR) of 0.5 L/ha or diluted at 40 ml/16L knapsack sprayer (at 12.5 spray loads per hectare). The first application was at 30 days after transplanting and another application at 45 days after transplanting.

5) Cultural Practices

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

6) Data gathered

a. Average plant height
b. Tiller count
c. Panicle count
d. Straw weight
e. Yield (tons/ha)
f. Soil analysis
g. Nutrient deficiency symptoms, if any
h. Phytotoxicity, if any
i. Weather conditions
j. Pest and disease incidence

RESULTS AND DISCUSSION

Plant Height (cm)

Plant height at 30 DAT (days after transplanting) were gathered as baseline data. The effect of the different treatments on height of plants at harvest are presented in Table 1.

The rice crop on plots that received application of conventional fertilizer (120-10-10) alone and with follow up application of various rates of Metalosate Crop Up foliar fertilizer blend were significantly taller compared with the plants in the untreated control plots. However, only Treatment 5 (1 ½ Metalosate Crop-Up + RRCF) gave significant increase in plant height at harvest as compared to the treatment applied only with conventional fertilizer (120-10-10).

Table 1. Average plant height (cm) 30 DAT and at harvest based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Treatments	Rate	Time of Application	Plant Height (cm)	
			30 DAT	At harvest
T1- Control (no fertilizer)	-	-	37.67[c]	66.69[d]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	120-10-10kg NPK/ha	Basal, 35 DAT	49.22[ab]	80.36[b]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	120-10-10 kg NPK/ha 20 ml/16L water	Basal, 35 DAT 30 DAT, 45 DAT	50.12[ab]	81.62[ab]
T4- RRCF + RRMCU	120-10-10 kg NPK/ha 40 ml/16L water	Basally, 35 DAT 30 DAT, 45 DAT	50.57[ab]	84.27[ab]
T5- RRCF + 1 ½ RRMCU	120-10-10 kg NPK/ha 60 ml/16L water	Basally, 35 DAT 30 DAT, 45 DAT	50.94[a]	85.22[a]
T6- RRMCU	40 ml/16L water	30 DAT, 45 DAT	44.12[b]	75.34[c]

Means followed by a common letter are not significantly different at the 5 % level by DMRT.
DAT- days after transplanting

Tiller Count (cm)

Tiller count at 30 DAT (days after transplanting) were gathered as baseline data. The effects of the fertilizer treatments on tiller count are presented in Table 2.

Relatively, there were higher number of tillers in treatment plots that received application of conventional fertilizer alone and with follow up spray application of various rates of Metalosate Crop Up foliar fertilizer. These treatments exhibited the same trend of tiller count at 30 DAT and up to harvest. However, treatment plots that received the recommended rate of conventional fertilizer (120-10-10) with follow up spray application of 1 ½ RR Metalosate Crop Up provided highest number of tillers.

Table 2. Average tiller count 30 DAT and at harvest based on the 10 randomly selected samples plants as affected by different fertilizer treatments

Treatments	Rate	Time of Application	Number of Tillers	
			30 DAT	At harvest
T1- Control (no fertilizer)	-	-	10.70[c]	12.03[c]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	120-10-10kg NPK/ha	Basal, 35 DAT	18.70[ab]	22.97[a]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	120-10-10 kg NPK/ha 20 ml/16L water	Basal, 35 DAT 30 DAT, 45 DAT	18.97[ab]	24.67[a]
T4- RRCF + RRMCU	120-10-10 kg NPK/ha 40 ml/16L water	Basally, 35 DAT 30 DAT, 45 DAT	21.23[a]	24.23[a]
T5- RRCF + 1 ½ RRMCU	120-10-10 kg NPK/ha 60 ml/16L water	Basally, 35 DAT 30 DAT, 45 DAT	21.73[a]	25.87[a]
T6- RRMCU	40 ml/16L water	30 DAT, 45 DAT	16.40[b]	17.53[b]

Means followed by a common letter are not significantly different at the 5 % level by DMRT.

