Evaluation of three dosage rates of NEB Root Exudates in paddy rice, Barangay Cawongan, Padre Garcia, Batangas, Philippines

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I. Introduction:

Rice is the most important grain crop in the Philippines, employing about 2.5 million Filipinos. The average rice farm size is 1.5 to 2.0 hectares per farm family with the average yield per hectare below 4.0 tons. In 2018, Philippine's rice production was 14,347,993 metric tons for irrigated system and 4,718,100 metric tons for rainfed. The area harvested for rice totalled 4,800,406 hectares, of which 3,286,152 hectares irrigated and 1,514,253 rainfed. Computed total harvest to area harvested is 3.972 tons per hectare. CALABARZON region produced 336,835 metric tons for irrigated and 83,397 metric tons for rainfed. Batangas province, where Padre Garcia is located, produced 32,390 metric tons for irrigated system and 14,919 metric tons for rainfed (Philippine Statistics Authority, 2018).

The country's average rice production is very low, with only 3.972 tons per hectare grain yield in 2018. In many developing countries, yields of irrigated rice are only about 4 to 6 tons/ha, while the potential yield of modern rice varieties is 10 to 11 tonnes per hectare under tropical humid conditions (FAO, 2004).

There is a need to increase the production of palay either by improving the agronomic systems, breeding, and/or nutrient use efficiency.

Root exudates offer the farmer an agronomic tool that can increase the yield of palay. Root exudates refer to a suite of substances that are secreted by the roots of living plants into the rhizosphere and microbially modified products of these substances. They consist of low-molecular-weight organic compounds that are freely and passively released root-cell material

and mucilage associated with roots. Root exudates are known to influence growth and establishment of crop and weed species, and these are released from living root systems. The use of root exudates in rice production may increase production, hence this trial.

II. Objective:

Measure the grain yield of paddy rice to determine the optimal blending rate of NEB on both at both 100% urea and 50% urea rates

III. Materials and Methods

1. Experimental Site

The experimental site is located in Barangay Cawongan, Padre Garcia, Batangas. The site is usually planted with lowland rice and vegetables. The soil series in Padre Garcia are Guadalupe series and Lipa series. The experimental site has a textural classification of Clay. The area is flat and accessible for monitoring. Irrigation is available almost any time of the year coming from a deep well located near the site.

2. Selection of Crop Variety

The rice variety used in the study is NSIC-RC238. The average yield of this variety is 6.4 tons per hectare, the maximum yield is 10.6 tons per hectare. This variety has a maturity of 110 days. Planting distance is 20cm x 20cm. The variety was the most common variety planted in Padre Garcia community.

3. Soil sampling and analysis

A soil sample was collected prior to land preparation and planting. The composite soil sample was collected from 10 holes of a depth of 15 cm. After mixing the soil from these holes, a kilogram was analyzed for nutrient content.

4. Application of treatments

There were nine treatments. The different treatments are as follows:

Treatment Summary

	NEB Blending Rate	Fertilizer #1 Basal	Fertilizer App #2 Tillering Stage	Fertilizer App #3 Booting Stage
T1	No Fertilizer Control	-----	-----	-----
T2	50% Urea Control	100 kg 14-14-14/HA NO NEB	50 kg urea/HA 50% urea rate NO NEB	50 kg urea/HA 50% urea rate NO NEB
T3	100% Urea Control	100 kg 14-14-14/HA NO NEB	100 kg urea/HA 100% urea rate NO NEB	100 kg urea/HA 100% urea rate NO NEB
T4	3 L NEB per ton	100 kg 14-14-14/HA NO NEB	50 kg urea/HA 50% urea rate NEB at 3 L/ton rate	50 kg urea/HA 50% urea rate NEB at 3 L/ton rate
T5	4 L NEB per ton	100 kg 14-14-14/HA NO NEB	50 kg urea/HA 50% urea rate NEB at 4 L/ton rate	50 kg urea/HA 50% urea rate NEB at 4 L/ton rate
T6	5 L NEB per ton	100 kg 14-14-14/HA NO NEB	50 kg urea/HA 50% urea rate NEB at 5 L/ton rate	50 kg urea/HA 50% urea rate NEB at 5 L/ton rate
T7	3 L NEB per ton	100 kg 14-14-14/HA NO NEB	100 kg urea/HA 100% urea rate NEB at 3 L/ton rate	100 kg urea/HA 100% urea rate NEB at 3 L/ton rate
T8	4 L NEB per ton	100 kg 14-14-14/HA NO NEB	100 kg urea/HA 100% urea rate NEB at 4 L/ton rate	100 kg urea/HA 100% urea rate NEB at 4 L/ton rate
T9	5 L NEB per ton	100 kg 14-14-14/HA NO NEB	100 kg urea/HA 100% urea rate NEB at 5L/ton rate	100 kg urea/HA 100% urea rate NEB at 5L/ton rate

7. Experimental Design

The experiment was laid out in randomized complete block design with three replications. Each experimental unit has an area of 25sqm with a dimension of 5m x 5m.

V. Cultural Management

1. Land Preparation

The experimental field was plowed, harrowed and levelled using a hand-held tractor. Small paddy plots measuring 5x5 m^2 were made manually using spade. A total of 27 paddy plots were established. An irrigation canal was constructed in between blocks to avoid contamination.

2. Sowing and Transplanting

Seedlings were prepared using "dapog system". Seedlings were transplanted at 15 days after sowing. Two seedlings per hill were transplanted in the field at a distance of 20cm x20cm. Thinning was done after a week. Replanting of missing hills was done but only up to a week after transplanting.

3. Water Management

The usual water management practices for irrigated rice were followed. After transplanting, water level was maintained at 3cm, and was gradually increased to 5-10cm (with increasing plant height) and remained there until the field was drained 7-10 days before harvest. To avoid contaminations between plots, canals were dugout between blocks. The plots were saturated before each fertilizer applications.

4. Pest Management

Weeds were removed with a manual weeder immediately after fertilizer applications. Spot weeding was done whenever necessary.

Regular monitoring of the rice plants was done to prevent disease outbreak. Infected plants showing unusual signs such as white or yellow streaks on the leaves, stunting, burning and tungro symptoms were immediately removed and burn.

Insect infestation was managed by applying insecticides appropriate to the target insect pest.

5. Harvesting

The rice grains were harvested manually when the grains is 80-85% straw colored. Each plot was harvested separately per treatment and replicates. The grains were manually harvested using a sickle. Yield and yield data were measured from the net plot. Threshing was also done manually. After threshing, the grains were cleaned by winnowing.

6. Data Gathered

Data before harvest

a. Tiller count at 30 DAT (Number per sq.m.). Four-corner hills, totalling 16 hills, outside the net plot (net plot was 2.5m x 2.5m) were utilized for agronomic data. These hills were tagged. The number of tillers was gathered from these tagged hills. The area occupied by 16 hills is 0.64 sq.m. The count was converted to number per sq.m.
b. Plant height at 30 DAT. The plant height at 30 DAT was measured from 16 tagged hills

Data at harvest

a. Plant height at harvest.
b. Tiller count at harvest
c. Straw yield (tons per hectare). The plants were cut close to the ground level per net plot area of 6.25 sqm and the rice straws were weighed after threshing. The weight was converted to tons per hectare.
d. Root weight. Tagged hills were uprooted, and soil particles were removed from the roots. The roots were detached from the plant by cutting at the base of the rice crop. Roots were weighed and converted to root weight per plant.
e. Grain yield (tons per hectare). The grain yields per 6.25 sqm net plot (2.5sqm x 2.5sqm) were measured and moisture content determined, and measurements were converted to weight at 14% MC. Yields were converted to tons per hectare.

7. Data analysis and interpretation

ANOVA was used to determine the significance of the treatments. LSD was used to compare the means of significant treatments.

VI. Results

Rice seedlings were sown on June 15, 2019. Transplanting of rice and basal application of fertilizers were done on July 3, 2019 (18 Days After Sowing, DAS). Second application of fertilizers was done on the tillering stage at 37 Days After Transplanting (37 DAT) (August 9, 2019) and the third and final application of fertilizers on August 25, 2019 (53 DAT). Harvesting was done on October 6, 2019.

1. Soil Fertility Data

Soil sample submitted to the Regional Soils Laboratory of Region 4A revealed that the area has a pH of 7.31, Organic Matter of 1.5 percent, Phosphorus of 11 ppm and Potassium of 59 ppm. Based on the analysis, the nutrient requirement rice is 100N-7P-20K or 4 bags ammonium sulphate (21-0-0-24), 1 bag complete (14-14-14) and 21.5 kg muriate of potash (0-0-60) fertilizers at planting, and 2 & ¼ bags ammonium sulphate (21-0-0-24) at panicle initiation.

2. Number of Tiller 30 DAT

The first application of NEB was applied at 37 DAT. Thus, the 30 DAT tiller count was not influenced by NEB. The basal application of fertilizer (applied at transplanting) was the same for treatments T2 – T9. The only difference was the untreated control, T1 that received no fertilizer. Only the application of basal fertilizers has affected the number of tillers, hence, the unfertilized control significantly shows the said influence. Please refer to Table 1 for the summary table of data before harvest.

Statistical analysis done on the number of tillers at 30 DAT revealed that the tillers of rice plants applied with the different treatments were not significantly different from each other, except the control (T1). Numerically, the greatest number of tillers was observed from plants applied with 100% urea coated with 5L NEB per ton of urea (T9) with 308 tillers per sqm. The lowest number of tillers came from the unfertilized control (T1) with 179.87 tillers per sqm. The NEB applied has not affected the number of tillers of rice plants, this is because the first application of treatments was done on the 37th DAT.

Table 1. Summary table, agronomic data before harvest, Padre Garcia, Batangas, October 2019

	TREATMENT	No of Tillers 30 DAT, per sqm		Plant Height 30 DAT, cm	
T1	Control	179.87	c	29.17	b
T2	50% Urea Control	300.80	ab	34.67	a
T3	100% Urea Control	299.17	ab	34.93	a
T4	**3 L NEB per ton, 50% Urea**	301.10	ab	34.97	a
T5	**4 L NEB per ton, 50% Urea**	299.13	ab	35.33	a
T6	**5 L NEB per ton, 50% Urea**	297.42	b	31.43	a
T7	**3 L NEB per ton, 100% Urea**	300.00	ab	34.17	a
T8	**4 L NEB per ton, 100% Urea**	297.35	b	33.97	a
T9	**5 L NEB per ton, 100% Urea**	308.42	a	33.73	a
CV		2.08		3.64	
LSD		10.3504		2.1182	

3. Plant Height at 30 DAT

The first application of NEB was applied at 37 DAT. Thus, the 30 DAT plant height was not influenced by NEB. The basal application of fertilizer (applied at transplanting) was the same for treatments T2 – T9. The only difference was the untreated control, T1 that received no fertilizer. Only the application of basal fertilizers has affected the plant height, hence, the unfertilized control significantly shows the said influence. Please refer to Table 1 for the summary table of data before harvest.

Data on plant height at 30 DAT revealed the same result as the number of tillers at 30 DAT. In both parameters, the basal application of fertilizers have affected the results when comparing T1 vs T2-T9. Numerically, the greatest plant height observed was 34.97cm (T4) while the least was 29.17 cm, however numberical differences were not statistically significant. Please see Table 1 for the summary table.

4. Number of Tillers at Harvest

NEB was applied at 37 and 53 DAT, so differences in the agronomic data at harvest were a result of NEB. At harvest, significant differences were observed on the number of tillers (Please refer to Table 2 for the summary table on agronomic data at harvest). The greatest number of tillers was observed from the 100% urea treatment coated with 5L NEB

per ton of urea (Treatment 9) with 568.33 tillers per sqm. This was followed with the number of tillers applied with 100% urea treatment coated with 3L NEB per ton of urea (Treatment 7), 100% urea treatment coated with 4L NEB per ton of urea (Treatment 8) and 50% urea treatment coated with 5L NEB per ton of urea (Treatment 6) with 478.33 tillers per sqm, 483.33 tillers per sqm and 425.00 tillers per sqm, respectively. The 50% urea treatment coated with 3L NEB per ton of urea (Treatment 4) and 50% urea treatment coated with 4L NEB per ton of urea (Treatment 5) yielded number of tillers of 375.00 per sqm and 408.33 per sqm, respectively. Those rice crops applied with urea without NEB coating have tillers of 341.67 per sqm (50% urea control) and 391.67 per sqm (100% urea control). Least number of tillers was observed from the unfertilized control with 290 tillers per sqm (Treatment 1).

Table 2. Summary table, agronomic data at harvest, Padre Garcia, Batangas, October 2019

	TREATMENT	No of Tillers at Harvest, per sqm		Plant Height at Harvest, cm		No of Panicles, per sqm		Root Weight, g	
T1	Control	290.00	e	93.33	b	261.67	f	14.01	f
T2	50% Urea Control	341.67	de	111.00	a	306.67	ef	20.54	de
T3	100% Urea Control	391.67	cd	113.44	a	343.33	cde	17.29	ef
T4	**3 L NEB per ton, 50% Urea**	375.00	cd	112.33	a	338.33	cd	30.22	bc
T5	**4 L NEB per ton, 50% Urea**	408.33	cd	122.50	a	375.00	bcd	25.53	cd
T6	**5 L NEB per ton, 50% Urea**	425.00	bc	121.06	a	385.00	bcd	29.28	bc
T7	**3 L NEB per ton, 100% Urea**	478.33	b	119.68	a	406.67	bc	30.25	bc
T8	**4 L NEB per ton, 100% Urea**	483.33	b	117.80	a	436.67	ab	31.31	b
T9	**5 L NEB per ton, 100% Urea**	568.33	a	120.11	a	490.00	a	39.09	a
CV		9.41		7.56		10.16		12.18	
LSD		68.0512		14.9934		65.305		5.5623	

5. Plant Height at Harvest

At harvest, the different treatments did not show significant differences in regards to the plant height, except for the unfertilized control (Treatment 1). The greatest measurement on plant height was 122.50 cm, while the least was 93.33 cm. See Table 2 for the summary table on agronomic data at harvest.

6. Number of Panicles

The number of panicles was measured on harvest. Based on the statistical analysis, the greatest number of panicles was observed from 100% urea treatments coated with 5L NEB per ton of urea (Treatment 9) with 490.00 panicles per sqm. The said measurement was

not significantly different from the observation on the number of panicles of plants applied with 100% urea treatment coated with 4L NEB per ton urea (Treatment 8) with 436.67 panicles per sqm. The application of 100% urea coated with 3L NEB per ton of urea yielded a panicle count of 406.67 per sqm (Treatment 7). Plants applied with 50% urea treatment coated with 3L, 4L and 5L NEB per ton urea (Treatment 4, Treatment 5 and Treatment 6) were observed to have panicle counts of 338.33, 375.00, and 385.00, respectively. Plants applied with 50% urea control was observed to have a panicle count of 306.67, while those applied with 100% urea control with 343.33. Least observation came from unfertilized control with 261.67 panicles per sqm. Refer to Table 2 for the summary table on agronomic data at harvest.

7. Root Weight

Data on root weight reveals that rice plants applied with 100% urea treatment coated with 5L NEB per ton of urea (treatment 9) have root weight significantly the greatest among treatments with 39.09 g per plant. Following the said treatment is the root weight of rice plants applied with 100% urea treatment coated with 4L NEB per ton of urea (Treatment 8) with 31.31 g per plant. The application of 100% urea treatment coated with 3L NEB per ton of urea (Treatment 7) yielded a root weight of 30.25 g per plant. The application of 50% urea treatment coated with 3L, 4L and 5L NEB (Treatment 4, Treatment 5 and Treatment 6) per ton of urea resulted to root weights of 30.22 g, 25.53 g, and 29.28 g per plant, respectively. The application of 50% urea control and 100% urea control yielded root weights of 20.54 g and 17.29 g, respectively. Unfertilized control has root weight of 14.01 g per plant. Please refer to Table 2 for the summary table on agronomic data.

8. Straw Weight

Result of the statistical analysis on straw weight showed that the application of 100% urea treatment coated with 3L, 4L and 5L NEB (Treatment 7, Treatment 8 and Treatment 9) per ton of urea have resulted to a straw weight of 13.57 tons per hectare, 14.47 tons per hectare and 14.66 tons per hectare, respectively (Refer to Table 3 for the summary table on straw and grain weights). The application of 50% urea treatment coated with 3L, 4L and 5L NEB (Treatment 4, Treatment 5 and Treatment 6) yielded straw weights of 9.9 tons per hectare, 11.21 tons per hectare and 11.98 tons per hectare, respectively. The application of

50% and 100% urea control (Treatment 2 and Treatment 3) were measured to have straw weights of 8.89 and 10.23 tons per hectare. The unfertilized control yielded a straw weight of 5.15 tons per hectare.

Table 3. Summary table, straw yield and grain yield data, Padre Garcia, Batangas, October 2019

	TREATMENT	Straw Weight, tons/ha		Grain Weight, tons/ha	
T1	Control	5.15	f	0.86	e
T2	50% Urea Control	8.89	e	2.82	d
T3	100% Urea Control	10.23	cde	3.43	c
T4	**3 L NEB per ton, 50% Urea**	9.90	de	3.30	cd
T5	**4 L NEB per ton, 50% Urea**	11.21	cd	3.75	bc
T6	**5 L NEB per ton, 50% Urea**	11.98	bc	3.97	ab
T7	**3 L NEB per ton, 100% Urea**	13.57	ab	4.20	a
T8	**4 L NEB per ton, 100% Urea**	14.47	a	4.90	a
T9	**5 L NEB per ton, 100% Urea**	14.66	a	5.05	a
CV		9.81		8.41	
LSD		1.8934		0.5219	

9. Grain Weight

The objective of this study was to identify the optimal blending rate at the 50% urea dosage as well as the 100% urea dosage. T2, the 50% urea control treatment, had equal quantity of fertilizer (including urea) to T4, T5 and T6, but these later treatments included 3, 4 and 5 L NEB per ton urea, respectively.

Treatment 2, which is 50% urea control, yielded 2.82 tons per hectare. On the other hand, the application of 50% urea treatment coated with 3L, 4L and 5L NEB (Treatment 4, Treatment 5 and Treatment 6) per ton of urea yielded grain weights of 3.30 tons per hectare, 3.75 tons per hectare and 3.97 tons per hectare, respectively. This represents a yield increase of 0.48, 0.93 and 1.15 tons per hectare yield increase. The 5 L/ton dosage was statistically significant.

Treatment 3, which is 100% urea control, yielded 3.43 tons per hectare. On the other hand, the application of 100% urea treatment coated with 3L, 4L and 5L NEB (Treatment 7, Treatment 8 and Treatment 9) per ton of urea yielded grain weights of 4.20 tons per hectare,

4.90 tons per hectare and 5.05 tons per hectare, respectively. This represents a yield increase of 1.47 and 1.62 tons per hectare yield increase. All three of the 100% urea treatment coated with 3L, 4L and 5L NEB (Treatment 7, Treatment 8 and Treatment 9) were statistically significant compared to the equal quantity of urea control, T3. Least grain yield came from unfertilized control with 0.86 tons per hectare. Please refer to Table 3 for the summary table on straw and grain yield.

VII. Conclusion and Recommendations

The application of NEB significantly provided beneficial effects on the growth and yield of rice. The benefits of the application of NEB can be observed with the application of the full dosage of urea to the rice plants as shown on the data on straw and grain yields, and supported with the results on the number of tillers, panicles and root weight.

In both the 50% and 100% urea data sets, the higher dosages of NEB had an upward trend. This suggests that higher dosages of NEB may produce larger benefits. In respect to the objective of the study of identifying the optimal blending rate of NEB at the 50% and 100% urea dosages as outlined previously, the data suggests that higher dosages of NEB may be optimal.

Limited to the three dosage rates as tested in this study, the 5L NEB per ton of urea provided the highest grain yield and agromonic data. The 5 L NEB per ton urea also provided statistically significant results. From these three rates, the 5 L NEB per ton urea proved to be the optimal blending rate.