Number of Panicle at Harvest

The number of panicle at harvest is presented in Table 3. Plants that applied with conventional fertilizer alone and conventional fertilizer with follow up spray application of Metalosate Crop Up provided significantly higher number of panicles compared with the untreated control plots. Application of 1 ½ RR Metalosate Crop Up (60 ml/16 liters spray load) as follow up spray application to conventional fertilizer provided the highest number of panicles which is statistically comparable only to plots that received the recommended rate of Metalosate Crop Up (40 ml/16 liters spray load).

Table 3. Average panicle count at harvest based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Treatments	Rate	Time of Application	Number of Panicle
T1- Control (no fertilizer)	-	-	10.4[d]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	120-10-10kg NPK/ha	Basal, 35 DAT	19.7[b]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	120-10-10 kg NPK/ha 20 ml/16L water	Basal, 35 DAT 30 DAT, 45 DAT	19.8[b]
T4- RRCF + RRMCU	120-10-10 kg NPK/ha 40 ml/16L water	Basally, 35 DAT 30 DAT, 45 DAT	21.4[ab]
T5- RRCF + 1 ½ RRMCU	120-10-10 kg NPK/ha 60 ml/16L water	Basally, 35 DAT 30 DAT, 45 DAT	22.8[a]
T6- RRMCU	40 ml/16L water	30 DAT, 45 DAT	15.5[c]

Means followed by a common letter are not significantly different at the 5 % level by DMRT.

Weight of Fresh Straw (g)

Table 4 shows the weight of straw at harvest for different treatments. Highest straw weight was recorded from treatment plots that received the conventional fertilizer rate (120-10-10) followed by foliar spray application of Metalosate Crop Up at the rate of 60 ml/16 liter spray load or equivalent to 750 ml Metalosate Crop Up per hectare. However, there were no significant differences obtained in terms of straw weight in between Metalosate Crop Up applied at the rate of 20, 40 and 60 ml/16 liter spray load ha, respectively. Straw weight obtained from respective treatment plot was significantly heavier than those obtained from untreated control plots and plots applied with recommended rate of conventional fertilizer only.

Table 4. Straw weight (g) at harvest based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Treatments	Rate	Time of Application	Straw Weight (g)
T1- Control (no fertilizer)	-	-	255.33[d]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	120-10-10kg NPK/ha	Basal, 35 DAT	662.00[b]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	120-10-10 kg NPK/ha 20 ml/16L water	Basal, 35 DAT 30 DAT, 45 DAT	752.67[a]
T4- RRCF + RRMCU	120-10-10 kg NPK/ha 40 ml/16L water	Basally, 35 DAT 30 DAT, 45 DAT	795.33[a]
T5- RRCF + 1 ½ RRMCU	120-10-10 kg NPK/ha 60 ml/16L water	Basally, 35 DAT 30 DAT, 45 DAT	817.33[a]
T6- RRMCU	40 ml/16L water	30 DAT, 45 DAT	408.33[c]

Means followed by a common letter are not significantly different at the 5 % level by DMRT.

Grain Yield (tons/ha)

Highly significant results showed that grain yield was affected by the different treatments evaluated (Appendix Table 5b). Results showed that the highest dosage (1 ½) the recommended rate, 60ml/16L water of Metalosate Crop-Up® applied at 30 and 45 DAT as follow spray application to conventional fertilizer provided the highest yield of 6.60 tons/ha (approximately 132 cavans per hectare) and is significantly higher than rest of the treatments. Using this treatment combination, there is an advantage in yield of 32 % over the application of recommended rate of conventional fertilizer alone and around 136 % over the control.

The follow up spray application of Metalosate Crop Up at the rate of 40 ml/16 liter spray load, provided 6.0 tons/ha. This translates to 20 % increase in yield over the yield obtained from plots that received the recommended rate of conventional fertilizer.

The increased in grain yield could be attributed to the increase in nutrient uptake and additional nutrients from the natural amino acid chelated Metalosate Crop-Up® liquid foliar fertilizer. This led to the production of more tillers and increase in the development of more panicles and grain weight for better yield.

The unfertilized plots produced the lowest grain yield with an average of 2.8 tons/ha.

Table 5. Grain yield in tons per hectare as affected by different fertilizer treatments

Treatments	Rate	Time of Application	Grain Yield (tons/ha)
T1- Control (no fertilizer)	-	-	2.8[e]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	120-10-10kg NPK/ha	Basal, 35 DAT	5.0[c]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	120-10-10 kg NPK/ha 20 ml/16L water	Basal, 35 DAT 30 DAT, 45 DAT	5.4[c]
T4- RRCF + RRMCU	120-10-10 kg NPK/ha 40 ml/16L water	Basally, 35 DAT 30 DAT, 45 DAT	6.0[b]
T5- RRCF + 1 ½ RRMCU	120-10-10 kg NPK/ha 60 ml/16L water	Basally, 35 DAT 30 DAT, 45 DAT	6.6[a]
T6- RRMCU	40 ml/16L water	30 DAT, 45 DAT	4.1[d]

Means followed by a common letter are not significantly different at the 5 % level by DMRT.

Comparison of Yield Increase

Table 6 presents the comparison of increase in yield. The highest yield of 6.6 tons/ha was obtained from RRCF + 1 ½ RRMCU having a yield advantage of 1.6 tons/ha and 32% yield increased over the recommended rate of conventional fertilizer alone. Moreover, application of RRCF + RRMCU has a yield increase of 1.0 ton/ha and 20 % over the application of conventional fertilizer alone.

Grain yield increased by 1.3 tons/ha or 46.43 % from the application of RRMCU over the control.

Results give an indication that application of Metalosate Crop-Up® Liquid Foliar Fertilizer increases grain yield of rice.

Table 6. Comparison of percent (%) yield increase

Treatments	Yield (Tons/Ha)	Increase in Yield over RRCF Inorganic Fertilizer	
		Tons/Ha	(%)
T2- Recommended Rate of Conventional Fertilizer (RRCF)	5.0[c]		
T3- RRCF + ½ Recommended Rate		0.4	8

of Metalosate Crop-Up® (RRMCU)	5.4[c]		
T4- RRCF + RRMCU	6.0[b]	1.0	20
T5- RRCF + 1 ½ RRMCU	6.6[a]	1.6	32

Treatments	Yield (Tons/Ha)	Increase in Yield over Control	
		Tons/Ha	(%)
T1- Control (no fertilizer)	2.8[e]		
T6- RRMCU	4.1[d]	1.3	46.43

SUMMARY AND CONCLUSION

Based on data parameters gathered during the duration of the trial, significant findings are the following:

- The application of 1 ½ RR Metalosate Crop-Up® Liquid Foliar Fertilizer applied at 30 and 45 DAT at the rate of 60ml/16L water in combination of recommended rate of conventional fertilizer (T5) produced the tallest plants at 30 DAT and at harvest, highest number of tillers at 30 DAT and at harvest, highest number of panicle at harvest, heaviest weight of fresh straw and highest grain yield among other treatments.
- Results obtained from using this treatment was statistically comparable to that of fertilizing the plants with 1.0 RR of Metalosate Crop-Up® Liquid Foliar Fertilizer in combination with recommended rate of conventional fertilizer in producing the tallest plants at 30 DAT and at harvest, highest number of tillers at 30 DAT and at harvest, highest number of panicle at harvest and heaviest weight of fresh straw.
- The untreated plants produced the shortest plant height at 30 DAT and at harvest, lowest number of tillers at 30 DAT and at harvest, lowest number of panicle at harvest, lightest weight of fresh straw and lowest grain yield.
- No phytotoxicity on the experimental crop due to the application of Metalosate Crop-Up® Liquid Foliar Fertilizer was observed.
- Incidence and occurrence of pests and diseases were insignificant probably due to high temperature at the early stage of growth until harvest.

- Highest grain yield of 6.60 tons/ha was obtained with the application of 1 ½ RR Metalosate Crop-Up® Liquid Foliar Fertilizer at the rate of 60 ml/16L water in combination of recommended rate of conventional fertilizer.
- In conclusion therefore, application of the Metalosate Crop-Up® Liquid Foliar Fertilizer at the rate of 40-60mL/16L water or 500 ml to 750 ml of product per hectare is highly recommended to adopt given that the grain yield obtained from T4 and T5 are both statistically greater than grain yield produced by T2.
- Based on the results of the field trial, it is hereby recommended to grant registration approval on Metalosate Crop-Up® as foliar fertilizer for rice with recommended rates of 500 ml to 750 ml of product per hectare.