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Annex 1. Plant Height at 30 DAT

Treatments	Replicates			Mean
	I	II	III	
T1: No Fertilizer Control	30.00	29.50	28.00	29.17b
T2: 50% Urea Control	34.50	34.00	35.50	34.67a
T3: 100% Urea Control	34.60	36.30	33.90	34.93a
T4: 50% Urea + NEB at 3 L/ton urea	35.00	33.60	36.30	34.97a
T5: 50% Urea + NEB at 4 L/ton urea	37.30	34.80	33.90	35.33a
T6: 50% Urea + NEB at 5 L/ton urea	30.00	30.60	33.70	31.43a
T7: 100% Urea + NEB at 3 L/ton urea	34.20	33.80	34.50	34.17a
T8: 100% Urea + NEB at 4 L/ton urea	34.10	33.20	34.60	33.97a
T9: 100% Urea + NEB at 5 L/ton urea	33.90	33.10	34.20	33.73a
CV				3.64%
LSD (0.05)				2.1182

ANOVA TABLE
Response Variable: Plant.Height 30DAT

Source	DF	Sum of Square	Mean Square	F Value	Pr(> F)
Block	2	2.0585	1.0293	0.69	0.5172
Treatment	8	97.8296	12.2287	8.17	0.0002
Error	16	23.9615	1.4976		
Total	26	123.8496			

Summary Statistics

CV(%)	Plant.Height Mean
3.64	33.60

Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	1.4976
Critical Value	2.1199
Test Statistics	2.1182

Summary of the Result:

Treatment	means	N	group
1	29.17	3	b
2	34.67	3	a
3	34.93	3	a
4	34.97	3	a
5	35.33	3	a
6	31.43	3	a
7	34.17	3	a
8	33.97	3	a
9	33.73	3	a

Means with the same letter are not significantly different.

Annex 2. Number of Tillers at 30 DAT

Treatments	Replicates			Mean
	I	II	III	
T1: No Fertilizer Control	182.50	177.25	179.85	179.87c
T2: 50% Urea Control	300.25	302.00	300.15	300.80ab
T3: 100% Urea Control	297.75	299.25	300.50	299.17ab
T4: 50% Urea + NEB at 3 L/ton urea	311.00	292.75	299.55	301.10ab
T5: 50% Urea + NEB at 4 L/ton urea	297.25	302.15	298.00	299.13ab
T6: 50% Urea + NEB at 5 L/ton urea	291.25	301.50	299.50	297.42b
T7: 100% Urea + NEB at 3 L/ton urea	299.50	291.00	309.50	300.00ab
T8: 100% Urea + NEB at 4 L/ton urea	290.50	302.00	299.55	297.35b
T9: 100% Urea + NEB at 5 L/ton urea	312.25	300.75	309.25	308.42a
CV				2.08%
LSD (0.05)				10.3504

ANOVA TABLE
Response Variable: No.of.tillers.30DAT

Source	DF	Sum of Square	Mean Square	F Value	Pr(> F)
Block	2	41.7689	20.8844	0.58	0.5691
Treatment	8	39016.0283	4877.0035	136.39	0.0000
Error	16	572.1294	35.7581		
Total	26	39629.9267			

Summary Statistics

CV(%)	No.of.tillers.30DAT Mean
2.08	287.03

Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	35.7581
Critical Value	2.1199
Test Statistics	10.3504

Summary of the Result:

Treatment	means	N	group
1	179.87	3	c
2	300.80	3	ab
3	299.17	3	ab
4	301.10	3	ab
5	299.13	3	ab
6	297.42	3	b
7	300.00	3	ab
8	297.35	3	b
9	308.42	3	a

Means with the same letter are not significantly different.

Annex 3. Plant Height at Harvest

Treatments	Replicates			Mean
	I	II	III	
T1: No Fertilizer Control	118.00	78.00	84.00	93.33b
T2: 50% Urea Control	111.00	109.00	113.00	111.00a
T3: 100% Urea Control	116.00	103.00	121.33	113.44a
T4: 50% Urea + NEB at 3 L/ton urea	111.00	108.00	118.00	112.33a
T5: 50% Urea + NEB at 4 L/ton urea	117.00	124.50	126.00	122.50a
T6: 50% Urea + NEB at 5 L/ton urea	122.00	125.00	115.67	121.06a
T7: 100% Urea + NEB at 3 L/ton urea	117.00	121.78	120.25	119.68a
T8: 100% Urea + NEB at 4 L/ton urea	116.60	116.56	120.25	117.80a
T9: 100% Urea + NEB at 5 L/ton urea	118.74	122.08	119.51	120.11a
CV				7.56%
LSD (0.05)				14.9934

ANOVA TABLE
Response Variable: Plant.Height.at.Harvest

Source	DF	Sum of Square	Mean Square	F Value	Pr(> F)
Block	2	91.7549	45.8775	0.61	0.5548
Treatment	8	1926.5911	240.8239	3.21	0.0225
Error	16	1200.5421	75.0339		
Total	26	3218.8881			

Summary Statistics

CV(%)	Plant.Height.at.Harvest Mean
7.56	114.58

Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	75.0339
Critical Value	2.1199
Test Statistics	14.9934

Summary of the Result:

Treatment	means	N	group
1	93.33	3	b
2	111.00	3	a
3	113.44	3	a
4	112.33	3	a
5	122.50	3	a
6	121.06	3	a
7	119.68	3	a
8	117.80	3	a
9	120.11	3	a

Means with the same letter are not significantly different.

Annex 4. Number of Tillers at Harvest

Treatments	Replicates			Mean
	I	II	III	
T1: No Fertilizer Control	300.00	280.00	290.00	290.00e
T2: 50% Urea Control	370.00	335.00	320.00	341.67de
T3: 100% Urea Control	410.00	400.00	365.00	391.67cd
T4: 50% Urea + NEB at 3 L/ton urea	405.00	395.00	325.00	375.00cd
T5: 50% Urea + NEB at 4 L/ton urea	435.00	405.00	385.00	408.33cd
T6: 50% Urea + NEB at 5 L/ton urea	465.00	420.00	390.00	425.00bc
T7: 100% Urea + NEB at 3 L/ton urea	505.00	460.00	470.00	478.33b
T8: 100% Urea + NEB at 4 L/ton urea	510.00	465.00	475.00	478.33b
T9: 100% Urea + NEB at 5 L/ton urea	555.00	480.00	670.00	568.33a
CV				9.41%
LSD (0.05)				68.0512

ANOVA TABLE
Response Variable: No.of.Tillers.at.Harvest

Source	DF	Sum of Square	Mean Square	F Value	Pr(> F)
Block	2	6368.5185	3184.2593	2.06	0.1599
Treatment	8	166212.9630	20776.6204	13.44	0.0000
Error	16	24731.4815	1545.7176		
Total	26	197312.9630			

Summary Statistics

CV(%)	No.of.Tillers.at.Harvest Mean
9.41	417.96

Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	1545.7176
Critical Value	2.1199
Test Statistics	68.0512

Summary of the Result:

Treatment	means	N	group
1	290.00	3	e
2	341.67	3	de
3	391.67	3	cd
4	375.00	3	cd
5	408.33	3	cd
6	425.00	3	bc
7	478.33	3	b
8	483.33	3	b
9	568.33	3	a

Means with the same letter are not significantly different.

Annex 5. Number of Panicles at Harvest

Treatments	Replicates			Mean
	I	II	III	
T1: No Fertilizer Control	270.00	240.00	275.00	261.67f
T2: 50% Urea Control	310.00	310.00	300.00	306.67ef
T3: 100% Urea Control	350.00	350.00	330.00	343.33cde
T4: 50% Urea + NEB at 3 L/ton urea	325.00	370.00	320.00	338.33de
T5: 50% Urea + NEB at 4 L/ton urea	405.00	380.00	320.00	338.33bcd
T6: 50% Urea + NEB at 5 L/ton urea	410.00	395.00	350.00	385.00bcd
T7: 100% Urea + NEB at 3 L/ton urea	430.00	405.00	385.00	406.67bc
T8: 100% Urea + NEB at 4 L/ton urea	435.300	425.00	450.00	436.67ab
T9: 100% Urea + NEB at 5 L/ton urea	445.00	435.00	590.00	490.00a
CV				10.16%
LSD (0.05)				65.3054

ANOVA TABLE
Response Variable: No.of.Panicles

Source	DF	Sum of Square	Mean Square	F Value	Pr(> F)
Block	2	274.0741	137.0370	0.10	0.9087
Treatment	8	113640.7407	14205.0926	9.98	0.0001
Error	16	22775.9259	1423.4954		
Total	26	136690.7407			

Summary Statistics

CV(%)	No.of.Panicles Mean
10.16	371.48

Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	1423.4954
Critical Value	2.1199
Test Statistics	65.3054

Summary of the Result:

Treatment	means	N	group
1	261.67	3	f
2	306.67	3	ef
3	343.33	3	cde
4	338.33	3	de
5	375.00	3	bcd
6	385.00	3	bcd
7	406.67	3	bc
8	436.67	3	ab
9	490.00	3	a

Means with the same letter are not significantly different.

Annex 6. Straw Weight

Treatments	Replicates			Mean
	I	II	III	
T1: No Fertilizer Control	5.60	4.67	5.18	5.15f
T2: 50% Urea Control	8.61	9.09	8.96	8.89e
T3: 100% Urea Control	12.06	9.44	9.18	10.23cde
T4: 50% Urea + NEB at 3 L/ton urea	9.28	10.02	10.40	9.90de
T5: 50% Urea + NEB at 4 L/ton urea	12.35	10.11	11.17	11.21cd
T6: 50% Urea + NEB at 5 L/ton urea	12.74	11.42	11.78	11.98bc
T7: 100% Urea + NEB at 3 L/ton urea	14.69	11.42	14.59	13.57ab
T8: 100% Urea + NEB at 4 L/ton urea	16.16	12.22	15.04	14.47a
T9: 100% Urea + NEB at 5 L/ton urea	15.65	12.90	15.42	14.66a
CV				9.81%
LSD (0.05)				1.8934

ANOVA TABLE
Response Variable: Straw.Weight

Source	DF	Sum of Square	Mean Square	F Value	Pr(> F)
Block	2	18.4842	9.2421	7.72	0.0045
Treatment	8	227.2751	28.4094	23.74	0.0000
Error	16	19.1451	1.1966		
Total	26	264.9045			

Summary Statistics

CV(%)	Straw.Weight Mean
9.81	11.15

Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	1.1966
Critical Value	2.1199
Test Statistics	1.8934

Summary of the Result:

Treatment	means	N	group
1	5.15	3	f
2	8.89	3	e
3	10.23	3	cde
4	9.90	3	de
5	11.21	3	cd
6	11.98	3	bc
7	13.57	3	ab
8	14.47	3	a
9	14.98	3	a

Means with the same letter are not significantly different.

Annex 7. Root Weight

Treatments	Replicates			Mean
	I	II	III	
T1: No Fertilizer Control	16.40	14.83	10.80	14.01f
T2: 50% Urea Control	21.00	22.17	18.45	20.54de
T3: 100% Urea Control	22.20	17.37	12.29	17.29ef
T4: 50% Urea + NEB at 3 L/ton urea	29.60	31.95	29.11	30.22bc
T5: 50% Urea + NEB at 4 L/ton urea	30.80	25.21	20.57	25.53cd
T6: 50% Urea + NEB at 5 L/ton urea	33.20	29.78	24.88	29.28bc
T7: 100% Urea + NEB at 3 L/ton urea	36.80	28.62	25.34	30.25bc
T8: 100% Urea + NEB at 4 L/ton urea	39.00	29.50	25.43	31.31b
T9: 100% Urea + NEB at 5 L/ton urea	50.40	35.81	31.07	39.09a
CV				12.18%
LSD (0.05)				5.5623

ANOVA TABLE
Response Variable: Root.Weight

Source	DF	Sum of Square	Mean Square	F Value	Pr(> F)
Block	2	369.5232	184.7616	17.89	0.0001
Treatment	8	1484.0067	185.5008	17.96	0.0000
Error	16	165.2279	10.3267		
Total	26	2018.7578			

Summary Statistics

CV(%)	Root.Weight Mean
12.18	26.39

Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	10.3267
Critical Value	2.1199
Test Statistics	5.5623

Summary of the Result:

Treatment	means	N	group
1	14.01	3	f
2	20.54	3	de
3	17.29	3	ef
4	30.22	3	bc
5	25.53	3	cd
6	29.29	3	bc
7	30.25	3	bc
8	31.31	3	b
9	39.09	3	a

Means with the same letter are not significantly different.

Annex 8. Grain Weight

Treatments	Replicates			Mean
	I	II	III	
T1: No Fertilizer Control	0.64	0.77	1.18	0.86e
T2: 50% Urea Control	2.59	3.01	2.85	2.82d
T3: 100% Urea Control	3.68	3.10	3.52	3.43c
T4: 50% Urea + NEB at 3 L/ton urea	3.49	3.17	3.23	3.30cd
T5: 50% Urea + NEB at 4 L/ton urea	4.13	3.49	3.65	3.75bc
T6: 50% Urea + NEB at 5 L/ton urea	4.42	3.62	3.87	3.97ab
T7: 100% Urea + NEB at 3 L/ton urea	4.61	3.68	4.32	4.20a
T8: 100% Urea + NEB at 4 L/ton urea	4.70	5.28	4.70	4.90a
T9: 100% Urea + NEB at 5 L/ton urea	5.22	4.99	4.93	5.05a
CV				8.41%
LSD (0.05)				0.5219

ANOVA TABLE
Response Variable: Grain.Weight

Source	DF	Sum of Square	Mean Square	F Value	Pr(> F)
Block	2	0.3122	0.1561	1.72	0.2111
Treatment	8	37.5365	4.6921	51.61	0.0000
Error	16	1.4547	0.0909		
Total	26	39.3034			

Summary Statistics

CV(%)	Grain.Weight Mean
8.41	3.59

Least Significant Difference (LSD) Test

Alpha	0.05
Error Degrees of Freedom	16
Error Mean Square	0.0909
Critical Value	2.1199
Test Statistics	0.5219

Summary of the Result:

Treatment	means	N	group
1	0.86	3	e
2	2.82	3	d
3	3.43	3	c
4	3.30	3	cd
5	3.76	3	bc
6	3.97	3	ab
7	4.20	3	a
8	4.89	3	a
9	5.05	3	a

Means with the same letter are not significantly different.

Efficacy Evaluation of NEB Root Exudates in Combination of Different Dosage Rate of Inorganic Fertilizer on the Growth and Yield of Transplanted Rice Grown During Wet Season Planting

Product/Manufacturer: NEB Root Exudates
AGMOR INC.
246 Briar Place
Belgrade, Montana USA.

Researcher: Belinda G. Elming

Study Reference: RICE #169

Location: Nueva Ecija, Philippines

Duration of the Study: July 2019 to October 2019

Efficacy Evaluation of NEB Root Exudates on Combination of different dosage rate of Inorganic Fertilizer on the Growth and Yield of Transplanted Rice Grown During Wet Season Planting

[1/] **Belinda G. Elming**

ABSTRACT

NEB Root Exudates (NEB) was evaluated for its efficacy on the growth and yield of transplanted rice grown during wet season planting on July 2019 to October 2019 at Barangay, Bacal II, Talavera, Nueva Ecija, Philippines.

The objective of this study is to determine if NEB increases grain yield of paddy rice at the dosages of 450 or 600 ml/ha when NEB is blended on to inorganic fertilizer. The study design included a no fertilizer control (T1) and three paired comparisons: 4 bags of fertilizer with and without NEB (T2 and T3); 6 bags of fertilizer with and without NEB (T4 and T5); 9 bags of fertilizer with and without NEB (T6 and T7). This provides three direct comparisons to evaluate efficacy. Both agronomic factors were collected in addition to grain yield.

Research findings showed that all the agronomic characteristics of rice such as plant height, tiller count, panicle count, etc. as well as grain yield all showed statistically significant increases with the addition of NEB. This statistically significant yield increase was consistent for all three of the paired treatment comparisons, underscoring the efficacy of the product. The grain yield increase ranged from 0.56 to 0.70 ton/ha yield increase.

The higher dosages of fertilizer produced higher yields, both with and without NEB. Result of the trial revealed that in order to produce the highest grain yield of 6.80 tons/ha during wet season cropping, the application of NEB at 600 ml/ha coated with urea, divided equally between tillering and booting stage in combination with fertilizer rate of 9 bags/ha is recommended.

[1/] Project Leader, Central Luzon State University, Science City of Muñoz, Nueva Ecija.

INTRODUCTION

Rice is the staple food of the Filipino. The rice sufficiency program in the country is the battle cry of the government. Rice production in the Philippines is important to the food supply in the country and economy. The Philippines is the 9th largest rice producer in the world, accounting for 2.8% of global rice production and also the world's largest rice importer in Asia in 2010. As such, several yield increasing strategies and initiatives are being undertaken to meet the goal of rice sufficiency that is important to the food supply in the country and economy.

Proper nutrient management is one of the many factors to be considered in increasing the production of rice. Optimizing the dosage and fertilizer grades to be applied are necessary. The use of additional products such as NEB Root Exudates can be of great help to liberate additional nutrients needed for plant growth to produced more yield. Simply applying higher dosages of fertilizer at one time can damage and maybe even kill the plants, so optimizing the efficiency of fertilizer usage is an attractive strategy, both for the farmer and the environment.

NEB Root Exudates promotes growth and development of the whole plants, including larger and more complex root systems, thus making the plant more efficient in absorbing nutrients from a greater depth and volume of soil. The overall effect of product is to make plants more efficient on using applied fertilizer as well as to survive in soils of low fertility level. Growth of plants will be more vigorous and so therefore higher yield of crops is expected if shoots and roots of the plants are vigorous and have access to additional nutrients.

This study was conducted to assess the efficacy of NEB on combination of different dosage rates of fertilizer on the growth and yield of rice during wet season planting.

OBJECTIVES

1. Measure the yield of paddy rice grown with NEB coated on the urea to determine if NEB increases rice yields.
2. The study was designed to included a no fertilizer control (T1) and three paired treatment comparisons: 4 bags of fertilizer with and without NEB (T2 and T3); 6 bags of fertilizer with and without NEB (T4 and T5); 9 bags of fertilizer with and without NEB (T6 and T7). This provides three separate comparisons with equal dosages of fertilizer, isolating the application of NEB as the only variable to evaluate the impact of NEB at three fertilizer dosages.

TIME AND PLACE OF THE TRIAL

The study was conducted at Barangay, Bacal II, Talavera Nueva Ecija from July 2019 to October 2019.

METHODOLOGY

Land Preparation

An approximate area measuring 1,075 square meters of the lowland irrigated area in Barangay Bacal II, Talavera Nueva Ecija was thoroughly prepared by plowing, harrowing, padding and leveling operations using a big and hand tractor.

Experimental Design

The experiment was laid out in Randomized Complete Block Design. The area was divided into three (4) blocks representing replication and each block was further subdivided into eight (8) plots where the different treatments were randomly assigned. A one-meter distance was provided between blocks and treatment plots. Levees were constructed to prevent fertilizer competition between adjacent plots.

Seedling Procurement and Selection

Inbred variety of rice seed named NSIC Rc 222 was used and procured from Registered Seed Grower from Maligaya, Science City of Munoz, Nueva Ecija. Proper care and maintenance for seedling production was followed. Twenty five days old seedlings was used for straight method of transplanting at two seedlings per hill with a planting distance of 20 cm between rows and 20 cm between hills.

Weeding/Irrigation

Weeding was done twice inside the plots and thrice in the levees. Irrigation water was maintained 1-3 cm depth to prevent the growth of weeds until 13 days before harvest.

Harvesting

Harvesting was done twice; 85 days after transplanting Treatment 1, 2 3 followed by Treatment 4, 5, 6 and 7 at 88 days after transplanting.

Fertilization

The fertilizer rate of inorganic fertilizer (4, 6, and 9 bags per hectare) was applied in three split applications, basal application, tillering and booting stage. Inorganic fertilizer sources were 14-14-14, 0-0-60 (MOP) and 46-0-0 (Urea). Method of fertilizer application was broadcasting method.

NEB was applied to the urea only at the dosage of 3 ml NEB per 1 kg urea. Urea was applied at tillering and booting stages only, so NEB was applied at tiller and booting only (not at basal). T3 received 75 kg urea/ha at tillering and booting stage. At the 3 ml/kg blending rate, NEB was applied at 225 ml/ha at tillering and 225 ml/ha booting stage for a total of 450 ml/ha for T3.

Both T5 and T7 received 100 kg urea/ha at tillering and booting stage. At the 3 ml/kg blending rate, NEB was applied at 300 ml/ha at tillering and 300 ml/ha booting stage for a total of 600 ml/ha for T5 and T7. Thus, the variable between the treatments was not only the quantity of fertilizer applied (4, 6 and 9 bag fertilizer dosages) but also the dosage of NEB was 450 ml/ha for T3 and 600 ml/ha total for T5 and T7.

Treatments

The following treatments including the rates and time of application were evaluated:

	Reference	Fertilizer #1 Basal	Fertilizer App #2 Tillering Stage	Fertilizer App #3 Booting Stage
T1	No Fertilizer Control	-----	-----	-----
T2	4 Bag Fertilizer Rate Control	50 kg 14-14-14/ha	75 kg urea/ ha	75 kg urea/ ha
T3	4 Bag Fertilizer Rate + NEB	50 kg 14-14-14/ha	75 kg NEB UREA/ha	75 kg NEB UREA/ha
T4	6 Bag Fertilizer Rate Control	100 kg 14-14-14/ha	100 kg urea/ ha	100 kg urea/ ha
T5	6 Bag Fertilizer Rate + NEB	100 kg 14-14-14/ha	100 kg NEB UREA/ha	100 kg NEB UREA/ha
T6	9 Bag Fertilizer Rate Control	200 kg 14-14-14/ha 50 kg MOP/ha	100 kg urea/HA	100 kg urea/HA
T7	9 Bag Fertilizer Rate + NEB	200 kg 14-14-14/ha 50 kg MOP/ha	100 kg NEB UREA/ha	100 kg NEB UREA/ha

Data Gathered

1. Agronomic performance were measured using 10 sample hills per plot except for grain yield. The four corner hills were sampled after disregarding two border rows in all sides of each treatment plot.
   a. Average plant height (cm) at 30 DAT - height of the representative samples (10 hills per plot) measured from four corner hills after disregarding the border rows at 30 DAT.
   b. Average plant height (cm) at harvest - height of the representative samples (10 hills per plot) measured from four corner hills after disregarding the border rows at harvest.
   c. Average tiller count at 30 DAT - average number of tillers of the representative samples (based on 10 hills per plot) at 30 DAT.

d. Average tiller count at harvest - average number of tillers of the representative samples (based on 10 hills per plot) at harvest.

e. Panicle count at harvest - number of filled and unfilled panicle per hill based on 10 sample hills per plot at harvest.

2. Harvest data:

a. Grain yield on 2.5 m x 2.5 m (6.25m^2) sample size per plot.

b. Computed grain yield (per plot and per hectare) at 14% MC

Data were statistically analyzed following the analysis of variance for a Randomized Complete Block Design (RCBD). Comparison among treatment means was done using Duncan's Multiple Range Test (DMRT) at 5% level of significance.

Experimental Field Lay-out

RESULTS AND DISCUSSION

NEB Root Exudates in combination of different rates of inorganic fertilizer was evaluated during wet season planting July to October 2019 in order to determine its efficacy on transplanted lowland rice. A total of seven treatments replicated four times were evaluated. The study was designed to include a no fertilizer control (T1) and three paired treatment comparisons: 4 bags of fertilizer with and without NEB (T2 and T3); 6 bags of fertilizer with and without NEB (T4 and T5); 9 bags of fertilizer with and without NEB (T6 and T7). This provides three separate comparisons with equal dosages of fertilizer, isolating the application of NEB as the only variable to evaluate the impact of NEB at three fertilizer dosages.

Plant Height at 30 DAT and at Harvest (cm)

Presented on Table 1 and 2 the effect of the different treatments on height of plants 30 DAT and at harvest. Statistical analysis revealed highly significant differences on the effects of the different treatments over the no fertilizer control. When evaluating the three paired treatment comparisons, the NEB provided statistically significant increases in plant height for all three comparisons, both at 30 DAT and at harvest.

The 600 ml/ha NEB + 9 bags fertilizer per hectare rate garnered the tallest plants with average height of 87.76 cm, and 121.84 cm at 30 DAT and at harvest, respectively. Plants applied with NEB combination of Fertilizer Rate 4 and 6 bags per hectare produced heights at 30 DAT and at harvest which were significantly taller than the unfertilized plants.

The result implies that the treatments which exhibited the tallest plants were probably due to well balanced nutrients applied coming from NEB. This indicated that inorganic fertilized plots applied with NEB contributed to the increased in plant height when compared to the application of Fertilizer Rate Control 4, 6 and 9 bags/ha fertilizer alone. The results indicated the beneficial effect of NEB application together with inorganic fertilizer in increasing the growth of rice. Therefore, NEB blended with inorganic fertilizers (Urea) would be complementary in providing the nutrient requirements of rice plants.

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

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	59.66	54.40	58.59	56.63	229.28	57.32[e]
T2: 4 Bags Fertilizer Rate Control	68.69	69.72	69.01	68.70	276.12	69.03[d]
T3: 4 Bags Fertilizer Rate + NEB	72.05	72.88	74.98	71.58	291.49	72.87[c]
T4: 6 Bags Fertilizer Rate Control	74.21	75.16	75.75	75.41	300.53	75.13[c]
T5: 6 Bags Fertilizer Rate + NEB	80.95	79.92	81.44	81.46	323.77	80.94[b]
T6: 9 Bag Fertilizer Rate Control	83.58	80.57	82.56	77.98	324.69	81.17[b]
T7: 9 Bag Fertilizer Rate + NEB	88.50	87.59	89.09	85.87	351.05	87.76[a]
CV						1.81%
LSD (0.05)						2.01

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

Table 2. Average plant height (cm) at harvest based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	87.71	86.95	89.45	87.69	351.80	87.95[f]
T2: 4 Bags Fertilizer Rate Control	103.87	102.66	104.56	101.98	413.07	103.27[e]
T3: 4 Bags Fertilizer Rate + NEB	110.84	107.40	109.63	108.71	436.58	109.15[d]
T4: 6 Bags Fertilizer Rate Control	112.87	109.40	111.71	111.48	445.46	111.37[c]
T5: 6 Bags Fertilizer Rate + NEB	115.80	115.72	116.18	115.68	463.38	115.85[b]
T6: 9 Bag Fertilizer Rate Control	117.05	116.12	117.08	114.56	464.81	116.20[b]
T7: 9 Bag Fertilizer Rate + NEB	124.16	120.58	120.87	121.74	487.35	121.84[a]
CV						0.84%
LSD (0.05)						1.36

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

Tiller Count at 30 DAT and at Harvest

Table 3 and 4 presents the average tiller count at 30 DAT and at harvest. Statistical analysis revealed highly significant differences on the effects of the different treatments over the no fertilizer control.

Data revealed that the addition of NEB positively impacted tiller count at 30 DAT and at harvest at the rate of 600 ml/ha with applied Fertilizer Rate of 9 bags/ha produced the highest tiller count at 30 DAT and at harvest with an average of 24.30 and 20.78 tillers at 30 DAT and at harvest, respectively.

Moreover, it can be noted that plants applied NEB fertilizer enhancer with applied Fertilizer rate 4 and 6 bags/ha significantly produced better results from that of purely Fertilizer Rate Control 4 and 6 bags/ha application and the no fertilizer control.

The increased in tiller count could be attributed to the effect of NEB in enhancing the plant roots to expand through the soil consequently and increasing the efficiency of rice plants for nutrients absorption in the root zone. The lowest value for rice tiller count were recorded in the No Fertilizer Control. Producing tillers of rice crop was significantly enhanced with the addition of NEB applied blended with Urea fertilizer.

Results of the efficacy evaluation showed that treatments using NEB significantly increased tiller count per plant 30 DAT and at harvest compared to the no fertilizer control.

Table 3. Average tiller count at 30 DAT based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	9.80	8.70	10.20	9.40	38.10	9.53[e]
T2: 4 Bags Fertilizer Rate Control	15.20	14.70	16.10	15.60	61.60	15.40[d]
T3: 4 Bags Fertilizer Rate + NEB	17.30	16.50	17.40	18.20	69.40	17.35[cd]
T4: 6 Bags Fertilizer Rate Control	18.30	19.20	18.40	19.40	75.30	18.83[c]
T5: 6 Bags Fertilizer Rate + NEB	22.40	21.70	19.80	21.40	85.30	21.33[b]
T6: 9 Bag Fertilizer Rate Control	21.20	20.80	21.20	22.90	86.10	21.53[b]
T7: 9 Bag Fertilizer Rate + NEB	24.40	23.40	26.30	23.10	97.20	24.30[a]
CV%						4.99%
LSD (0.05)						1.36

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

Table 4. Average tiller count at harvest based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	8.10	6.30	8.20	6.50	29.10	7.28[f]
T2: 4 Bags Fertilizer Rate Control	12.60	11.70	11.90	12.80	49.00	12.25[e]
T3: 4 Bags Fertilizer Rate + NEB	14.90	14.30	14.70	14.00	57.90	14.48[d]
T4: 6 Bags Fertilizer Rate Control	15.90	16.80	16.10	17.00	65.80	16.45[c]
T5: 6 Bags Fertilizer Rate + NEB	18.70	18.40	16.90	18.60	72.60	18.15[bc]
T6: 9 Bag Fertilizer Rate Control	18.50	17.60	18.90	19.40	74.40	18.60[b]
T7: 9 Bag Fertilizer Rate + NEB	21.60	20.10	22.20	19.20	83.10	20.78[a]
CV%						5.46%
LSD (0.05)						1.25

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

Panicle count at harvest

The effect of the different treatments on panicle count at harvest is presented on Table 5. Statistical analysis revealed significant effects of the different treatments over the no fertilizer control.

Data revealed that using Fertilizer Rate 9 bags per hectare + recommended rate of NEB fertilizer enhancer produced the highest number of panicle with an average of 19.55 among the rest of the treatments.

Result showed that the no fertilizer control plants has lowest produced panicle with an average of 6.65.

Produced panicle is one of the most important traits in rice productivity determination. The number of flowers per panicle is established in the early stages of panicle development. Nitrogen coming from the applied fertilizer is essential in the production of panicles. Application of NEB blended with urea fertilizers probably enhances nutrient availability to produce productive panicles of rice.

Table 5. Panicle count at harvest based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	7.30	6.10	7.30	5.90	26.60	6.65[f]
T2: 4 Bags Fertilizer Rate Control	11.50	10.40	11.10	11.90	44.90	11.23[e]
T3: 4 Bags Fertilizer Rate + NEB	14.20	13.80	14.30	14.00	56.30	14.08[d]
T4: 6 Bags Fertilizer Rate Control	15.10	15.70	14.90	15.30	61.00	15.25[cd]
T5: 6 Bags Fertilizer Rate + NEB	17.20	17.60	15.60	15.80	66.20	16.55[bc]
T6: 9 Bag Fertilizer Rate Control	16.70	16.10	17.60	17.60	68.00	17.00[b]
T7: 9 Bag Fertilizer Rate + NEB	19.40	19.80	20.30	18.70	78.20	19.55[a]
CV%						4.90%
LSD (0.05)						1.04

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

Grain yield

The effect of the different treatments on grain yield is presented on Table 6. Highly significant results showed that grain yield was affected by the different treatments evaluated.

Combination NEB and 9 bags of fertilizer/ha significantly produced the highest grain yield at 6.80 tons/ha. Results obtained from using this treatment as the highest yielder is due to the production of more tillers and more panicles. This could be attributed also to the availability of soil microorganisms that are able to convert the unavailable form of nutrients elements to available form for the use of the plants.

Among other treatments, the no fertilizer control plots produced the lowest grain yield at 2.64 tons/ha (Table 4).

When evaluating the three paired treatment comparisons, the NEB provided statistically significant increases in grain yield for all three comparisons. 4 bags of fertilizer produced 4.23 ton/ha, but the addition of NEB raised the yield to 4.79 ton/ha, a yield increase of 0.56 ton/ha, which was statistically significant. Both the 6 and 9 fertilizer bag rates were also significantly increased with the addition of NEB by 0.63 and 0.70 ton/ha respectively.

Table 6. Computed grain yield tons per hectare based on 14 % MC as affected by different fertilizer treatments.

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	2.72	2.65	2.72	2.49	10.58	2.64[f]
T2: 4 Bags Fertilizer Rate Control	4.34	4.03	4.19	4.35	16.92	4.23[e]
T3: 4 Bags Fertilizer Rate + NEB	4.64	4.88	4.82	4.81	19.15	4.79[d]
T4: 6 Bags Fertilizer Rate Control	5.26	5.40	5.24	5.17	21.07	5.27[c]
T5: 6 Bags Fertilizer Rate + NEB	6.02	6.16	5.57	5.85	23.60	5.90[b]
T6: 9 Bag Fertilizer Rate Control	6.16	6.00	5.94	6.32	24.42	6.10[b]
T7: 9 Bag Fertilizer Rate + NEB	6.85	6.78	6.93	6.63	27.19	6.80[a]
CV%						3.14%
LSD (0.05)						0.24

SUMMARY AND CONCLUSION

A field experiment was conducted from July to October 2019 which aimed of determining the effect of NEB fertilizer enhancer in combination of three fertilizer rate 4, 6 and 9 bags/ha on the growth and yield of rice during wet season planting.

The study was designed to included a no fertilizer control (T1) and three paired treatment comparisons: 4 bags of fertilizer with and without NEB (T2 and T3); 6 bags of fertilizer with and without NEB (T4 and T5); 9 bags of fertilizer with and without NEB (T6 and T7). This provides three separate comparisons with equal dosages of fertilizer, isolating the application of NEB as the only variable to evaluate the impact of NEB at three fertilizer dosages. Table 7 summarizes all data metrics collected.

Table 7. Summary of agronomic data and grain yield

	Plant Height 30 DAT	**Plant Height Harvest**	**Tiller Count 30 DAT**	**Tiller Count Harvest**	**Panicle Count Harvest**	**Grain Yield**
T1: No Fertilizer Control	57.32^{e}	87.95^{f}	9.53^{e}	7.28^{f}	6.65^{f}	2.64^{f}
T2: 4 Bags Fertilizer Rate Control	69.03^{d}	103.27^{e}	15.40^{d}	12.25^{e}	11.23^{e}	4.23^{e}
T3: 4 Bags Fertilizer Rate + NEB	72.87^{c}	109.15^{d}	17.35^{cd}	14.48^{d}	14.08^{d}	4.79^{d}
T4: 6 Bags Fertilizer Rate Control	75.13^{c}	111.37^{c}	18.83^{c}	16.45^{c}	15.25^{cd}	5.27^{c}
T5: 6 Bags Fertilizer Rate + NEB	80.94^{b}	115.85^{b}	21.33^{b}	18.15^{bc}	16.55^{bc}	5.90^{b}
T6: 9 Bag Fertilizer Rate Control	81.17^{b}	116.20^{b}	21.53^{b}	18.60^{b}	17.00^{b}	6.10^{b}
T7: 9 Bag Fertilizer Rate + NEB	87.76^{a}	121.84^{a}	24.30^{a}	20.78^{a}	19.55^{a}	6.80^{a}
CV%	1.81%	0.84%	4.99%	5.46%	4.90%	3.14%
LSD (0.05)	2.01	1.36	1.36	1.25	1.04	0.24

The significant highlights are the following:

- Evaluation of the three paired treatments (4 bags fertilizer/ha with and without NEB, 6 bags fertilizer/ha with and without NEB and 9 bags fertilizer/ha with and without NEB) revealed that NEB increased all agronomic factors and grain yields. The increase in grain yields was statistically significant.

- The highest yield was 9 bags fertilizer/ha with NEB, yielding 6.80 ton/ha, a significant increase over the 9 bags fertilizer/ha without NEB at 6.10 ton/ha.

- The 9 bags fertilizer/ha without NEB yielded 6.10 tons/ha, whereas the 6 bags fertilizer/ha with NEB yielded 5.90 tons/ha. Even though the 9 bags fertilizer/ha dosage was numerically higher, statistically the yields were equivalent (alpha of 0.05). These lends credibility to the concept of increased nutrient efficacy as a result of NEB offered in this report.

- The 600 ml NEB/ha total dosage produced higher yield increases that than the 450 ml NEB/ha dosage. This may indicate higher NEB dosages are more effective, warranting further evalation.

- The untreated plants produced the shortest plant height, lowest count of tillers, lowest number of panicle and lowest grain yield compared to other treatments evaluated.

- Based on the results, in order to produce the highest yield of 6.80 tons/ha, the application of NEB Root Exudates applied at the rate of 600 ml per hectare at tillering stage and booting stage in combination of inorganic fertilizer applied at basal, tillering stage and booting stage with Fertilizer rate of 9 bags per hectare is recommended.

- Additional research is suggested to evaluate higher dosages of NEB to determine if higher dosages of NEB Root Exudates produce more favorable results on paddy rice.

APPENDIX

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

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	59.66	54.40	58.59	56.63	229.28	57.32[e]
T2: 4 Bags Fertilizer Rate Control	68.69	69.72	69.01	68.70	276.12	69.03[d]
T3: 4 Bags Fertilizer Rate + NEB	72.05	72.88	74.98	71.58	291.49	72.87[c]
T4: 6 Bags Fertilizer Rate Control	74.21	75.16	75.75	75.41	300.53	75.13[c]
T5: 6 Bags Fertilizer Rate + NEB	80.95	79.92	81.44	81.46	323.77	80.94[b]
T6: 9 Bag Fertilizer Rate Control	83.58	80.57	82.56	77.98	324.69	81.17[b]
T7: 9 Bag Fertilizer Rate + NEB	88.50	87.59	89.09	85.87	351.05	87.76[a]
CV%						1.81%
LSD (0.05)						2.01

Table 1A. Analysis of variance on average plant height (cm) at 30 DAT based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	3	17.5435	5.8478	3.18	3.16	5.09
Treatment	6	2355.9097	392.6516	213.51**	2.66	4.01
Error	18	33.1019	1.8390			
Total	27	2406.5551	89.1317			

**= highly significant
CV= 1.81%
LSD= 2.01

Table 2. Average plant height (cm) at harvest based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	87.71	86.95	89.45	87.69	351.80	87.95[f]
T2: 4 Bags Fertilizer Rate Control	103.87	102.66	104.56	101.98	413.07	103.27[e]
T3: 4 Bags Fertilizer Rate + NEB	110.84	107.40	109.63	108.71	436.58	109.15[d]
T4: 6 Bags Fertilizer Rate Control	112.87	109.40	111.71	111.48	445.46	111.37[c]
T5: 6 Bags Fertilizer Rate + NEB	115.80	115.72	116.18	115.68	463.38	115.85[b]
T6: 9 Bag Fertilizer Rate Control	117.05	116.12	117.08	114.56	464.81	116.20[b]
T7: 9 Bag Fertilizer Rate + NEB	124.16	120.58	120.87	121.74	487.35	121.84[a]
CV%						0.84%
LSD (0.05)						1.36

Table 2A. Analysis of variance on average plant height (cm) at harvest based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	3	17.1306	5.7102	6.77	3.16	5.09
Treatment	6	2976.5389	496.0898	588.38**	2.66	4.01
Error	18	15.1767	0.8432			
Total	27	3008.8462	111.4388			

**= highly significant

CV= 0.84%

LSD = 1.36

Table 3. Average tiller count at 30 DAT based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	9.80	8.70	10.20	9.40	38.10	9.53[e]
T2: 4 Bags Fertilizer Rate Control	15.20	14.70	16.10	15.60	61.60	15.40[d]
T3: 4 Bags Fertilizer Rate + NEB	17.30	16.50	17.40	18.20	69.40	17.35[cd]
T4: 6 Bags Fertilizer Rate Control	18.30	19.20	18.40	19.40	75.30	18.83[c]
T5: 6 Bags Fertilizer Rate + NEB	22.40	21.70	19.80	21.40	85.30	21.33[b]
T6: 9 Bag Fertilizer Rate Control	21.20	20.80	21.20	22.90	86.10	21.53[b]
T7: 9 Bag Fertilizer Rate + NEB	24.40	23.40	26.30	23.10	97.20	24.30[a]
CV%						4.99%
LSD (0.05)						1.36

Table 3A. Analysis of variance on average average tiller count at 30 DAT based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	3	2.1529	0.7176	0.86	3.16	5.09
Treatment	6	568.5471	94.7579	113.50**	2.66	4.01
Error	18	15.0271	0.8348			
Total	27	585.7271	21.6936			

**= highly significant

CV= 4.99%

LSD=1.36

Table 4. Average tiller count at harvest based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	8.10	6.30	8.20	6.50	29.10	7.28[f]
T2: 4 Bags Fertilizer Rate Control	12.60	11.70	11.90	12.80	49.00	12.25[e]
T3: 4 Bags Fertilizer Rate + NEB	14.90	14.30	14.70	14.00	57.90	14.48[d]
T4: 6 Bags Fertilizer Rate Control	15.90	16.80	16.10	17.00	65.80	16.45[c]
T5: 6 Bags Fertilizer Rate + NEB	18.70	18.40	16.90	18.60	72.60	18.15[bc]
T6: 9 Bag Fertilizer Rate Control	18.50	17.60	18.90	19.40	74.40	18.60[b]
T7: 9 Bag Fertilizer Rate + NEB	21.60	20.10	22.20	19.20	83.10	20.78[a]
CV%						5.46%
LSD (0.05)						1.25

Table 4A. Analysis of variance on average tiller count at harvest based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	3	2.0914	0.6971	0.98	3.16	5.09
Treatment	6	482.9886	80.4981	112.77**	2.66	4.01
Error	18	12.8486	0.7138			
Total	27	497.9286	18.4418			

**= highly significant

cv= 5.46%

LSD= 1.25

Table 5. Panicle count at harvest based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	7.30	6.10	7.30	5.90	26.60	6.65[f]
T2: 4 Bags Fertilizer Rate Control	11.50	10.40	11.10	11.90	44.90	11.23[e]
T3: 4 Bags Fertilizer Rate + NEB	14.20	13.80	14.30	14.00	56.30	14.08[d]
T4: 6 Bags Fertilizer Rate Control	15.10	15.70	14.90	15.30	61.00	15.25[cd]
T5: 6 Bags Fertilizer Rate + NEB	17.20	17.60	15.60	15.80	66.20	16.55[bc]
T6: 9 Bag Fertilizer Rate Control	16.70	16.10	17.60	17.60	68.00	17.00[b]
T7: 9 Bag Fertilizer Rate + NEB	19.40	19.80	20.30	18.70	78.20	19.55[a]
CV%						4.90%
LSD (0.05)						1.04

Table 5A. Analysis of variance on panicle count at harvest based on 10 randomly selected sample hills as affected by different fertilizer treatments.