APPENDIX TABLES

Appendix Table 1.1a. Average plant height (cm) at 30 days after transplanting based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Treatments	REPLICATION			TOTAL	MEAN
	I	II	III		
T1- Control (no fertilizer)	37.21	38.02	37.77	113.00	37.67[c]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	48.43	48.88	50.35	147.66	49.22[ab]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	56.35	44.68	49.34	150.37	50.12[ab]
T4- RRCF + RRMCU	51.64	43.18	56.89	151.71	50.57[ab]
T5- RRCF + 1 ½ RRMCU	50.10	50.14	52.57	152.81	50.94[a]
T6- RRMCU	45.15	42.15	45.06	132.36	44.12[b]

Appendix Table 1.1b.Analysis of variance on average plant height (cm) at 30 days after transplanting based on 10 randomly selected sample plants as affected by different fertilizer treatments

Source of variance	Df	SS	MS	F value	F tabular	
					.05	.01
Replication	2	61.5369	30.7684	2.67	4.10	7.56
Treatment	5	414.7914	82.9583	7.19**	3.33	5.64
Error	10	115.3659	11.5366			
Total	17	591.6941	34.8055			

**= highly significant

cv = 7.21%

Appendix Table 1.2a. Average plant height (cm) at harvest based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Treatments	REPLICATION			TOTAL	MEAN
	I	II	III		
T1- Control (no fertilizer)	68.45	69.90	61.71	200.06	66.69[d]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	82.13	78.71	80.23	241.07	80.36[b]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	83.48	80.29	81.10	244.87	81.62[ab]
T4- RRCF + RRMCU	86.17	81.38	85.27	252.82	84.27[ab]
T5- RRCF + 1 ½ RRMCU	84.31	86.93	84.43	255.67	85.22[a]
T6- RRMCU	75.56	74.68	75.79	226.03	75.34[c]

Appendix Table 1.2b.Analysis of variance on average plant height (cm) at harvest based on 10 randomly selected sample plants as affected by different fertilizer treatments

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	2	11.8088	5.9044	1.06	4.10	7.56
Treatment	5	720.6275	144.1255	25.83**	3.33	5.64
Error	10	55.7892	5.5789			
Total	17	788.2255	46.3662			

**= highly significant

cv = 2.99%

Appendix Table 2.1a. Average tiller count at 30 DAT based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Treatments	REPLICATION			TOTAL	MEAN
	I	II	III		
T1- Control (no fertilizer)	9.6	11.8	10.7	32.1	10.70[c]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	18.6	18.3	19.2	56.1	18.70[ab]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up ® (RRMCU)	19.6	18.9	18.4	56.9	18.97[ab]
T4- RRCF + RRMCU	22.7	19.3	21.7	63.7	21.23[a]
T5- RRCF + 1 ½ RRMCU	20.1	23.3	21.8	65.2	21.73[a]
T6- RRMCU	17.8	17.8	13.6	49.2	16.40[b]

Appendix Table 2.1b.Analysis of variance on average tiller count at 30 DAT based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	2	1.4444	0.7222	0.29	4.10	7.56
Treatment	5	244.9644	48.9929	19.51**	3.33	5.64
Error	10	25.1156	2.5116			
Total	17	271.5244	15.9720			

**= highly significant

cv = 8.82%

Appendix Table 2.2a. Average tiller count at harvest based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Treatments	REPLICATION			TOTAL	MEAN
	I	II	III		
T1- Control (no fertilizer)	11.9	12.3	11.9	36.1	12.03[c]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	21.7	24.1	23.1	68.9	22.97[a]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	23.3	26.4	24.3	74.0	24.67[a]
T4- RRCF + RRMCU	28.1	25.0	19.6	72.7	24.23[a]
T5- RRCF + 1 ½ RRMCU	26.6	27.5	23.5	77.6	25.87[a]
T6- RRMCU	16.2	17.9	18.5	52.6	17.53[b]

Appendix Table 2.2b.Analysis of variance on average tiller count at harvest based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	2	12.6700	6.3350	1.44	4.10	7.56
Treatment	5	430.7650	86.1530	19.58**	3.33	5.64
Error	10	44.0100	4.4010			
Total	17	487.4450	28.6732			