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	3	0.5286	0.1762	0.36	3.16	5.09
Treatment	6	435.3621	72.5604	146.98**	2.66	4.01
Error	18	8.8864	0.4937			
Total	27	444.7771	16.4732			

**= highly significant

CV= 4.90%

LSD= 1.04

Table 6. Computed grain yield tons per hectare based on 14 % MC as affected by different fertilizer treatments.

Treatment	Replication				Total	Mean
	I	II	III	IV		
T1: No Fertilizer Control	2.72	2.65	2.72	2.49	10.58	2.64[f]
T2: 4 Bags Fertilizer Rate Control	4.34	4.03	4.19	4.35	16.92	4.23[e]
T3: 4 Bags Fertilizer Rate + NEB	4.64	4.88	4.82	4.81	19.15	4.79[d]
T4: 6 Bags Fertilizer Rate Control	5.26	5.40	5.24	5.17	21.07	5.27[c]
T5: 6 Bags Fertilizer Rate + NEB	6.02	6.16	5.57	5.85	23.60	5.90[b]
T6: 9 Bag Fertilizer Rate Control	6.16	6.00	5.94	6.32	24.42	6.10[b]
T7: 9 Bag Fertilizer Rate + NEB	6.85	6.78	6.93	6.63	27.19	6.80[a]
CV%						3.14%
LSD (0.05)						0.24

Table 6A. Analysis of variance on computed grain yield tons per hectare based on 14 % MC as affected by different fertilizer treatments.

Source of variance	df	SS	MS	F value	F tabular	
					.05	.01
Replication	3	0.0301	0.0100	0.39	3.16	5.09
Treatment	6	45.7816	7.6303	296.92**	2.66	4.01
Error	18	0.4626	0.0257			
Total	27	46.2743	1.7139			

**= highly significant
CV= 3.14%
LSD = 0.24

NEB-26 FERTILIZER ENHANCER
EFFICACY TEST ON RICE

INTRODUCTION

NEB-26 is a fertilizer supplement that increases the efficiency of urea fertilizer. It is organic, non-toxic and mixture of natural blend exudates that enhanced absorption of ions. Plant root exudates composed of mucilaginous polysaccharides that bind soil particles together. Root exudates eliminate bad microbes. More nutrients and space are available for beneficial microbes, thus increasing quickly microbial population. A diverse soil microbial population produces nutrient-mineralizing enzymes such as deaminases, phosphatases and suphatases, which are particularly abundant in rhizosphere (the region of soil close to the plant root) where organically bound nitrogen, phosphorus, sulphur and other nutrients are continually released.

NEB-26 cuts fertilizer cost, increases crops efficiency resulting to higher yield and consequently higher farm income.

OBJECTIVES

The main purpose of this study is to evaluate the growth and yield performance of rice as affected by **NEB-26 FERTILIZER ENHANCER** application. The data that will be generated will be submitted to Fertilizer & Pesticide Authority so as to suffice their requirements for label expansion.

Site Description

The experimental site was located in Brgy. Granada, Bacolod City, Negros Occidental.

Selection of Crop Variety:

The RC120 rice variety was used in the study.

Time of Study:

The study commenced November 2009 and ended March 2010.

Research Design and Experimental lay-out:

An area of approximately one thousand (1000) square meters was laid out using a Randomized Complete Block Design (RCBD) and further the area was divided into four (4) blocks. Plot size was 4 x 5 sq. meters.

Lay-out:

(Please see attached separate sheet)

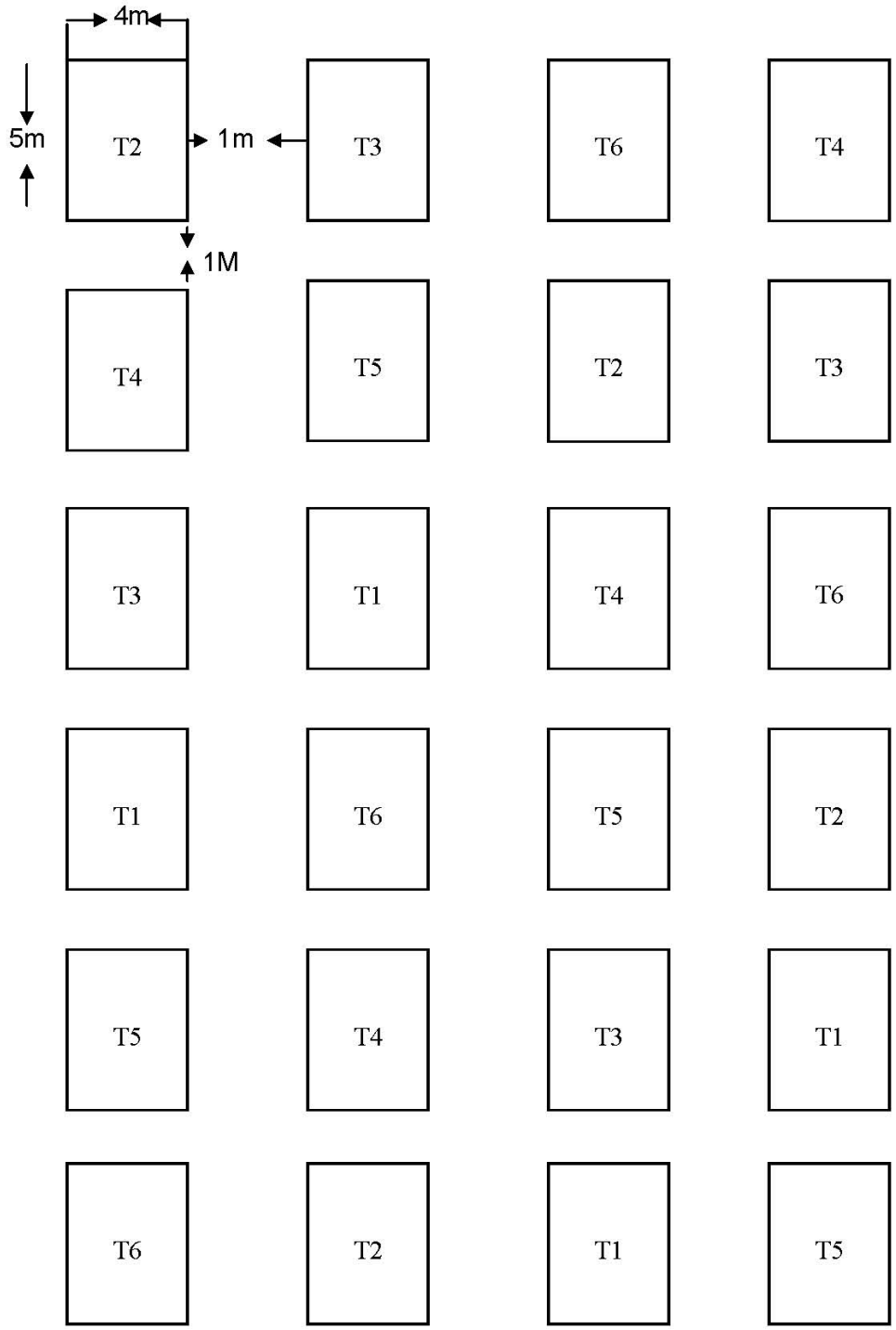

Figure 1. Experimental Lay-out

Treatments:

The following treatments were used in the study:

T1 - Control

T2 - 90-60-60 kgs/ha of NPK

T3 - 45-60-60 kgs/ha of NPK

T4 – 45-60-60 kgs/ha of NPK + 250 ml of NEB-26 FE/bag of N Fertilizer

T5 - 250 ml of NEB-26 FE/bag of sand

T6 - 90-60-60 kg/ha of NPK + 250 ml of NEB-26 FE/bag of N Fertilizer

Land Preparation:

The experimental site was plowed once, harrowed thrice, and leveled to ensure good soil tilth and maintain the water level.

Planting/Transplanting:

Seeds were sown in the seedbed, 20 – 21 days before the seedlings were transferred to the field. Transplanting was done at a distance of twenty (20) centimeters between hills and thirty 20 centimeters between furrows.

Fertilization:

All of the required inorganic phosphorus and potassium and one half (1/2) of the recommended nitrogen were applied as basal fertilizer. The remaining nitrogen fertilizer was applied 30 days after transplanting. NEB-26 was applied basally in plots

designated as treatment 5. Nitrogen Fertilizer was coated with NEB-26 and was applied in split dosage – basally and 30 days after transplanting.

Cultivation and Weeding:

Cultivation was done when roots of plants were already established in the soil. Weeding was scheduled regularly to minimize the growth of weeds.

Pest and Disease Control:

Handpicking of pests and diseases were strictly observed. Pesticide was used to drive away pests.

Water Management:

Plants were supplied with water to ensure good growth.

Harvesting/Data Gathering:

The following were the data gathered:

a. Plant data before harvest
    a. Average plant height in cms. 30 days after transplanting. Measurement was done from 4 corner-hills per corner (a total of 16 hills) from base of plant to the tallest leaf of the tagged 16 hills.
    b. Tiller count, 30 DAT. From the tagged 16 hills, tiller count was recorded and transformed to number of tillers per m^2. The area covered by the 16 hills was 0.64 m^2.

b. Plant data at harvest

a. Average plant height, in cms. From the tagged 16 hills, plant height was measured from the base of plants to the tip of the highest panicle.

b. Tiller count (productive and unproductive) was taken from the tagged 16 hills.

c. Panicle count. Panicles from the tagged 16 hills were counted and transformed to panicle count per m^2. The data represented the number of productive tillers.

d. Straw weight at harvest/4m^2, in kg. From the harvest area of 4m^2, rice straws were weighed and recorded.

e. Grain yield in tons/ha. Dry weight of filled grains were recorded and converted to tons per hectare.

Statistical Analysis:

Yield data that were generated were analyzed using the Analysis of Variance (ANOVA) for Randomized Complete Block Design (RCBD). Duncan's Multiple Range Test (DMRT) was used to test the level of significance among treatment means.

Results and Discussion

Plant Height at 30 DAT

The different levels of fertilizer application greatly affected the heignt of RC120 rice variety. Tallest plants of 60.00 centimeters were obtained from the area fertilized with 90-60-60 kilograms per hectare of NPK plus 250 ml of NEB-26 Fertilizer Enhancer mixed per bag of N fertilizer (T6), those measured from plots applied with 45-60-60 kilograms per hectare of NPK in combination with 250 ml of NEB-26 Fertilizer Enhancer mixed per bag of N fertilizer (T4), and plants taken from rows applied with full dose of inorganic fertilizers (T2). The shortest rices were 49.00 centimeters noted from control rows.

Tillers count at 30 DAT

A comparable tiller performance of 252.00 tillers were noted from rows fertilized with 90-60-60 kilograms per hectare OF NPK in combination with 250 ml of NEB-26 Fertilizer Enhancer mixed per bag of N fertilizer and plants treated with 90-60-60 kilograms per hectare of NPK (T2), significantly had 4 more tillers compared to rices treated with 45-60-60 kg/ha of NPK plus 250 ml of NEB-26 Fertilizer Enhancer per bag of Fertilizer N (T4). The least number of tillers per square meter was 230.00 tillers recorded from control rows.

Plant Height at Maturity

Plants applied with 90-60-60 kilograms per hectare of NPK plus 250 ml of NEB-26 Fertilizer Enhancer per bag of fertilizer N (T6) registered the tallest plants of 98.00

centimeters, significantly taller by 4.00 centimeters compared to plants fertilized with 90-60-60 kilograms per hectare of NPK (T2) alone. T2 plants exhibited an average plant height of 94.00 centimeters at harvest comparably the same in height with the rices treated with 45-60-60 kilograms per hectare of NPK in combination with 250 ml of NEB-26 Fertilizer Enhancer per bag of fertilizer N (T4). Matured rices from the control rows registered to be the shortest with an average height of 83 centimeters.

Tiller Count at Maturity

Tiller count of rices applied with 90-60-60 kilograms per hectare of NPK and 250 ml of NEB-26 Fertilizer Enhancer per bag of fertilizer N (T6) showed the highest number of 259.00 tillers at maturity, significantly higher by 6.00 tillers compared to plants fertilized with 90-60-60 kilograms per hectare of NPK (T2) alone which produced 253.00 tillers. Rows treated with 250 ml of NEB-26 Fertilizer Enhancer per bag of sand (T5) registered an average number of 240.00 tillers, significantly short of 13.00 tillers compared to T2 plants. However, T5 plants revealed a significant increase of 10.00 more tillers compared to control plants which produced 230.00 tillers per square meter at maturity.

Panicle Count

Rices from plants fertilized with 90-60-60 kilograms per hectare of NPK in combination with 250 ml of NEB-26 Fertilizer Enhancer per bag of fertilizer N obtained the highest number of panicles of 234.00, remarkably higher by 6.00 panicles compared

to plants treated with 90-60-60 kilograms per hectare of NPK (T2) which produced 228.00 panicles. The lowest panicle count was 206.00 recorded from control rows.

Number of Unfilled Grains Per Panicle

Control rows obtained the highest number of 48.00 unfilled grains per panicle while the lowest number of unfilled grains per panicle was 22.00 registered by rices fertilized with 90-60-60 kilograms per hectare of NPK plus 250 ml of NEB-26 Fertilizer Enhancer per bag of fertilizer N (T6). There is no significant difference in the number of unfilled grains per panicle obtained from plants fertilized with 45-60-60 kilograms per hectare of NPK in combination with 250 ml of NEB-26 Fertilizer Enhancer per bag of fertilizer N (T4) and those applied with 90-60-60 kilograms per hectare of NPK which registered an average of 29.00 unfilled grains per panicle.

Number of Filled Grains Per Panicle

An average of 190.00 filled grains per panicle was counted from plants treated with 90-60-60 kilograms per hectare of NPK in combination with 250 ml of NEB-26 Fertilizer Enhancer per bag of fertilizer N (T6), remarkably higher by 10.00 filled grains compare to plants fertilized with 90-60-60 kilograms per hectare of NPK (T2) alone which recorded an average of 180.00 filled grains per panicle. Control plants obtained the lowest filled grains of 141.00 per panicle.

Straw Weights in Tons Per Hectare

Rice straw weights after harvest were significantly higher by 1.12 tons per hectare in rows fertilized with 90-60-60 kilograms per hectare of NPK plus 250 ml of NEB-26 Fertilizer Enhancer per bag of fertilizer N (T6) over plants applied with 90-60-60 kilograms per hectare of NPk (T2) alone which recorded an average straw weight of 6.20 and 5.00 tons respectively. Rice straws collected from area treated with 250 ml of NEB-26 Fertilizer Enhancer per bag of sand (T5) was 4.12 tons significantly higher by 0.92 tons against the control plants. The average straw weight obtained by control plants was 3.20 toms per hectare.

Grain Yield in Tons Per Hectare

The application of 90-60-60 kilograms per hectare of NPK in combination with 250 ml of NEB-26 Fertilizer Enhancer per bag of fertilizer N (T6) produced an average grain yield of 5.25 tons per hectare, significantly better by 1.85 tons compared with the harvest of plants treated with 90-60-60 kilograms per hectare of NPK (T2) which obtained an average yield of 3.40 tons. The average mean yield of control plants was 1.60 tons, significantly inferior by 0.65 tons against the yield of rices fertilized with 250 ml of NEB-26 Fertilizer Enhancer per bag of sand (T5). Harvested rices from T5 showed an average yield of 2.25 tons per hectare.

Conclusion and Recommendation

The use of NEB-26 Fertilizer Enhancer significantly influenced the growth and yield components of the RC120. In all the data gathered the use of NEB-26 Fertilizer Enhancer alone or in combination with the full dose or 50% reduction in the use of inorganic fertilizers based on soil analysis showed a remarkable difference in plant height, tiller count 30 DAT and at harvest, number of unfilled and filled grains per panicle, straw weight and grain yield over the control plants and those applied with inorganic fertilizers alone.

Base on the trial therefore, the use of NEB-26 Fertilizer Enhancer in combination with inorganic fertilizers is recommended.

PNT - 117

TABLE 1

Average Plant Height and Tiller Number 30 DAP, Panicle Count, Plant Height and Tiller Count at Maturity of RC 120 Variety

Treatment	Plant Height at 30 DAT(cm)	Tiller Count at 30 DAT (no./m²)	Plant Height at Maturity (cm)	Tiller Count at Maturity (no./m²)	Panicle Count
Control	49.00 d	230.00 e	83.00 d	230.00 d	206.00 d
90-60-60	60.00 a	252.00 a	94.00 b	253.00 b	228.00 b
45-60-60	57.00 b	235.00 d	90.00 c	240.00 c	218.00 c
45-60-60 + NEB-26	60.00 a	248.00 b	94.00 b	253.00 b	228.00 b
NEB-26	57.00 b	240.00 c	89.00 c	240.00 c	218.00 c
90-60-60 + NEB-26	60.00 a	252.00 a	98.00 a	259.00 a	234.00 a
CV(%)	**3.10 %**	**5.98 %**	**5.20 %**	**5.15 %**	**4.86 %**

TABLE 2

Mean Grain Yield Components of RC 120 Applied with NEB-26 Alone/ in Combination with Inorganic Fertilizer

Treatment	No. of Unfilled Grains Per Panicle	No. of Filled Grains per Panicle	Straw wt. (ton/ha)	Grain Yield (ton/ha)
Control	48.00 a	141.00 d	3.20 d	1.60 c
90-60-60	29.00 c	180.00 b	5.00 b	3.40 c
45-60-60	33.00 b	153.00 e	4.10 c	2.20 d
45-60-60 + NEB-26	29.00 c	180.00 b	5.10 b	4.25 b
NEB-26	33.00 b	154.00 c	4.12c d	2.25 d
90-60-60 + NEB-26	22.00 d	190.00 a	6.20 a	5.25 a
CV (%)	**7.30 %**	**6.52 %**	**4.25 %**	**4.38 %**

RICE #136

THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF PADDY RICE

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JULY - OCTOBER 2016

I. INTRODUCTION

Asia is estimated to have about 250 million rice farmers cultivating about one hectare per capita. In Southern Philippines and other Regions of the country, paddy rice production is one of the main sources of family income. It is also considered as the prime commodity consisting of 20% or more of the production on the agricultural sector (Rice Production Techno Guide, 1993).

Correct and proper usage of fertilizer was recently the focus of researches in the field. At the same time, the government of the Philippines, through the Department of Agriculture, is promoting the most efficient use of organic or inorganic fertilizers. The overall objective is to create sustainability of the soil and increase grain production.

This study aimed to determine the rate of NEB-26 (eNEBler) when applied with the recommended rate of urea that produces the largest yield increase of grain production of paddy rice.

II. OBJECTIVES

a. To determine the quantity of NEB-26 (eNEBler) applied with the recommended rate of urea to produce the largest yield increase on paddy rice (RC 160 Variety) of grain production.
b. Evaluate the yield response of several quantities of NEB-26 (eNEBler) to determine the optimal rate, based on the grain yield.