**= highly significant

cv = 9.88%

Appendix Table 3a. Average panicle count at harvest based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Treatments	REPLICATION			TOTAL	MEAN
	I	II	III		
T1- Control (no fertilizer)	11.2	12.1	7.9	31.2	10.4[d]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	20.9	17.0	21.1	59.0	19.7[b]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	21.1	18.2	20.1	59.4	19.8[b]
T4- RRCF + RRMCU	22.4	21.0	20.9	64.3	21.4[ab]
T5- RRCF + 1 ½ RRMCU	24.2	21.7	22.6	68.5	22.8[a]
T6- RRMCU	15.6	16.4	14.5	46.5	15.5[c]

Appendix Table 3b.Analysis of variance on average panicle count at harvest based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	2	8.3544	4.1772	1.83	4.10	7.56
Treatment	5	314.1961	62.8392	27.46**	3.33	5.64
Error	10	22.8856	2.2886			
Total	17	345.4361	20.3198			

**= highly significant

cv = 8.27%

Appendix Table 4a. Straw weight (g) at harvest based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Treatments	REPLICATION			TOTAL	MEAN
	I	II	III		
T1- Control (no fertilizer)	253	292	221	766	255.33[d]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	737	571	678	1986	662.00[b]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	785	763	710	2258	752.67[a]
T4- RRCF + RRMCU	839	784	763	2386	795.33[a]
T5- RRCF + 1 ½ RRMCU	825	807	820	2452	817.33[a]
T6- RRMCU	455	434	336	1225	408.33[c]

Appendix Table 4b.Analysis of variance on straw weight (g) at harvest based on the 10 randomly selected sample plants as affected by different fertilizer treatments

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	2	11563.0000	5781.5000	2.98	4.10	7.56
Treatment	5	800073.1667	160014.6333	82.39**	3.33	5.64
Error	10	19422.3333	1942.2333			
Total	17	831058.5000	48885.7941			

**= highly significant

cv = 7.16%

Appendix Table 5a. Grain yield in tons per hectare as affected by different fertilizer treatments

Treatments	REPLICATION			TOTAL	MEAN
	I	II	III		
T1- Control (no fertilizer)	2.9	3.0	2.4	8.3	2.8[e]
T2- Recommended Rate of Conventional Fertilizer (RRCF)	5.2	5.0	4.8	15.0	5.0[c]
T3- RRCF + ½ Recommended Rate of Metalosate Crop-Up® (RRMCU)	5.5	5.4	5.2	16.1	5.4[c]
T4- RRCF + RRMCU	6.4	6.1	5.5	18.0	6.0[b]
T5- RRCF + 1 ½ RRMCU	6.6	6.4	6.8	19.8	6.6[a]
T6- RRMCU	4.3	4.0	3.9	12.2	4.1[d]

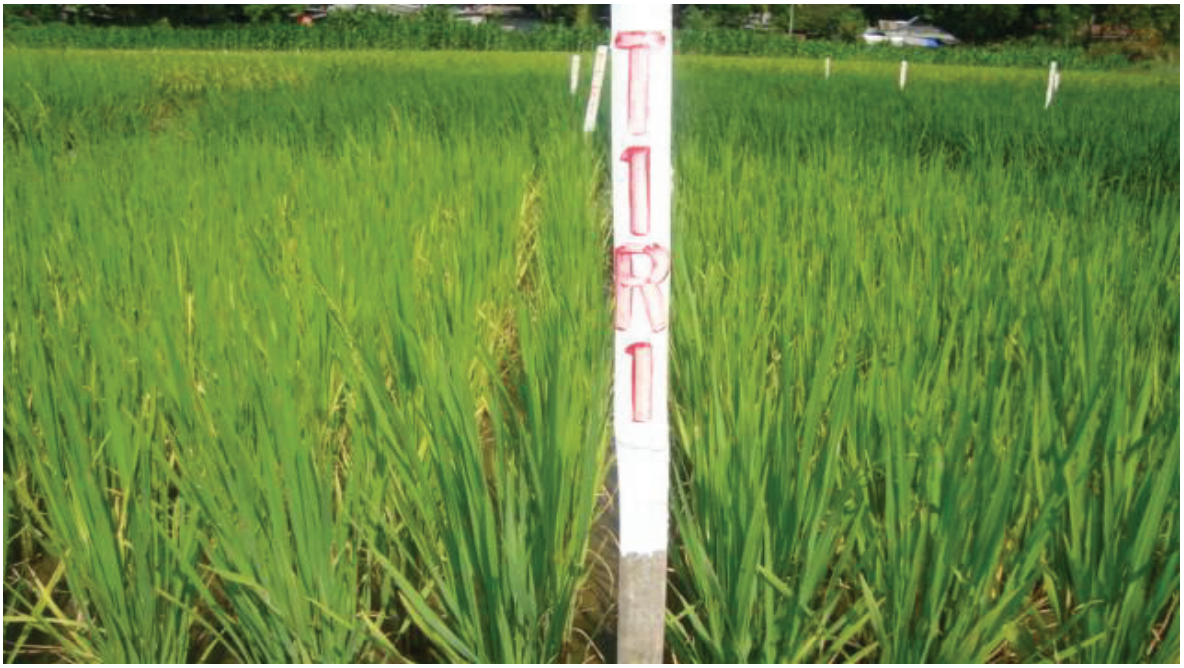
Appendix Table 5b. Analysis of variance on grain yield in tons per hectare as affected by different fertilizer treatments

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	2	0.4433	0.2217	4.65	4.10	7.56
Treatment	5	28.6400	5.7280	120.17**	3.33	5.64
Error	10	0.4767	0.0477			
Total	17	29.5600	1.7388			

**= highly significant

cv = 4.39%

PICTURES
(54 DAT)



T1-Control (no fertilizer)

T2-Recommended Rate of Conventional Fertilizer (RRCF)

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

T4- RRCF + RRMCU

T5- RRCF + 1 ½ RRMCU

T6- RRMCU

PICTURES
(top view)

T1-Control (no fertilizer)

T2-Recommended Rate of Conventional Fertilizer (RRCF)

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

T4- RRCF + RRMCU

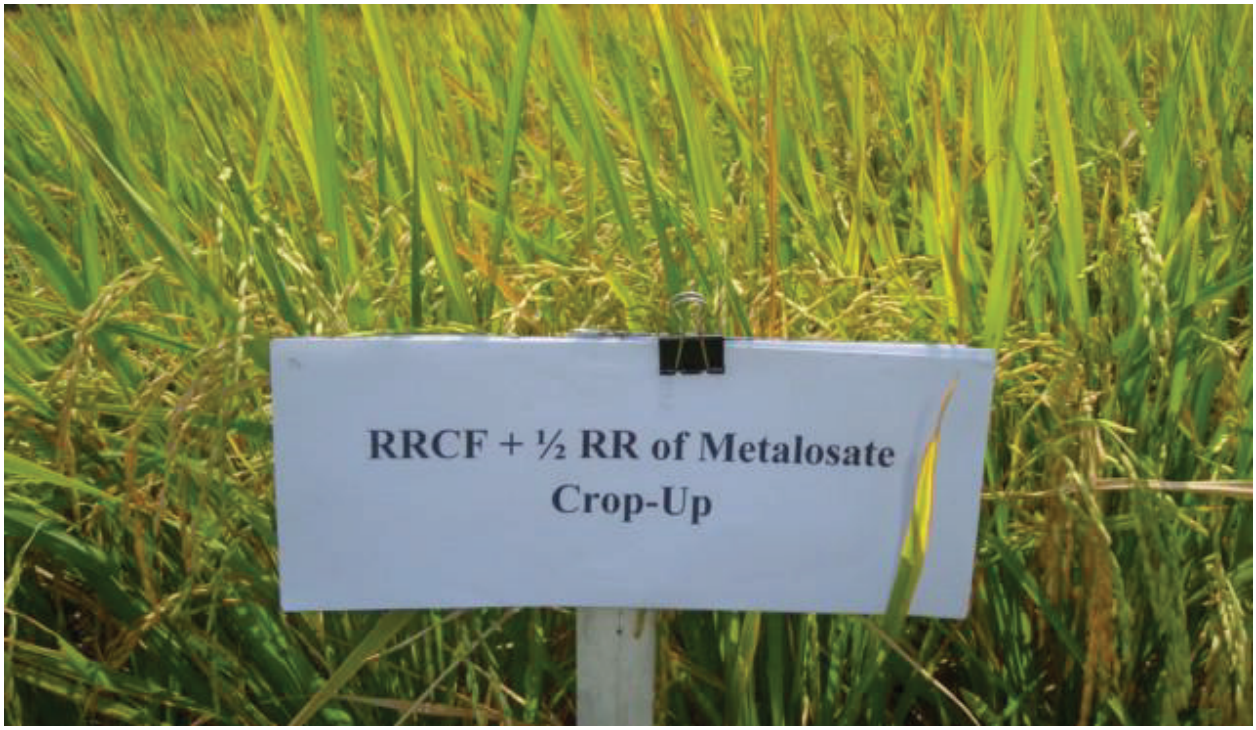
T5- RRCF + 1 ½ RRMCU

T6- RRMCU

PICTURES
(front view)

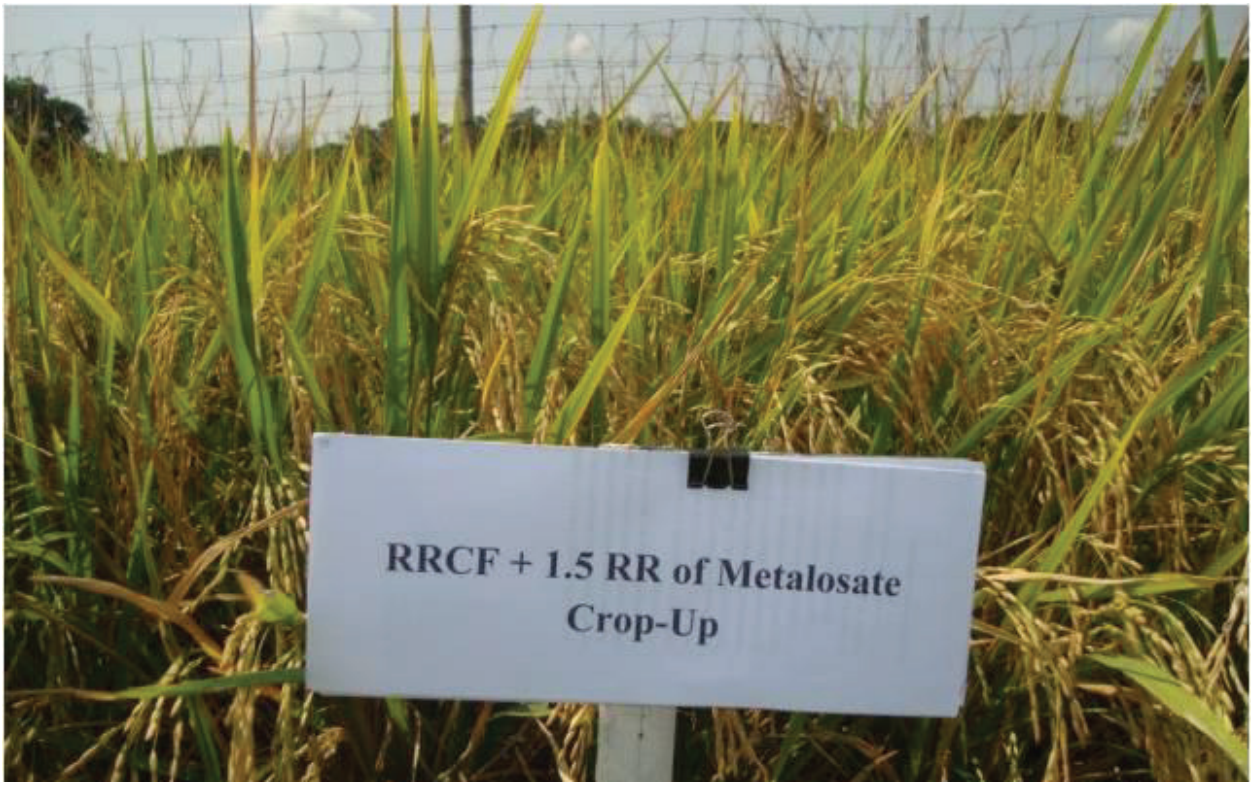
Treatment 1

Treatment 2



Treatment 3

Treatment 4



Treatment 5

Treatment 6

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