III. RESEARCHER

RODRIGO B. ESPAÑA

RBE Research / Breeding Station San Jose, General Santos City

IV. TARGET CROP PLANTED

Rice (RC 160 Variety)

V. DURATION OF THE STUDY

July to October 2016

VI. METHODOLOGY

The rice trial was conducted at RBE Research Station, Vineyard Barangay San Jose, General Santos City, Philippines with an area of ONE THOUSAND, ONE HUNDRED EIGHTY-EIGHT (1,188) square meters. The area was generally plain and irrigated with a fine volcanic sandy loam soil. The NEB-26 (eNEBler) was applied with the different levels of the recommended rate of urea rice (RC 160 Variety) in lowland rice field. A five (5) by five (5) meters plots were prepared for the trial. There were eight (8) treatments replicated four (4) times within the field using Randomized Complete Block Design (RCBD).

LAND PREPARATION/PLANTING/FERTILIZATION

An area of ONE THOUSAND ONE HUNDRED AND EIGHTY-EIGHT (1,188) square meters was prepared for the rice trial. The land was thoroughly plowed and harrowed several times using tractor to ensure good land preparation. While land preparation was going on, we soaked the palay seeds into a drum full of water for TWENTY-FOUR (24) hours. While waiting for the soaked seeds we prepared the seedbed measuring two (2) by twenty (20) meters.

On August 7, 2016, we applied the first application of fertilizer (basal) at the rate of 175 kg of 14-14-14 complete fertilizer per hectare and 75 kg of muriate of potash (0-0-60) per hectare. The seedlings were transplanted on August 9-10, 2016 in a 5m by 5m = 25 square meters plot. Replanting was done on the dying plants to ensure a good final stand count of the trial.

NEB-26 (eNEBler) was applied with the urea at 15 DAT and the booting stage at the rate of 100 kg urea per hectare and 125 kg urea per hectare respectively. All treatments (except T1) received the same quantity of fertilizer. The treatments were:

T1 – No Fertilizer, No eNEBler (no fertilizer control)

T2- NO eNEBler (full RR fertilizer control)

T3- 135 ml/ha eNEBler

T4- 202.5 ml/ha eNEBler

T5- 270 ml/ha eNEBler

T6- 337.5 ml/ha eNEBler

T7- 405 ml/ha eNEBLer

T8- 472.5 ml/ha eNEBler

CARE AND MAINTENANCE

The spraying schedules were done based on insect pest and diseases appearances. Package of technologies for lowland rice production and guidance by the Advanced Agrisolutions Philippines Corporation was followed.

HARVESTING

November 18, 2016 was scheduled of harvesting the rice trial. We gathered all the necessary data, before we started harvesting. All the harvested palay were placed in a sack, in order to minimize spillage, such that our data was accurately gathered. It was weighed and properly threshed. After threshing 32 plots were dried for THREE (3) successive sunny days until it turned to 14% moisture content. Parameters that were gathered correctly are as followed:

1. Average Plant height (in cm) at (30 DAT) this was done, by measuring 20 hills at random per plot.
2. Average Plant Height (in cm) at harvest date. This was done by measuring the base up to the highest panicle of 20 plants at random within the plot.
3. Average tiller count at (30 DAT) and number of tillers were counted among the 20 hills in a plot.
4. Average tiller count at harvest. All the tillers within the plot were counted, as well as the panicles.
5. Straw weight within a plot was weighed strictly.
6. Fresh grain weight was weighed.
7. Dried grain weight for every plot after THREE (3) successive sunny days was all weighed.

DISCUSSION

This research study was conducted at RBE Research Station Barangay San Jose, General Santos City during the period from July 9 to November 18, 2016. The area was generally plain with a fine sandy loam soil. The lowland area is supplied water using a gravity irrigation system. The soil analysis, prior to the land preparation, revealed that RBE Research Station has a ph of 6.2 with 90-30-30kg NPK/ha fertilizer requirement. The test crop of the trial was (RC 160 Variety). The objective of this test was to determine if eNEBler increased the grain production of paddy rice, and the optimal quantity of eNEBler to accomplish same.

The results of the trial showed that (Table 1) Average plant height of (30 DAT), doubled which ranges a very significant result from 18.39cms T1 to 38.71cms T8. Also in Table 2, a significant result of the plant height at harvest ranged from T1 = 85.01cms to 125.69cms T8 with a difference of 40.68cms. All entries treated with eNEBler from T3, T4, T5, T6, T7 and T8 shows significantly difference from T1 and T2 as control.

In Table 3, tiller count at (30 DAT) had doubled the count resulted from T1=14.25 to 28.86 T8, a highly significant result. From T2= 17.29 had a difference of 11.57 = T8. All entries applied with eNEBler T3, T4, T5, T6, T7 and T8 has significantly difference from T1 and T2 as control.

In Table 4, tiller count at harvest exhibited a highly significant from T1=117, T2=217 to 322 of T8 with a difference of T1= 205 and T2= 105 respectively. All entries applied with eNEBler T3, T4, T5, T6, T7 and T8 were highly superior to that of T1 and T2.

In Table 5, panicle count at harvest showed a very significant result from T1=114.50, T2=216 to 321.75 of T8. Again, all treatments applied with eNEBler T3, T4, T5, T6, T7, T8 has a significant result from that of T1 and T2.

All treatments applied with eNEBler T3= 4.96 tons, T4= 5.56 tons, T5=6.49 tons, T6=6.92 tons, T7= 7.80 tons, and T8= 8.24 tons got the highest grain yield compared to T1=1.73 tons and T2= 3.88 tons which resulted to a very significant yield with difference of from T1= 6.51 tons and T2= 4.36 tons compared to 8.24 tons T8.

Finally, T8= 28.40 tons applied with eNEBler got the highest tonnage of rice straw with a difference of T1= 22.49 tons, T2= 15.04 tons. All T3, T4, T5, T6 and T7 applied with eNEBler got also a significant tonnage compared to the Control T1 and T2.

CONCLUSION

Based on the result of this study it was found out that eNEBler, when applied with the recommended quantity of fertilizers created the highest yield, which was statistically significant result. Observations of plant growth indexes, as those measured in this report but also visual observations, were superior with eNEBler. The increased physiological characteristics support the manufacturers claim of increasing tillers and enhanced absorption of nitrogen. Both the yield data, growth data and visual observations support this claim.

It was further concluded, based in our result that the higher dosage (volume of eNEBler) give us the highest grain yield, which facts have shown us compared to the yield performance T8 got 8.24 tons, almost five (5) times and two (2) times significantly higher in yield than T1 and T2 as our Control. And so, with the rice straw, all T3, T4, T5, T6, T7 and T8 got significantly more volume of rice straw yield to that of the Control T1 and T2.

It therefore concluded that using eNEBler with the recommended quantity of fertilizer produces the largest volume of rice grain yield. Based on these findings we recommend farmers in the Philippines to apply eNEBler to paddy rice at the rate of 472.5 ml per hectare.

TABLE 1.

DATA SET: AVERAGE PLANT HEIGHT (IN CM) AT 30 DAT OF LOWLAND RICE

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF RICE (RICE 136).

JULY – OCTOBER 2016.

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	17.10	20.00	16.95	19.50	73.55	18.39
2	21.50	19.95	18.95	20.50	80.90	20.23
3	31.25	32.10	33.25	34.00	130.60	32.65
4	35.00	34.95	35.50	36.10	141.55	35.39
5	34.95	36.05	36.10	35.95	143.05	35.76
6	35.85	36.95	37.20	37.50	147.50	36.88
7	37.95	37.95	38.55	38.80	153.25	38.31
8	38.65	37.85	39.40	38.95	154.85	38.71
TOTAL	252.25	255.80	255.90	261.3		
GRAND TOTAL					1025.25	
GRAND MEAN						32.04

*= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT

ANOVA TABLE

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	5.23	5.09	6.97 **HS	3.07	4.87
Treatment	7	1834.65	262.06	359.03**HS	2.49	3.65
Error	21	15.28	0.73			
TOTAL	31	1855.16				

CV = 2.7%

*** * HS = Highly Significant**

TABLE 2.

DATA SET: AVERAGE PLANT HEIGHT (IN CM) AT HARVEST OF LOWLAND RICE

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF RICE (RICE 136).

JULY – OCTOBER 2016.

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	89.10	79.95	82.90	88.10	340.05	85.01
2	105.00	99.25	98.95	99.10	402.30	100.58
3	118.25	116.25	115.85	114.25	464.60	116.15
4	121.10	118.65	116.20	115.95	471.90	117.98
5	120.85	119.85	118.95	119.60	479.25	119.81
6	124.00	122.95	121.95	123.85	492.75	123.14
7	123.95	125.85	123.75	124.10	497.65	124.41
8	126.00	124.95	125.85	125.95	502.75	125.69
TOTAL	**928.25**	**907.70**	**904.40**	**910.90**		
GRAND TOTAL					**3651.25**	
GRAND MEAN						**114.10**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA TABLE

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F 05	TABULAR F 01
Replication	3	42.36	14.12	4.02*	3.07	4.87
Treatment	7	5616.23	802.32	228.58** HS	2.49	3.65
Error	21	73.77	3.51			
TOTAL	31	5732.36				

CV = 1.64%

*** = Significant**

*** * HS = Highly Significant**

TABLE 3.

DATA SET: AVERAGE TILLER COUNT AT 30 DAT OF LOWLAND RICE

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF RICE (RICE 136).

JULY – OCTOBER 2016

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	14.75	13.95	15.10	13.20	57.00	14.25
2	16.95	16.65	17.25	18.30	69.15	17.29
3	20.15	19.85	21.35	22.10	83.45	20.86
4	23.35	22.15	23.25	21.95	90.70	22.68
5	24.25	23.95	24.10	24.20	96.50	24.13
6	24.65	24.55	25.50	26.10	100.80	25.20
7	25.95	24.95	27.20	26.85	104.95	26.24
8	28.85	27.95	29.70	28.95	115.45	28.86
TOTAL	**178.90**	**174.00**	**183.45**	**181.65**		
GRAND TOTAL					**718.00**	
GRAND MEAN						**22.44**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA TABLE

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F 05	TABULAR F 01
Replication	3	6.35	2.12	1.96 NS	3.07	4.87
Treatment	7	649.17	92.74	85.87**HS	2.49	3.65
Error	21	22.69	1.08			
TOTAL	31	678.21				

CV = 4.63%

NS **= Not Significant**

*** * HS = Highly Significant**

TABLE 4.

DATA SET: AVERAGE TILLER COUNT AT HARVEST OF LOWLAND RICE

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF RICE (RICE 136).

JULY – OCTOBER 2016

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	115	112	120	121	468	117.00
2	221	199	223	225	868	217.00
3	228	225	219	223	895	223.75
4	227	228	230	235	920	230.00
5	300	295	301	320	1216	304.00
6	229	310	321	325	1255	313.75
7	320	326	299	335	1280	320.00
8	345	298	320	325	1288	322.00
TOTAL	**2055**	**1993**	**2033**	**2109**		
GRAND TOTAL					**8190**	
GRAND MEAN						**255.75**

ANOVA TABLE

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	877.37	292.46	2.68 NS	3.07	4.87
Treatment	7	146596.37	20942.34	192.04**HS	2.49	3.65
Error	21	2290.13	109.05			
TOTAL	31	149763.87				

CV = 4.08%

NS **= Not Significant**

*** * HS = Highly Significant**

TABLE 5.

DATA SET: AVERAGE PANICLE COUNT AT HARVEST OF LOWLAND RICE

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF RICE (RICE 136).

JULY – OCTOBER 2016

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	113	110	115	120	458	114.50
2	220	199	221	224	864	216.00
3	226	223	215	223	887	221.75
4	227	226	230	234	917	229.25
5	298	295	301	318	1212	303.00
6	299	309	321	324	1253	313.25
7	319	326	298	334	1277	319.25
8	345	297	320	325	1287	321.75
TOTAL	**2047**	**1985**	**2021**	**2102**		
GRAND TOTAL					**8155**	
GRAND MEAN						**254.84**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA TABLE

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F 05	TABULAR F 01
Replication	3	909.10	303.03	2.84 NS	3.07	4.87
Treatment	7	149241.47	21320.21	199.91**HS	2.49	3.65
Error	21	2239.65	106.65			
TOTAL	31	152390.22				

CV = 4.05%

NS **= Not Significant**

*** * HS = Highly Significant**

TABLE 6.

DATA SET: AVERAGE GRAIN YIELD (IN TONS) PER HECTARE OF LOWLAND RICE

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF RICE (RICE 136).

JULY – OCTOBER 2016

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	2.26	1.57	1.39	1.69	6.91	1.73
2	4.00	3.78	3.92	3.82	15.52	3.88
3	4.62	4.74	5.52	4.96	19.84	4.96
4	5.56	5.66	5.48	5.52	22.22	5.56
5	6.22	6.44	6.70	6.60	25.96	6.49
6	6.74	6.60	7.08	7.26	27.68	6.92
7	7.40	7.96	7.64	8.18	31.18	7.80
8	7.96	8.24	8.40	8.34	32.94	8.24
TOTAL	**44.76**	**44.99**	**46.13**	**46.37**		
GRAND TOTAL					**182.25**	
GRAND MEAN						**5.70**

ANOVA TABLE

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F 05	01
Replication	3	0.25	0.083	1.11 NS	3.07	4.87
Treatment	7	130.36	18.62	248.27 **HS	2.49	3.65
Error	21	1.57	0.075			
TOTAL	31	132.18				

CV = 4.8%

NS **= Not Significant**

*** * HS = Highly Significant**

TABLE 7a.

DATA SET: AVERAGE DRIED GRAIN WEIGHT (IN KILOGRAM) OF HARVESTED LOWLAND RICE

TREATMENT	I	II	III	IV
1	5.65	3.92	3.47	4.22
2	10.00	9.45	9.80	9.55
3	11.55	11.86	13.79	12.40
4	13.90	14.15	13.70	13.80
5	15.55	16.10	16.75	16.50
6	16.85	16.50	17.70	18.15
7	18.50	19.90	19.10	20.45
8	19.90	20.60	21.00	20.85

Table 7b. AVERAGE DRIED GRAIN WEIGHT (IN TONS) PER HECTARE AT 14% MC

TREATMENT	I	II	III	IV
1	2260	1568	1388	1688
2	4000	3780	3920	3820
3	4620	4744	5516	4960
4	5560	5660	5480	5520
5	6220	6440	6700	6600
6	6740	6600	7080	7260
7	7400	7960	7640	8180
8	7960	8240	8400	8340

Table 7c. AVERAGE FRESH GRAIN WEIGHT (IN KILOGRAM) PER HECTARE OF NEWLY HARVESTED LOWLAND RICE

TREATMENT	I	II	III	IV
1	6.50	4.50	3.85	4.85
2	11.50	10.85	11.25	10.95
3	13.25	15.95	15.85	14.25
4	15.95	16.25	15.75	15.85
5	17.85	18.50	19.25	18.95
6	19.35	18.95	20.35	20.85
7	21.25	22.85	21.95	23.50
8	22.95	23.65	24.10	23.95

Table 7d. AVERAGE RICE STRAW WEIGHT (IN KILOGRAM) PER HECTARE

TREATMENT	I	II	III	IV
1	19.50	13.50	11.55	14.55
2	34.50	32.55	33.75	32.85
3	39.75	47.85	47.55	42.75
4	47.85	48.75	47.25	47.55
5	53.55	55.50	57.50	56.85
6	58.05	56.85	61.05	62.55
7	63.75	68.55	65.85	70.50
8	68.85	70.95	72.30	71.85

Table 7e. AVERAGE RICE STRAW WEIGHT (IN TONS) PER HECTARE OF LOWLAND RICE

TREATMENT	I	II	III	IV
1	7800	5,400	4,620	5,820
2	13,800	13,000	13,500	13,140
3	15,900	19,140	19,020	17,100
4	19,140	19,500	18,900	19,020
5	21,420	22,200	23,000	22,740
6	23,220	22,740	24,420	25,020
7	25,500	27,420	26,340	28,200
8	27,540	28,380	28,920	28,740

TABLE 8.

DATA SET: AVERAGE STRAW WEIGHT (IN TONS) AT HARVEST OF LOWLAND RICE

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF RICE (RICE 136).

JULY – OCTOBER 2016

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	7.80	5.40	4.62	5.82	23.64	5.91
2	13.80	13.00	13.50	13.14	53.44	13.36
3	15.90	19.14	19.02	17.10	71.16	17.79
4	19.14	19.50	18.90	19.02	76.56	19.14
5	21.42	22.20	23.00	22.74	89.36	22.34
6	23.22	22.74	24.42	25.02	95.40	23.85
7	25.50	27.42	26.34	28.20	107.46	26.87
8	27.54	28.38	28.92	28.74	113.58	28.40
TOTAL	**154.32**	**157.78**	**158.72**	**159.78**		
GRAND TOTAL					**630.6**	
GRAND MEAN						**19.71**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA TABLE

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F 05	01
Replication	3	2.10	0.7	0.68 NS	3.07	4.87
Treatment	7	1541.81	220.26	213.84**HS	2.49	3.65
Error	21	21.53	1.03			
TOTAL	31	1565.44				

CV = 5.2%

NS **= Not Significant**

*** * HS = Highly Significant**

RICE #137

EFFICACY AND RATE DETERMINATION OF eNEBler ON RICE *(NSIC Rc 308)* PRODUCTION

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NOVEMBER 2016

I. OBJECTIVES

To determine the efficacy of eNEBler when applied to rice and to determine the rate of eNEBler applied with the normal quantity of urea that produces the largest yield increase on rice (NSIC Rc 308).

II. INTRODUCTION

In Asia it was estimated that about 250 million rice farmers cultivate mostly no less than one (1) hectare. Production was about 520 million tons of unmilled rice in 1998.

The consumption of each Asian is equal to about 87 – 214 kilograms of milled rice annually, which provide 25 – 80% of the total calories consumed. By the year 2020, rice production should increase to 690 million tons to cater the needs of every Asian (Electronic database, 1999).

In Southern Philippines, and in other regions of the country, rice is one of the main sources of income. It is also considered as the prime commodity consists of 20% or more of the production on the agricultural sector (Rice Production Techno guide, 1993).

In this connection, correct and proper usage of fertilizer was recently the focus of researchers in the field. At the same time, the government through the Department of Agriculture is promoting the wise use of fertilizer whether organic or inorganic ones. The objective was to create sustainability of the soil to a profitable production.

The study aimed to evaluate the yield response of rice to different rates of eNEBler and inorganic soil applied fertilizer. Secondly, to determine the effects of eNEBler on yield and other agronomic characters of lowland rice.

I. RESEARCHER: ROEL C. DE RAMOS/PNT 025
DA-CEMIARC For Upland & Lowland
Tupi, South Cotabato

II. TARGET CROP: Lowland Rice (NSIC Rc 308)

III. DURATION OF THE STUDY: July to November 2016

VI. METHODOLOGY

The trial was conducted at Tupi Research and Experiment Station, Bololmala, Tupi, South Cotabato, with an area of one thousand one hundred eighty-eight (1,188 m^2) square meters. The area is generally plain and irrigated with a soil type of Tupi fine sandy loam. The product was tested using lowland rice (NSIC Rc 308). A four by five (4m x 5m) plot was prepared thoroughly ready for field planting. There were eight (8) treatments replicated four (4) times within the field using randomized complete block design (RCBD).

TREATMENT SUMMARY:

eNEBler was applied at different rates, as shown:

T1 No fertilizer control (no fertilizer, no eNEBler)
T2 RR fertilizer control (no eNEBler)
T3 RR fertilizer + 135 ml/ha eNEBler
T4 RR fertilizer + 202.5 ml/ha eNEBler
T5 RR fertilizer + 270 ml/ha eNEBler
T6 RR fertilizer + 337.5 ml/ha eNEBler
T7 RR fertilizer + 405 ml/ha eNEBler
T8 RR fertilizer + 472.5 ml/ha eNEBler

LAND PREPARATION

An area of approximately 1,188 m^2 was prepared for the rice trial, to ensure good land preparation and control of weeds, a thorough plowing and harrowing and leveling was done using tractor drawn implements.

SEEDBED PREPARATION & SEED SOWING

Seedbed was prepared ahead of the area to be transplanted with rice seedlings. A 1m X 10m bed was thoroughly prepared ready for planting. Rice seeds were soak in clean water for 24 hours and incubated for another 24 hours before sowing in the seedbed.

APPLICATION OF FERTILIZER AND FIELD PLANTING

Before the final leveling of the rice field, all the necessary inputs/fertilizers were applied as basal. Rice seedlings twenty one (21) days old from seedbed were transplanted two to three (2-3) seedlings per hill at a distance of 20cm X 20cm, allowing twenty five (25) square rows per plot. Replanting was done as soon as dying of seedling was noticed.

Fifteen (15) days after transplanting application of urea blended with eNEBler was done based on the proper volume of urea needed in the trial. Third application of urea blended with proper volume of eNEBler was at booting stage (45-55 DAT) of the rice plant in the trial. The recommended rate of fertilizer was 128-25-70 (kg of nitrogen, phosphorous and potassium respectively) was applied per hectare.

CARE AND MAINTENANCE

Package of technology for production of lowland rice was strictly followed aside from the application of eNEBler product with urea as per Advanced Agrisolutions Philippines Corporation instruction and guidance.

HARVESTING

Harvesting was done when rice plant reach maturely (105-110 DAT).

PARAMETERS GATHERED:

1. Average plant height (cm) at 30 DAT. This was done by measuring the height of the plant from the base up to the tip of the tallest leaf, four (4) corner hills per corner, a total of 16 hills samples per treatment plot (these were tagged).
2. Tiller count at 30 DAT. Number of tillers was counted and recorded from the tag 16 hills per plot and these were transform to number of tillers per square meter (m^2).
3. Average plant height (cm) at harvest. Plant height was measured from the base of the plant to the tip of the highest panicle, from the tagged 16 hills.
4. Tiller count at harvest (productive and unproductive). The counting was gathered at tagged 16 hills and transformed into tiller count per square meter.
5. Panicles count at harvest. The counting was gathered from the tagged 16 hills representing the number of productive tillers and transformed into panicle count per square meters.
6. Straw weight (kg) at harvest. This was gathered from the harvest of four square meters ($4m^2$) per plot. After manual threshing, straw was weighed and recorded.
7. Grain yield (kg/ha) at harvest. This was done by gathering the dry weight (14% MC) of filled grains from the harvest of 20 m^2 plots in every treatments and convert to tons per hectare yield.

Pest and disease, taken a week before harvest (when noticed). All data were gathered at designated area/rows of each experimental plot.

STUDY TITLE: EFFICACY AND RATE DETERMINATION OF eNEBler ON RICE *(NSIC Rc 308)* PRODUCTION

FIELD LAY-OUT

REP I

BORDER	T8 8	T7 7	T6 6	T5 5	T4 4	T3 3	T2 2	T1 1	BORDER

REP II

BORDER	T2 16	T5 15	T1 14	T3 13	T8 12	T7 11	T6 10	T4 9	BORDER

REPIII

BORDER	T3 17	T4 18	T2 19	T7 20	T6 21	T1 22	T5 23	T8 24	BORDER

REP IV

BORDER	T1 25	T8 26	T3 27	T2 28	T7 29	T5 30	T4 31	T6 32	BORDER

Plot size = 4X5 meters
Distance of Planting = 20cm X 20cm apart

VII. RESULTS AND DISCUSSION

The trial on the **"**EFFICACY AND RATE DETERMINATION OF eNEBler ON RICE *(NSIC Rc 308)* PRODUCTION**"** was conducted at the rice production area of the DA-Tupi Research and experiment Station, Bololmala, Tupi from July to November 2016. The station has an irrigation facility that can support the two (2) season regular planting (WS & DS). Its soil is fine sandy loam which is easy to drain and possess a pH of 5.8. Even distribution of rainfall (July 2016 = 14.09 mm, August 2016 = 8.07 mm, September 2016 = 10.51 mm and October 2016 = 9.89 mm) was experienced during the trial period. Insect pest and diseases in the area did not show damaging result for NSIC Rc 308 rice variety that was used as test crop for the trial.

Table 1. Average plant height (cm) of rice at 30 days after transplanting (DAT) as applied with eNEBler at different rate in combination with inorganic fertilizer, that the highest average plant height was treatment 8 (22.362 cm) followed by treatments 5 (22.275 cm), 7 (22.025 cm), 4 (21.787 cm), 6 (21.762 cm), 3 (21.337 cm), 2 (20.337 cm) and the lowest was treatment 1 with only 18.475 cm height. Although treatment 8 was the highest, all treatments applied with inorganic fertilizer and different volume of eNEBler give comparable height, and it was shown also in treatment 2 (only inorganic fertilizer). Treatment 1 (no fertilization) was the only treatment that was significantly different from all treatments with eNEBler application.

Table 1. Average plant height of rice (cm) from 16 hills samples/plot at 30 DAT , applied with eNEBler at different rates in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	18.25	17.35	18.00	20.30	73.90	18.475^{b}
2	18.00	21.35	21.00	21.00	81.35	20.337^{ab}
3	22.00	20.00	21.35	22.00	85.35	21.337^{a}
4	23.10	22.00	21.00	21.05	87.15	21.787^{a}
5	22.00	21.00	23.05	23.05	89.10	22.275^{a}
6	20.00	23.05	22.00	22.00	87.05	21.762^{a}
7	22.00	22.00	23.05	21.05	88.10	22.025^{a}
8	23.10	21.35	22.00	23.00	89.45	22.362^{a}
Total	**168.45**	**168.10**	**171.45**	**173.45**	**681.45**	**21.295**

* Treatment means having a common letter superscript are statistically the same.

Table 2. Average tiller count at 30 DAT, a highly significant result was observed. T_8 and T_6 produced more tillers as compared to other treatments. Treatment 8 account for the highest average number of tillers (23.39) followed by T_6 (23.32), treatment 7 (21.83), treatment 5 (21.61), treatment 3 (20.43), treatment 2 (20.21), treatment 4 (19.54) and treatment 1 the lowest number of average tillers (13.77). Comparable number of tillers was shown between treatments 5, 6, 7 and 8, although treatments 5 and seven was comparable to treatments 2, 3 and 4.

Table 2. Average tiller count of rice in 1.0m2 at 30 DAT as applied with eNEBler at different rates in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	14.45	13.14	13.50	14.00	55.09	13.77^{c}
2	18.70	20.62	22.40	19.15	80.87	20.21^{b}
3	21.37	19.65	19.73	21.00	81.75	20.43^{b}
4	20.97	18.92	19.15	19.12	78.16	19.54^{b}
5	23.02	21.35	20.07	22.00	86.44	21.61^{ab}
6	23.65	23.35	24.15	22.15	93.30	23.32^{a}
7	23.30	19.95	22.23	21.85	87.33	21.83^{ab}
8	23.16	23.19	23.18	24.05	93.58	23.39^{a}
Total	**168.62**	**160.17**	**164.41**	**163.32**	**656.52**	**20.516**

* Treatment means having a common letter superscript are statistically the same.

Table 3. Average plant height at harvest, a highly significant result was observed. Average height ranges from 90.870 cm (T_6 – highest) followed by T_7 (89.927 cm), T_5 (89.112 cm), T_2 (89.042 cm), T_8 (88.945 cm), T_4 (88.257 cm), T_3 (86.725 cm) and treatment 1 (85.607 cm) the lowest. Treatments 5, 6, and 7 gave comparable height with treatments 3, 4 and 8 but were significantly different to treatment 1 (no fertilization).

Table 3. Average plant height of rice (cm) at harvest taken from 16 hills samples/plot as applied with eNEBler at different rates in combination with inorganic fert. DA-RES Tupi, Nov. 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	87.50	84.05	85.50	85.38	342.43	85.607^{c}
2	91.10	87.03	89.00	89.04	356.17	89.042^{bc}
3	88.90	84.20	87.15	86.65	346.90	86.725^{ab}
4	90.00	86.15	88.90	87.98	353.03	88.257^{ab}
5	89.30	90.05	87.98	89.12	356.45	89.112^{a}
6	92.50	89.80	91.02	90.16	363.48	90.870^{a}
7	89.45	91.00	89.50	89.76	359.71	89.927^{a}
8	88.78	90.15	87.77	89.08	355.78	88.945^{ab}
Total	**717.53**	**702.43**	**706.82**	**707.17**	**2833.95**	**88.561**

* - Treatment means having a common letter superscript are statistically the same at 1% level DMRT.

Table 4. The average tiller count (from 16 hills sample/plot) during harvest, significant differences in treatment means were observed. The highest average tiller count was noticed on treatment 8 (324.29) comparable to treatments 5 (322.46), 4 (314.06), 3 (301.78), 7 (299.40) and 2 (285.77). These treatments were significantly different from treatment 1 (208.78) the control or no fertilization.

Table 4. Average tiller count of rice from 16 hills samples/plot at harvest, as applied with eNEBler at different rates in combination with inorganic fert. DA-RES Tupi, Nov. 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	203.15	209.10	224.02	198.86	835.13	208.78[b]
2	282.16	315.15	268.22	277.56	1143.09	285.77[a]
3	308.00	289.12	321.00	288.98	1207.10	301.78[a]
4	306.12	336.22	315.12	298.78	1256.24	314.06[a]
5	316.24	352.15	310.26	311.22	1289.87	322.46[a]
6	345.22	285.00	272.04	287.79	1190.05	297.51[a]
7	299.86	300.18	298.78	298.78	1197.60	299.40[a]
8	304.22	356.45	312.34	306.18	1279.19	324.29[a]
Total	**2364.97**	**2443.37**	**2321.78**	**2268.15**	**9398.27**	**293.695**

* - Treatment means having a common letter superscript are statistically the same at 1% level DMRT.

Table 5. Average panicle count taken from one square meter area, highly significant result was observed. Treatment 7 give the highest panicle count (255.727) that was comparable to treatments 8 (249.352), 4 (247.560), 6 (241.887) and treatment 5 (235.380). Treatment 2 (226.100) was also comparable to treatments 3, 4, 5, 6 and eventually all treatments applied with fertilizer was found significantly different from the control (T_1 -140.345) or no fertilization.

Table 5. Average panicle count of rice (1.0 m2) as applied with eNEBler at different rates in combination with inorganic fertilizer. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	146.22	157.00	122.00	136.16	561.38	140.345^{d}
2	223.32	230.00	225.00	226.08	904.40	226.100^{bc}
3	208.76	200.00	207.00	229.76	845.52	211.380^{c}
4	238.56	255.00	242.00	254.68	990.24	247.560^{ab}
5	233.08	237.00	238.00	233.44	941.52	235.380^{ab}
6	228.68	251.00	240.00	247.87	967.55	241.887^{ab}
7	236.16	248.45	282.30	256.00	1022.91	255.727^{a}
8	244.08	249.72	254.46	249.15	997.41	249.352^{ab}
Total	**1758.86**	**1828.17**	**1810.76**	**1833.14**	**7230.93**	**225.966**

* - Treatment means having a common letter superscript are statistically the same at 1% level DMRT.

Table 6. Average straw weight of rice taken 4 square meter area per plot, revealed a highly significant result. Straw weights ranges from 6.091 kg/plot the highest (T_7), to 2.706 kilograms/plot the lowest (T_1). Comparable treatments were treatment 4 (5.579 kg/plot), 5 (6.044 kg/plot), 6 (6.011 kg/plot), 7 (6.091 kg/plot) and 8 (6.085 kg/plot), although treatment 3 (5.010 kg/plot) was noticed comparable to treatment 4 (5.579 kg/plot) and treatment 2 (4.668 kg/plot) but all treatments with combination of eNEBler and inorganic fertilizer showed a significant difference to treatments without eNEBler (T_2) and treatment without fertilizer (T_1 -2.706 kg/plot).

Table 6. Average straw weight of rice in kilograms taken from 4m2sample/plot as applied with eNEBler at different rates in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	2.508	3.150	3.075	2.093	10.826	2.706^{d}
2	5.055	4.850	4.160	4.608	18.673	4.668^{c}
3	4.980	4.900	5.150	5.012	20.042	5.010^{bc}
4	5.675	5.185	5.880	5.576	22.316	5.579^{ab}
5	6.140	5.915	6.080	6.044	24.179	6.044^{a}
6	6.060	5.890	6.085	6.012	24.047	6.011^{a}
7	6.112	6.124	6.114	6.012	24.362	6.091^{a}
8	6.022	6.202	6.096	6.023	24.343	6.085^{a}
Total	**42.552**	**42.216**	**42.640**	**41.38**	**168.788**	**5.274**

* - Treatment means having a common letter superscript are statistically the same at 1% level DMRT.

Table 7. The grain yield in tons per hectare of rice (NSIC Rc 308), highly significant differences in treatment means were observed. Highest yield was observed in treatment 8 (5.22 tons/ha), comparable to treatments 7 (5.16 tons/ha) and treatment 6 (4.96 tons/ha). Treatment 5 (4.89 tons/ha) was also comparable to treatments 6 and 7 even in treatment 4 (4.84 tons/ha). But all of the higher treatments (6, 7 and 8) were found significantly different to treatments 3 (4.53 tons/ha), 2 (3.08 tons/ha) and eventually to the control (T_1) with only 1.96 tons per hectare yield.

Table 7. Grain yield in tons per hectare of lowland rice (NSIC Rc308) as applied with eNEBler at different rates in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	1.98	2.03	1.87	1.96	7.84	1.96^{f}
2	3.08	3.12	3.05	3.08	12.33	3.08^{e}
3	4.62	4.14	4.79	4.55	18.10	4.53^{d}
4	4.83	4.80	4.97	4.76	19.36	4.84^{c}
5	4.80	4.87	5.00	4.89	19.56	4.89^{bc}
6	5.07	4.93	4.97	4.88	19.85	4.96^{abc}
7	5.12	5.33	5.18	5.02	20.65	5.16^{ab}
8	5.08	5.23	5.22	5.34	20.87	5.22^{a}
Total	**34.580**	**34.450**	**35.050**	**34.480**	**138.56**	**4.33**

* - Treatment means having a common letter superscript are statistically the same at 1% level DMRT.

VIII. SUMMARY AND CONCLUSION

As shown in tables 1 to 7, almost all results showed significant result in favor of treatments 5, 6, 7 and 8. The application of eNEBler in combination of inorganic fertilizer (14-14-14, 0-0-60 and 46-0-0) made the growth and yield of NSIC Rc 308 better. Average tiller count during the vegetative stage (Table 2) was increased from 13.77 (T_1) as high as 23.39 (T_8). In Table 4, the average tiller count during maturity/harvest, the count was increased from 208.78 (T_1) to 324.29 (T_8). Another was the increase in panicle count, although increasing inconsistently but contributory, from 247.560 (T_4) to 255.727 (T_7). Finally on Table 7, gradual increase in yield from treatment 3 (4.53 tons/ha) to treatment 8 (5.22 tons/ha) was obviously noticeable. An increase of about 2.57 tons/ha when eNEBler was added (T_1 to T_3). There was another increase of 3.26 tons/ha from T_1 (1.96 tons/ha) to T_8 (5.22 tons/ha) when a maximum amount of eNEBler was added.

IX. RECOMMENDATION

It is recommended therefore, based on the result of this trial, that fertilizer be supplemented with 472.5 ml/ha eNEBler to increase rice production. Is it also recommended to increase the volume of eNEBler added to inorganic fertilizer; the data shows a clear positive trend suggesting benefit may be more at higher rates of eNEBler. These choices of application would increase a rice farmer's yield and eventually increased income.

RICE 145

THE QUANTITY OF eNEBLer THAT PRODUCES THE HIGHEST YIELD WITH THE NORMAL QUANTITY OF UREA (100 PERCENT UREA) AS WELL AS A 50 PERCENT REDUCTION OF UREA.

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MARCH – JULY 2017

Comments from Agmor (manufacturer of NEB)

The objective of this study was to (1) measure the yield increase when NEB is coated onto urea when the normal quantity of urea is applied, and (2) measure the yield increase of the normal quantity of urea control is compared to a 50% reduction of urea to access if urea can be reduced by 50% without a loss of yield from the addition of NEB.

Agmor is focusing on NEB applied on urea without a reduction of urea. For this reason, the treatments to consider when reviewing this study are as follows:

T1, the untreated control (normal rate of urea without NEB) compared to

T4, NEB coated onto urea (normal rate of urea with NEB)

These relevant treatments are highlighted in green below:

Treatment Summary

	Urea	NEB Dosage	Yield
T1	100% urea	No NEB (Control)	2395 kg/ha
T2	100% urea (no reduction)	2.1 L/ton urea	3650 kg/ha
T3	100% urea (no reduction)	2.55 L/ton uea	4170 kg/ha
T4	100% urea (no reduction)	3 L/ton urea	4895 kg/ha
T5	50% urea (50% reduction)	4.2 L/ton	3525 kg/ha
T6	50% urea (50% reduction)	5.1 /ton uea	4025 kg/ha
T7	50% urea (50% reduction)	6 L/ton urea	4105 kg/ha
T8	50% urea (50% reduction)	6.9 L/ton	4245 kg/ha

Agmor Conclusions

1. Comparing the 100% urea control (T1) to the 100% urea with 675 ml/ha NEB (T4), the yield increase due to NEB is 2,500 kg/ha (4,895 kg/ha – 2,395 kg/ha).
2. It is noteworthy that the 50% urea treatments with NEB (T5-T8) yielded higher than the 100% urea control, which has been demonstrated many times both in other research trials and farmer trials. However, maximum yield is achieved with the 100% rate of urea.

Product Reference

Advanced AgriSolutions is marketing NEB in the Philippines under the brand name “eNEBler” and urea coated with NEB as “eNEBled urea”. All references in this report that refer to eNEBler or eNEBled urea refer to the product NEB, manufactured by Agmor, Inc in the USA.

I. INTRODUCTION

Our government, through the Executive Officials of the Department of Agriculture had announced an immediate implementation of Hybridization Program of Rice Production in a **THREE HUNDRED THOUSAND** (300, 000) hectares of Lowland. Rice fields all over the country, to be financed by the different government Agencies, such as the Land Bank of the Philippines, Agricultural Credit Policy Council (ACPC) and the Department of Agriculture.

The Department of Agriculture should be informed and encouraged for the utilization of eNEBler application to these **THREE HUNDRED THOUSAND** (300,000) hectares all over the country, inorder to attain the success of this project.

Specifically, this study aimed to determine the quantity of eNEBler that produces the highest yield with the normal quantity of Urea (100 percent urea) as well as a 50 percent reduction of urea.

II. OBJECTIVES

- To determine the quality of eNEBler that produces the highest yield with the normal quantity of Urea (100 percent Urea) as well as 50 percent reduction of Urea.
- Determine if 50% percent or 100% percent Urea with eNEBler provides the highest yield.
- To act as show window to our rice farmers in SOCKSARGEN areas.

III. RESEARCHER

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IV. TARGET CROP PLANTED

Rice (RC 160 Variety)

V. DURATION OF THE STUDY

March 25, 2017 to July 13, 2017

VI. METHODOLOGY

Our Rice Trial Number 145 was conducted at RBE Research Station, Vineyard, Barangay San Jose, General Santos City, Philippines with an area of more or less ONE THOUSAND ONE HUNDRED EIGHTY EIGHT (1,188) square meters. The area is generally plain and irrigated with fine volcanic sandy loam soil. The product eNEBLer was applied with the different level that produces the highest yield with Normal quantity of Urea (100 percent and 50 percent reduction of Urea, tested in using (RC 160 Variety) in lowland rice field. A five (5) meters plot was prepared for the trial. There were EIGHT (8) Treatments replicated FOUR (4) times within the field using Randomized Complete Block Design (RCBD).

LAND PREPARATION/PLANTING/FERTILIZATION

An area of **ONE THOUSAND ONE HUNDRED EIGHTY EIGHT (1,188)** square meters was prepared for Rice Trial # 145. The land was plowed and harrowed several times using drawn animal (horse and carabao) to make sure of good land preparation. While preparing the seedbed two (2) meters by twenty (20) meters, we soaked the palay seeds into a drum full of water for TWENTY FOUR (24) hours, and let the seeds sprouted for another two (2) days.

We sowed the palaynos seeds in March 5, 2017. In March 18, 2017 we broadcasted the (basal) at 437.5 grams of (14-14-14) complete fertilizer and 187.5 grams of Muriate of Potash (0-0-60) per plot respectively. It was March 25, 2017, when we transplanted the palay seedlings, in five (5) meters by five (5) meters equals twenty five square meters plot. There were THIRTY TWO (32) plots consisting of eight (8) entries, with FOUR (4) Replication trials. Immediately replanting was done on the dying plants, to ensure a good and perfect stand count of the trial.

APPLICATION OF FERTILIZER

The basal application was done SEVEN (7) days before the transplanting period March 18, 2017 was done. The second fertilizer application was applied in April 9, 2017, as top dressing which was done as follows:

TREATMENTS	UREA (in grams)	eNEBLer (in ml)
T_1	250 grams Urea/plot	No eNEBler
T_2	250 grams Urea/plot	210 ml eNEBler/plot
T_3	250 grams Urea/plot	255 ml eNEBler/plot
T_4	250 grams Urea/plot	300 ml eNEBler/plot
T_5	250 grams Urea/plot	210 ml eNEBler/plot
T_6	250 grams Urea/plot	255 ml eNEBler/plot
T_7	250 grams Urea/plot	300 ml eNEBler/plot
T_8	250 grams Urea/plot	345 ml eNEBler/plot

The third and last fertilizer application was in May 20, 2017 as follows:

TREATMENTS	APPLICATION
T_1	312.5 grams Urea , No eNEBLer
T_2	312.5 grams Urea plus 265 ml eNEBLer/ plot
T_3	312.5 grams Urea plus 320 ml eNEBLer/ plot
T_4	312.5 grams Urea plus 375 ml eNEBLer/ plot
T_5	156.25 grams Urea plus 265 ml eNEBLer/ plot
T_6	156.25 grams Urea plus 320 ml eNEBLer/ plot
T_7	156.25 grams Urea plus 375 ml eNEBLer/ plot
T_8	156.25 grams Urea plus 430 ml eNEBLer/ plot

CARE AND MAINTENANCE

The spraying of schedules was done on the basis of insect, pest, and diseases appearances. Package of technologies for lowland rice production and guidance by the Advanced Agrisolution Corporation was followed.

HARVESTING

It was July 15 supposedly our harvesting but it was scheduled earlier July 13, 2017 due to some circumstances that hindered our harvesting. Before harvesting we gathered the necessary data such as plant height, stand count, teller count and panicle count. All the harvested palay were sun dried for the whole day before putting it up in a sack, inorder to avoid so much spillage, and that we expected an accurate data. It was weighed and threshed every treatment. We weighed also the ricestraw. After threshing the 32 plots were dried for FOUR (4) sunny days until the moisture content was 14 percent.

PARAMETERS were gathered correctly as follows:

1. **Average Plant Height** (in cm) at THIRTY (30) DAYS (DAT) this was done right in the field measuring 20 hills at random per plot.
2. **Average Plant Height** (in cm) at harvest date was done by measuring the base up to the highest panicle of 20 plants at random within the plot.
3. **Average Tiller Count** at (30 DAT) number of tillers were counted among the 20 random hills in a plot.
4. **Average Tiller Count** at harvest. All the tillers within the plot were counted, as well as the Panicles.
5. **Straw Weight** within a plot was weighed strictly.
6. **Fresh Grain Weight** were weighed.
7. **Dried Grain Weight** for every plot after FOUR (4) successive sunny days were all weighed.

IV. RESULTS AND DISCUSSION

The rice trial number 145 was conducted at RBE Research Station, Brgy. San Jose, General Santos City during the period from March 25, 2017 to July 13, 2017. The area was generally plain with fine volcanic sandy loam soil, irrigated using the gravitational system. Our station has a 6.2ph with 90-30-30NPK/ha fertilizer requirement. Our test crop was RC 160 variety. This was a test on the rate of eNEBLer applied at 100% percent Urea and a 50 % percent Urea reduction, to which of it could provide the highest yield increase in rice production.

The result of the trial # 145 showed that Table 1 the average plant height at 30 DAT, doubled the height of T_1 = 18.88 which resulted to a very significant number of centimeters, T_2= 38.06, T_3=39.84, T_4= 39.96, T_5= 37.54, T_6= 38.14, T_7= 38.48, T_8= 38.95. In Table 2, the plant height at harvest has resulted to significant differences to that of T1. The differences to that of T_1 were T_2= 30.05 cm, T_3= 37.41, T_4= 39.36, T_5= 29.65, T_6= 31.20, T_7= 37.31, T_8= 38.56 cm.

The Table 1, the average plant height at 30 DAT of 100 % percent Urea has only minimal differences to that of 50 % percent Urea, such that T2 got only 0.52cm to that of T5, T3 with 1.7cm to that of T6, and T4 with 1.48cm to that of T7, and T4 with 1.01cm difference to that of T_8. In Table 2, T_2, T_3, T_4 got differences of T_5= 0.4cm, T_6= 6.21cm, T_7= 2.05, T_8= 0.8cm difference from T=4.

In Table 3, all T_2, T_3, T_4, T_5, T_6, T_7 and T8 applied with eNEBLer has a very significant differences of Teller count compared to T1 which proved to have the differences as follows T_2=5.72, T_3= 9.50, T_4= 13.62, T_4= 5, T_6= 7.65, T_7= 9.6 and T_8= 11.15cm tillers differences to that of T_1. Table 4, had shown that T_1 has a very big differences of teller count to those treatments applied with eNEBLer such as T_2= 62, T_3= 104.5, T_4= 149.74, T_5= 55, T_6= 84.15, T_7= 105.6 and T_8= 122.65.

Table 5 Average Panicle count had shown a very significant differences among those treatments applied with eNEBLer to that of T_1= 0 eNEBLer such as T_2= 62.45 panicles, T_3= 102.26, T_4= 144.60, T_5= 54.10, T_6= 82.30, T_7= 104.38, T_8= 123.75 panicles differences.

There was just a minimal differences among those treatments applied with eNEBLer of different levels, though treated with 100 percent of Urea to that of 50 percent reduction

in Urea which resulted as follows: T_2= 241.35 minus T_5= 233= 8.35 panicles, T_3= 281.16 minus T_6= 261.53 = 19.63, T_4= 323.50 minus T_7= 283.28 = 40.22, and T_4= 323.50 minus T_8 = 302.65 = 20.85 panicles only.

In Table 6, the average grain yield (in ton) per hectare for all entries applied with eNEBLer has the largest yield compared to the control the differences among those entries applied with eNEBLer to that of T_1 were as follows: T_2= 3650 minus T_1 = 2395 equals 1.26 tons/hectare, T_3 =1.80 tons/hectare, T_5= 1.13 tons/hectare, T_6= 1.63 tons/hectare, T_7=1.71 tons/hectare, T_8 = 1.85 tons/hectare differences.

There were minimal differences in a 100 percent Urea applied to that of 50 percent reduction of Urea in trial # 145 which resulted as follows: T_2= 3650 minus T_5= 3525 equals 125 kilos difference, T_3 minus T_6= 145 kilos, T_4 minus T_7 equals 790 kilos and T_4-T_8= 650 kilograms differences.

Finally T_4 with 17, 520 tons per hectare got the highest weight of straw follow by T_8= 14, 895 tons per hectare, T_3= 14, 640, T_7= 14,400, T_6= 14,115, T_2 = 12, 825, T5= 12,375, and the last is the control T_1=8,400.

V. SUMMARY AND CONCLUSION

Based on the result of this study RICE TRIAL # 145, it was found that all treatments applied with eNEBLer produced the highest yield compared to the control T1 which was applied with the same quantity of fertilizer. Additionally, all the agronomic measurements including tiller count, panicle count and plant height were all higher with eNEBLer compared to the control T1.

The highest yield was with the at the 100% rate of urea was found with T4 which also had the highest agronomic measurements, which was statistically significant from the T1 untreated control. The highest yield with the 50% urea rate was T8 which was statistically significant from the T1 untreated control. Thus, for farmers that desire the maximum yield it is recommended to apply the 100% rate of urea and add eNEBler at the rate used in T4. If 50% urea is desired, it is recommended to apply the quantity of eNEBler used in T8.

Table 1. **AVERAGE PLANT HEIGHT (IN CM) AT THIRTY (30) DAT OF LOWLAND RICE AS INFLUENCED BY QUANTITY OF eNEBLer APPLIED WITH NORMAL QUANTITY OF UREA (100 PERCENT UREA) AND 50 PERCENT PERCENT REDUCTION OF UREA THAT PRODUCED THE LARGEST YIELD INCREASED IN RICE (RC 160 VARIETY) PRODUCTION.**

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	18.20	19.50	18.85	18.9518.95	75.50	18.88
2	37.75	38.10	37.75	38.65	152.25	38.06
3	39.75	40.60	39.85	39.15	159.35	39.84
4	40.25	39.65	40.10	39.85	159.85	39.96
5	37.35	37.25	38.30	37.25	150.15	37.54
6	38.75	37.40	38.25	38.15	152.55	38.14
7	38.85	38.15	38.25	38.65	153.90	38.48
8	39.65	38.65	38.75	38.75	155.80	38.95
TOTAL	**290.55**	**289.30**	**290.10**	**289.40**		
GRAND TOTAL					**1159.35**	
GRAND MEAN						**36.23**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	0.13	0.043	0.17 NS	3.07	4.87
Treatment	7	1397.14	199.59	798.16	2.49	3.65
Error	21	5.18	0.25			
TOTAL	31	1402.45				

CV = 1.40 %

NS = Not Significant

Table 2. **AVERAGE PLANT HEIGHT (IN CM) AT HARVEST OF LOWLAND RICE AS INFLUENCED BY QUANTITY OF eNEBLer APPLIED WITH NORMAL QUANTITY OF UREA (100 PERCENT UREA) AND 50 PERCENT PERCENT REDUCTION OF UREA THAT PRODUCED THE LARGEST YIELD INCREASED IN RICE (RC 160 VARIETY) PRODUCTION.**

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	85.10	79.95	84.90	85.15	335.10	83.78
2	115.20	110.95	113.90	115.25	455.30	113.83
3	121.90	122.20	119.80	120.85	484.75	121.19
4	123.80	122.90	121.95	123.90	492.55	123.14
5	115.10	111.20	113.20	114.20	453.70	113.43
6	114.95	115.20	113.80	115.95	459.90	114.98
7	120.90	122.80	120.85	119.80	484.35	121.09
8	122.90	121.95	123.80	120.70	489.35	122.34
TOTAL	**919.85**	**907.15**	**912.20**	**915.80**		
GRAND TOTAL					**3655**	
GRAND MEAN						**114.22**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	10.92	3.64	1.60 NS	3.07	4.87
Treatment	7	4677.52	668.22	293.00 **HS	2.49	3.65
Error	21	47.61	2.28			
TOTAL	31	4736.05				

CV = 1.32%

NS= No Significant

**** = Highly Significant**

Table 3. **AVERAGE TILLER COUNT AT THIRTY (30) DAT OF LOWLAND RICE AS TRIAL NUMBER 145 AS INFLUENCED BY QUANTITY OF eNEBLer APPLIED WITH NORMAL QUANTITY OF UREA (100 PERCENT UREA) AND 50 PERCENT PERCENT REDUCTION OF UREA THAT PRODUCED THE LARGEST YIELD INCREASED IN RICE (RC 160 VARIETY) PRODUCTION.**

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	16.25	15.95	15.75	16.10	64.05	16.01
2	21.85	20.95	22.15	21.95	86.90	21.73
3	25.65	24.95	25.75	25.70	102.05	25.51
4	29.75	28.95	29.95	29.85	118.50	29.63
5	19.95	20.10	22.10	21.90	84.05	21.01
6	23.90	22.95	23.85	23.95	94.65	23.66
7	25.75	25.80	24.95	25.95	102.45	25.61
8	27.50	26.70	27.10	27.35	108.65	27.16
TOTAL	**190.60**	**186.35**	**191.60**	**192.75**		
GRAND TOTAL					**761.30**	
GRAND MEAN						**23.79**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	2.93	0.98	4.45 *s	3.07	4.87
Treatment	7	496.78	70.97	322.59**HS	2.49	3.65
Error	21	4.64	0.22			
TOTAL	31	504.35				

CV = 1.97%

*** * = Highly Significant**

*** = Significant**

Table 4. **AVERAGE TILLER COUNT AT HARVEST OF LOWLAND RICE AS TRIAL NUMBER 145 AS INFLUENCED BY QUANTITY OF eNEBLer APPLIED WITH NORMAL QUANTITY OF UREA (100 PERCENT UREA) AND 50 PERCENT PERCENT REDUCTION OF UREA THAT PRODUCED THE LARGEST YIELD INCREASED IN RICE (RC 160 VARIETY) PRODUCTION.**

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	178.75	175.45	173.25	177.10	704.55	176.14
2	240.35	230.45	243.65	241.45	955.90	238.98
3	282.15	274.45	283.25	282.70	1122.55	280.64
4	327.25	318.45	329.45	328.35	1303.50	325.88
5	219.45	221.10	243.10	240.90	924.55	231.14
6	262.90	252.45	262.35	263.45	1041.15	260.29
7	283.25	283.80	274.45	285.45	1126.95	281.74
8	302.50	293.70	298.10	300.85	1195.15	298.79
TOTAL	**2096.60**	**2049.80**	**2107.60**	**2120.25**		
GRAND TOTAL					**8374.3**	
GRAND MEAN						**261.70**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	328.04	109.35	3.86 *S	3.07	4.87
Treatment	7	60109.88	8587.13	303.22 **HS	2.49	3.65
Error	21	594.68	28.32			
TOTAL	31	61032.6				

CV =2.03 %

** = Highly Significant**

* = Significant**

Table 5. **AVERAGE PANICLE COUNT AT HARVEST OF LOWLAND RICE AS TRIAL NUMBER 145 AS INFLUENCED BY QUANTITY OF eNEBLer APPLIED WITH NORMAL QUANTITY OF UREA (100 PERCENT UREA) AND 50 PERCENT PERCENT REDUCTION OF UREA THAT PRODUCED THE LARGEST YIELD INCREASED IN RICE (RC 160 VARIETY) PRODUCTION.**

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	179.95	178.45	177.65	179.55	715.60	178.90
2	245.35	235.40	242.20	242.45	965.40	241.35
3	283.20	275.45	282.30	283.70	1124.65	281.16
4	325.25	320.65	328.35	319.75	1294.00	323.50
5	225.45	233.75	245.20	227.60	932.00	233.00
6	265.95	255.40	260.35	264.40	1046.10	261.53
7	285.30	286.80	275.60	285.40	1133.10	283.28
8	310.50	299.65	299.60	300.85	1210.60	302.65
TOTAL	**2120.95**	**2085.55**	**2111.25**	**2103.70**		
GRAND TOTAL					**8421.45**	
GRAND MEAN						**263.17**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	84.11	28.04	1.11 NS	3.07	4.87
Treatment	7	57667.2	8238.17	325.75 **HS	2.49	3.65
Error	21	531.18	25.29			
TOTAL	31	58282.49				

CV = 1.91 %

NS = No Significant

*** * = Highly Significant**

Table 6. **AVERAGE GRAIN YIELD (IN TON) PER HECTARE OF LOWLAND RICE AS TRIAL NUMBER 145 AS INFLUENCED BY QUANTITY OF eNEBLer APPLIED WITH NORMAL QUANTITY OF UREA (100 PERCENT UREA) AND 50 PERCENT PERCENT REDUCTION OF UREA THAT PRODUCED THE LARGEST YIELD INCREASED IN RICE (RC 160 VARIETY) PRODUCTION.**

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	2260	2460	2380	2480	9580	2395
2	3580	3740	3700	3580	14600	3650
3	3980	4260	4340	4100	16680	4170
4	4860	4780	4940	5000	19580	4895
5	3560	3580	3460	3500	14100	3525
6	4060	3980	4040	4020	16100	4025
7	4200	4140	4100	3980	16420	4105
8	4300	4440	4140	4100	**16980**	4245
TOTAL	**30800**	**31380**	**31100**	**30760**		
GRAND TOTAL					**124040**	
GRAND MEAN						**3876.25**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	31450	10483.33	0.93 NS	3.07	4.87
Treatment	7	14812950	2116135.71	188.34 ** HS	2.49	3.65
Error	21	235950	11235.71			
TOTAL	31	15080350				

CV = 2.73 %

NS = No Significant

*** * = Highly Significant**

Table 6a. AVERAGE DRIED GRAIN WEIGHT (IN KILOGRAM) OF HARVESTED LOWLAND RICE (RC 160 VARIETY)

TREATMENT	I	II	III	IV
1	5.65	6.15	5.95	6.20
2	8.95	9.35	9.25	8.95
3	9.95	10.65	10.85	10.25
4	12.15	11.95	12.35	12.50
5	8.90	8.95	8.65	8.75
6	10.15	9.95	10.10	10.05
7	10.50	10.35	10.25	9.95
8	10.75	11.10	10.35	10.25

Table 6A1. AVERAGE DRIED GRAIN WEIGHT (IN TON) PER HECTARE AT 14 % PERCENT MOISTURE CONTENT (MC)

TREATMENT	I	II	III	IV
1	2260	2460	2380	2480
2	3580	3740	3700	3580
3	3980	4260	4340	4100
4	4860	4780	4940	5000
5	3560	3580	3460	3500
6	4060	3980	4040	4020
7	4200	4140	4100	3980
8	4300	4440	4140	4100

Table 6B. AVERAGE FRESH GRAIN WEIGHT (IN KILOGRAM) PER HECTARE OF NEWLY HARVESTED LOWLAND RICE (RC 160 VARIETY)

TREATMENT	I	II	III	IV
1	6.60	7.20	6.95	7.25
2	10.50	10.95	10.85	10.45
3	11.65	12.45	12.70	12.00
4	14.20	13.95	14.45	14.60
5	10.40	10.50	10.10	10.25
6	11.85	11.65	11.80	11.75
7	12.30	12.10	11.95	11.65
8	12.60	12.95	12.10	12.00

Table 6B1. AVERAGE RICE STRAW (IN KILOGRAM) PER HECTARE OF LOWLAND RICE

TREATMENT	I	II	III	IV
1	19.80	21.60	20.85	21.75
2	31.50	32.85	32.55	31.35
3	34.95	37.35	38.10	36.00
4	42.60	41.85	43.35	43.80
5	31.20	31.50	30.30	30.75
6	35.55	34.95	35.40	35.25
7	36.90	36.30	35.85	34.95
8	37.80	38.85	36.30	36.00

Table 6B2. AVERAGE RICE STRAW (IN TON) PER HECTARE OF LOWLAND RICE

TREATMENT	I	II	III	IV	TOTAL	MEAN
1	7,920	8,640	8,340	8,700	33,600	8,400
2	12,600	13,140	13,020	12,540	51,300	12,825
3	13,980	14,940	15,240	14,400	58,560	14640
4	17,040	16,740	17,340	17,520	68,640	17,160
5	12,480	12,600	12,120	12,300	49,500	12,375
6	14,220	13,980	14,160	14,100	56,460	14,115
7	14,760	14,520	14,340	13,980	57,600	14,400
8	15,120	15,540	14,520	14,400	59,500	14,895

Table 7. **AVERAGE RICE STRAW WEIGHT (IN KGS) PER HECTARE OF LOWLAND RICE AS TRIAL NUMBER 145 AS INFLUENCED BY QUANTITY OF eNEBLer APPLIED WITH NORMAL QUANTITY OF UREA (100 PERCENT UREA) AND 50 PERCENT PERCENT REDUCTION OF UREA THAT PRODUCED THE LARGEST YIELD INCREASED IN RICE (RC 160 VARIETY) PRODUCTION.**

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	19.80	21.60	20.85	21.75	84.00	21.00
2	31.50	32.85	32.55	31.35	128.25	32.06
3	34.95	37.35	38.10	36.00	146.40	36.60
4	42.60	41.85	43.35	43.80	171.60	42.90
5	31.20	31.50	30.30	30.75	123.75	30.94
6	35.55	34.95	35.40	35.25	141.15	35.29
7	36.90	36.30	35.85	34.95	144.00	36.00
8	37.80	38.85	36.30	36.00	**148.95**	37.24
TOTAL	**270.30**	**275.25**	**272.70**	**269.85**		
GRAND TOTAL					**1088.1**	
GRAND MEAN						**34.00**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	2.32	0.77	0.89 NS	3.07	4.87
Treatment	7	1136.97	162.42	186.69 **HS	2.49	3.65
Error	21	18.18	0.87			
TOTAL	31	1157.47				

CV = 2.74 %

***S = Significant at .05 %**

*** * HS = Highly Significant**

Effect of NEB Root Exudates on the growth and yield of sugar cane

I. OBJECTIVE:

To measure the effect of NEB applied with the normal quantity of fertilizer, applied with either one or two applications of NEB.

II. PROPONENT:

Agmor, Inc.

IV. RESEARCHERS:

Ms. Haydee P. Villariez and Ms. Chona R. Untal
PHILSURIN Experiment Station
VMC Compound, Victorias City
Negros Occidental

V. TEST LOCATION:

Hda. Luisita, Cadiz City, Negros Occidental

VI. TARGET CROP:

Sugarcane

VIII. DURATION OF THE STUDY:

March 2018 to February 2019

INTRODUCTION

Due to continuous mono-cropping that brought loss of essential plant foods through crop removal, soil erosion, surface run-off and alteration of its biological, physical and chemical properties, soil productivity in most sugarcane areas in the Philippines gradually declined (Alaban, et al, 1990; PCARRD, 2001). Thus, fertilizers in large quantity are needed to attain high yields and these are among the expensive farm inputs which require proper management.

The combination of Urea (46-0-0), Di-Ammonium Phosphate (18-46-0) and Muriate of Potash (0-0-60) is currently the most commonly used materials to satisfy the NPK requirements for sugarcane especially in Western Visayas which grow 75% of sugarcane for the country (PSA, Dec 2018). This combination seems the most cost efficient NPK sources at present. Moreover, heavy Nitrogen fertilization is commonly practiced to attain high yields by medium to big sugarcane farms. Urea application usually reaches 7 to 9 bags (350 to 450 kg) per hectare.

Low N recovery of the crop or the low effectivity of Urea fertilizers because of Nitrogen losses due to volatilization and leaching had been noted especially in sandy soils. However, recent studies have shown the potential of Nitrogen fertilizer enhancers such as controlled release products, urease nitrification inhibitors and coatings for N fertilizers in reducing Nitrogen losses and the possible improvement of plant yields (Chen, 2008).

Currently, Agrisolutions Philippines, Inc. recommends the use of an organic, non-toxic fertilizer supplement that would increase the effectivity of Urea fertilizer when applied to plants. The expected increased effectivity is due to the enhanced absorption of the N-fertilizer. A trial conducted last November 2016 (Villariez and Untal. 2017) showed that addition of Neb-26 at 1200 to 1400ml/ha to 100% Urea resulted to a significant increase in stalk length, size and average weight which resulted to numerical increase in TC/Ha and LKg/Ha. It also proved that Neb could be added at higher rates of 1200 to 1400ml/ha to only 60% Urea (138kg N/ha), in order to attain comparable yield with the Farmer's practice of applying 230kgN/ha.

Thus, this trial was conducted to determine the most effective rate and the number of applications of NEB fertilizer additive in increasing tonnage and sugar yield when added to the normal farmer practice fertilizer levels.

ABSTRACT

A trial was conducted to measure the effect of NEB applied with the normal quantity of fertilizer, applied with either one or two applications of NEB.

Results showed that except for the Unfertilized Control which exhibited the lowest growth and yield parameters, all fertilized plots were statistically similar in germination, tillering and stalk population from 1.5 until 7.0 MAP regardless of NEB treatments. NEB-treatments at higher rates showed longer stalks over 100% NPK alone from 4.0 until 7.0 MAP; but the advantages in height were statistically insignificant. Stalk size were generally similar among fertilized plots at 5.0 to 7.0 MAP. All treatments showed similar root length at 4.0 and 5.0 MAP. However, NEB-treated plots showed significantly heavier root weight over the Unfertilized Control and have generally numerically heavier roots over the 100% NPK treatment.

At harvest, significant effects on stalk parameters were noted. The highest rate of NEB at 1,750 ml/ha applied twice with 100% NPK was significantly longer and heavier compared to 100% NPK alone. This resulted to its significantly higher tonnage and sugar yield over this Control and over NEB treatments applied once with 625 ml/ha, 750 ml/ha and 875 ml/ha added to 100% NPK.

Moreover, the 1,500 ml NEB /ha applied twice also showed significantly longer, bigger and heavier stalks over the 100% NPK alone. Although, its tonnage was statistically similar with the latter, it was significantly higher over it in LKg/Ha. On the other hand, 1,000ml NEB/ha applied once also showed significantly higher LKg/Ha over 100% NPK alone but its average weight and TC/Ha were only comparable with it.

Based on these results, applying NEB twice at a rate of 1,500 to 1,750 ml/ha in addition to 100% NPK could be recommended to attain significantly higher tonnage and sugar yield over the conventional NPK fertilization alone.

MATERIALS and METHODS

A. Location, soil type and weather pattern

The trial was planted last March 3, 2018 at Hda. Luisita, Cadiz City, Negros Occidental. The test area has clay loam soil type and falls under the Type A weather, which is characterized as wet or rainy throughout the year with at most 1.5 months dry period under normal condition. It was harvested last February 8-9, 2019.

B. Cultural Management

The trial field which had not used NEB before was thoroughly prepared with 2 plowings and 2 harrowings before furrowing. Soil sampling of the field was done during land preparation. Fertilization was applied based on rates and timings recommended by the proponent as shown in Table 1. Herbicide spraying was done at 7 DAP. Maintenance operations including hand weeding and cultivation were implemented as scheduled. Irrigation was done twice – after planting and when the canes were at 2.5 months old.

C. Experimental Design and Lay-out

The trial was laid down in a Randomized Complete Block Design (RCBD) replicated four times. Two-eye cane points of VMC 84-524 were planted at a rate of 4.5 seed pieces per linear meter in 10 rows x 10 meter plots with a furrow spacing of 1.2 meter. The following treatments were considered:

Field Lay-out:

IV	T3	T2	T1
	T8	T4	T7
	T9	T6	T5
III	T7	T8	T2
	T4	T1	T3
	T5	T9	T6
II	T7	T1	T4
	T3	T5	T9
	T6	T8	T2
I	T9	T4	T7
	T5	T2	T8
	T1	T6	T3
	ROAD		

Treatment	Reference
T1	No Fertilizer Control
T2	100% Fertilizer Control
T3	2 Apps NEB (1,250ml/Ha total) + 100% Fertilizer
T4	2 Apps NEB (1,500ml/Ha total) + 100% Fertilizer
T5	2 Apps NEB (1,750ml/Ha total) + 100% Fertilizer
T6	1 App NEB (625ml/Ha total) + 100% Fertilizer
T7	1 App NEB (750ml/Ha total) + 100% Fertilizer
T8	1 App NEB (825ml/Ha total) + 100% Fertilizer
T9	1 App NEB (1,000ml/Ha total) + 100% Fertilizer

Rates and timing of application of NPK and Neb per treatment

Schedule of Application					
Treatments		**Fertilizer #1 Basal**	**Fertilizer App #2 (30-45 DAP)**	**Fertilizer App #3 (90 DAP)**	**TOTAL NEB**
T1	NO FERTILIZER CONTROL	No Fertilizer **NO NEB**	No Fertilizer **NO NEB**	No Fertilizer **NO NEB**	--------
T2	100% FERTILIZER CONTROL	50 kg urea 150 kg DAP **NO NEB**	200 kg urea/HA **NO NEB**	200 kg urea/HA 150 kg MOP/HA **NO NEB**	--------
T3	**2 Apps NEB 1,250 ml/HA total** 100% fertilizer	50 kg urea 150 kg DAP **NO NEB**	200 kg urea/HA **625 ml NEB/HA**	200 kg urea/HA 150 kg MOP/HA **625 ml NEB/HA**	**1,250 ml NEB/HA**
T4	**2 Apps NEB 1,500 ml/HA total** 100% fertilizer	50 kg urea 150 kg DAP **NO NEB**	200 kg urea/HA **750 ml NEB/HA**	200 kg urea/HA 150 kg MOP/HA **750 ml NEB/HA**	**1,500 ml NEB/HA**
T5	**2 Apps NEB 1,750 ml/HA total** 100% fertilizer	50 kg urea 150 kg DAP **NO NEB**	200 kg urea/HA **875 ml NEB/HA**	200 kg urea/HA 150 kg MOP/HA **875 ml NEB/HA**	**1,750 ml NEB/HA**
T6	**1 App NEB 625 ml/HA total** 100% fertilizer	50 kg urea 150 kg DAP **NO NEB**	200 kg urea/HA **625 ml NEB/HA**	200 kg urea/HA 150 kg MOP/HA **NO NEB**	**625 ml NEB/HA**
T7	**1 App NEB 750 ml/HA total** 100% fertilizer	50 kg urea 150 kg DAP **NO NEB**	200 kg urea/HA **750 ml NEB/HA**	200 kg urea/HA 150 kg MOP/HA **NO NEB**	**750 NEB/HA**
T8	**1 App NEB 875 ml/HA total** 100% fertilizer	50 kg urea 150 kg DAP **NO NEB**	200 kg urea/HA **875 ml NEB/HA**	200 kg urea/HA 150 kg MOP/HA **NO NEB**	**875 ml NEB/HA**
T9	**1 App NEB 1,000 ml/HA total** 100% fertilizer	50 kg urea 150 kg DAP **NO NEB**	200 kg urea/HA **1,000 ml NEB/HA**	200 kg urea/HA 150 kg MOP/HA **NO NEB**	**1,000 ml NEB/HA**

a. Method of Fertilizer Application

Blending instructions provided by the proponent were strictly followed by the researchers. Required amount of NEB was measured accurately from a well shaken bottle by using a pipette. This was added to the Urea in a plastic bag with the required amount per treatment. The bag was shaken well and after the Urea was evenly colored, the required quantity per plot was measured.

Fertilization was applied three times. First dose was given as basal during planting, 2nd dose was done at 45 DAP (days after planting) and 3rd dose was applied at 90 DAP. The total fertilization per hectare for the Control (T2) which was considered the Farmer's practice was 450 kg 46-0-0, 150 kg 18-46-0 and 150 kg 0-0-60. Treatments from T3 to T5 were given the full NPK rate plus 1,250ml, 1,500ml and 1,750ml NEB/ha respectively applied twice at 45 and 90 DAP. On the other hand, Treatments 6 to 9 were given full NPK plus 625, 750, 825 and 1,000 ml/ha respectively applied only once at 45 DAP.

The amount of fertilizer materials and rates of NPK per application time is shown below:

Application	Urea	N	P	K
Fertilizer #1 (**Basal**)	50 kg urea 150 kg DAP	50 kg N	69 kg P	-----
Fertilizer #2 (**45 DAP**)	200 kg urea	92 kg N	-----	-----
Fertilizer #3 (**90 DAP**)	200 kg urea 150 kg MOP	92 kg N	-----	90 kg K
TOTAL		**234 N**	**69 kg P**	**90 kg K**

Gathered Data

a. Weather Data

Insufficient rainfall was noted during the germination and early tillering stage which fall within the months of March and May 2018 (Figure 1). Thus, irrigation was given twice – after planting and at 2.5 MAP, to sustain normal growth and tillering of the crop. Nevertheless, total precipitation from March 2018 to February 2019 reached **2451** mm.

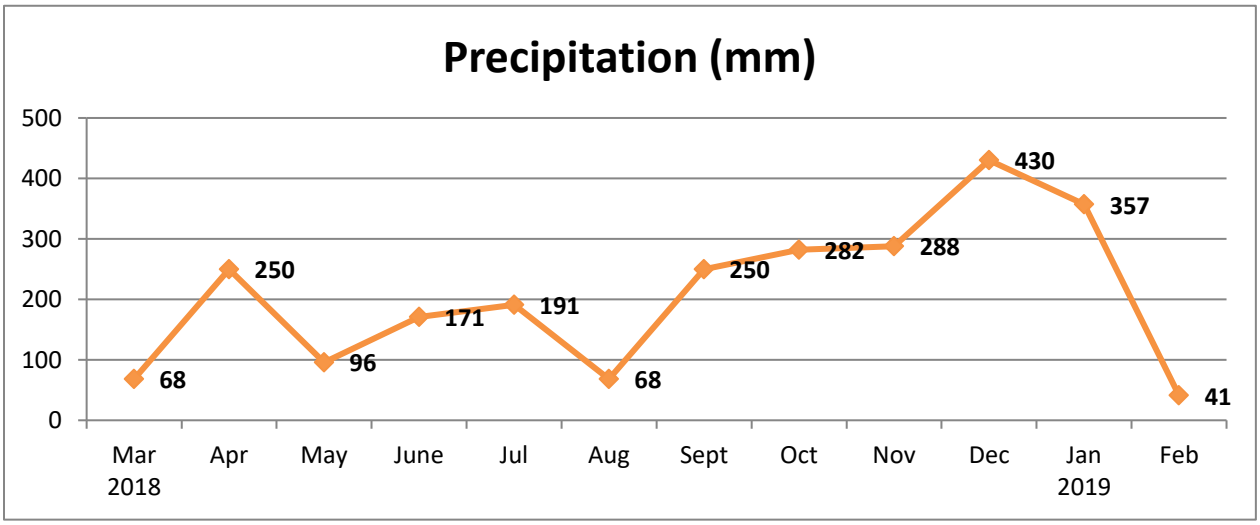

Figure 1. Monthly rainfall from March 2018 to February 2019.

b. Sugarcane growth and yield data

Gathered data included the germination count for sugarcane at 30 and 45 DAP (Days After Planting), tiller number at 3.0, 4.0 and 5.0 MAP (Months After Planting) and stalk count at 7.0 MAP. Plant height was taken at 4.0, 5.0 and 7.0 MAP, while root samples were taken at 4.0 and 5.0 MAP to get the root length and weight.

Harvesting was done at 11.0 months and data taken included the stalk population per m^2, and the stalk parameters at harvest including size, length and average weight which were taken from the 10 representative stalk samples. The representative samples were then brought to the laboratory for LKg/TC analysis. Cane weight from the inner 6 center rows of each plot were also taken for the computation of tonnage (TC/Ha). Sugar yield per hectare (LKg/Ha) was computed from TC/Ha x LKg/TC.

ANOVA was computed following the RCBD design and treatment means were compared using DMRT at 5% level of significance.

RESULTS and DISCUSSION

1. Sugarcane germination, tillering and stalk population until 7.0 MAP

Significantly lower counts on sugarcane germination at 45 DAP, tillering at 3.0 to 5.0 MAP and stalk population at 7.0 MAP were observed under the Unfertilized Control (Treatment 1). This control treatment was significantly lower compared to all fertilized plots which were all statistically similar at all observation times regardless of NEB treatments (Table 1 and Figure 2).

Table 1. Germination at 30 and 45 DAP, tiller counts at 3.0 to 5.0 MAP, and stalk count at 7.0 MAP*

Treatments	Germination Counts				Tiller counts						Stalk Count	
	1.0MAP		1.5MAP		3.0 MAP		4.0 MAP		5.0 MAP		7.0 MAP	
T1- No Fertilizer Control	225	a	326	b	555	b	479	b	367	b	454	b
T2- 100% Fertilizer Control	234	a	381	ab	647	a	609	a	507	a	521	a
T3- 2 Apps NEB (1,250ml/Ha)	243	a	387	ab	637	ab	617	a	517	a	525	a
T4- 2 Apps NEB (1,500ml/Ha)	245	a	382	ab	666	a	607	a	529	a	529	a
T5- 2 Apps NEB (1,750ml/Ha)	237	a	381	ab	655	a	609	a	531	a	524	a
T6- 1 App NEB (625ml/Ha)	237	a	384	ab	668	a	614	a	529	a	509	a
T7- 1 App NEB (750ml/Ha)	249	a	392	ab	648	a	605	a	508	a	524	a
T8- 1 App NEB (875ml/Ha)	228	a	390	ab	668	a	607	a	518	a	514	a
T9- 1 App NEB (1,000ml/Ha)	243	a	413	a	647	a	616	a	523	a	516	a
%CV	*12.13*		*10.95*		*8.83*		*7.70*		*7.49*		*5.55*	
F-test	*ns*		*s*		*s*		*s*		*s*		*s*	

***from inner 6rows x 10 meter per plot**

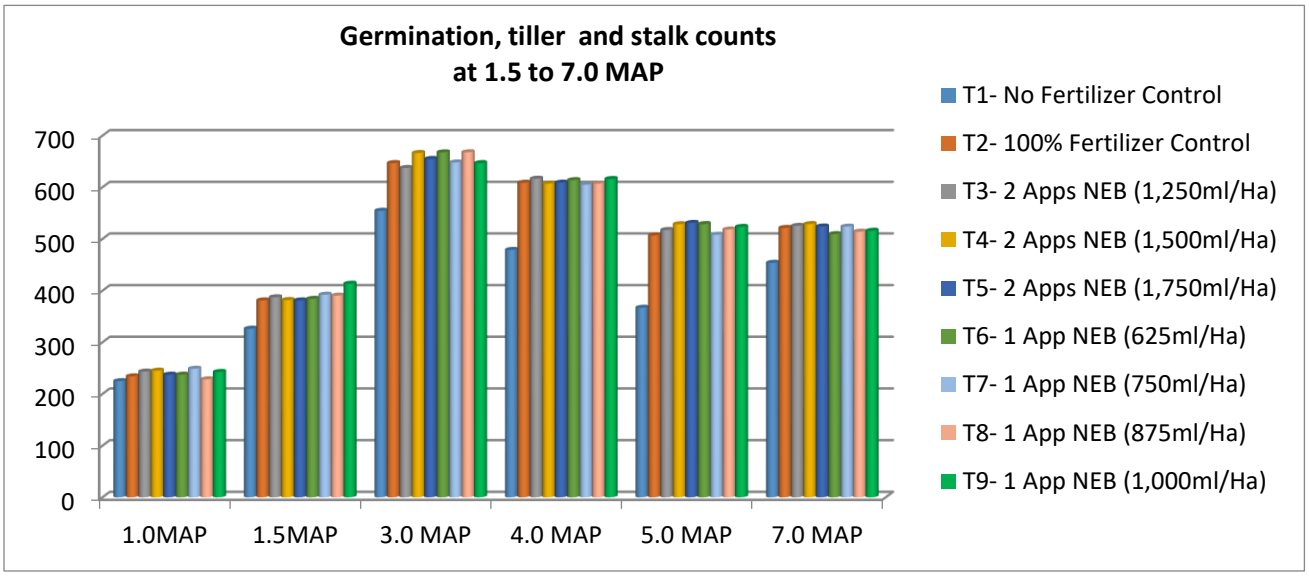

Fig. 2. Germination at 45 DAP, tiller counts at 3.0 and 4.5 MAP, and stalk count at 7.0 MAP

2. **Plant height at 4.0 to 7.0 MAP and stalk size at 5.0 and 7.0 MAP**

The Unfertilized Control showed the shortest height starting from 4.0 until 7.0 MAP. Likewise, Treatment 2 (100% NPK only) generally showed shorter height compared to NEB-treated plots with higher rates of application at all observation times. However, the advantage in height of these NEB-treated plots over Treatment 2 was not significant when statistically compared. In terms of stalk size, except for the Unfertilized Control which showed the smallest stalks, all fertilized plots were generally comparable at 5.0 and 7.0 MAP. Nevertheless, Treatment 9 (100% NPK + 1 App NEB (1,000ml/Ha) showed significantly bigger stalks than the 100% NPK alone treatment at 7.0 MAP (Table 2 and Figure 3).

Table 2. Plant height at 4.0, 5.0 and 7.0 MAP and stalk size at 5.0 and 7.0 MAP

Plant height at 4.0 to 7.0 MAP							**Stalk size at 5.0 and 7.0 MAP**			
Treatments	4.0 MAP		5.0 MAP		7.0 MAP		5.0 MAP		7.0 MAP	
T1- No Fertilizer Control	**83**	b	**147**	b	**202**	b	**2.70**	b	**2.97**	c
T2- 100% Fertilizer Control	**89**	ab	**158**	a	**225**	a	**3.06**	a	**3.06**	b
T3- 2 Apps NEB (1,250ml/Ha)	**99**	a	**167**	a	**232**	a	**3.06**	a	**3.09**	ab
T4- 2 Apps NEB (1,500ml/Ha)	**95**	ab	**165**	a	**230**	a	**3.08**	a	**3.13**	ab
T5- 2 Apps NEB (1,750ml/Ha)	**98**	ab	**167**	a	**236**	a	**2.94**	a	**3.11**	ab
T6- 1 App NEB (625ml/Ha)	**94**	ab	**166**	a	**227**	a	**3.00**	a	**3.09**	ab
T7- 1 App NEB (750ml/Ha)	**90**	ab	**161**	a	**226**	a	**2.95**	a	**3.10**	ab
T8- 1 App NEB (875ml/Ha)	**99**	a	**161**	a	**227**	a	**3.02**	a	**3.08**	ab
T9- 1 App NEB (1,000ml/Ha)	**102**	a	**167**	a	**231**	a	**3.10**	a	**3.14**	a
%CV	*10.24*		*3.56*		*3.63*		*3.65*		*1.49*	
F-test	*s*		*s*		*S*		*S*		*s*	

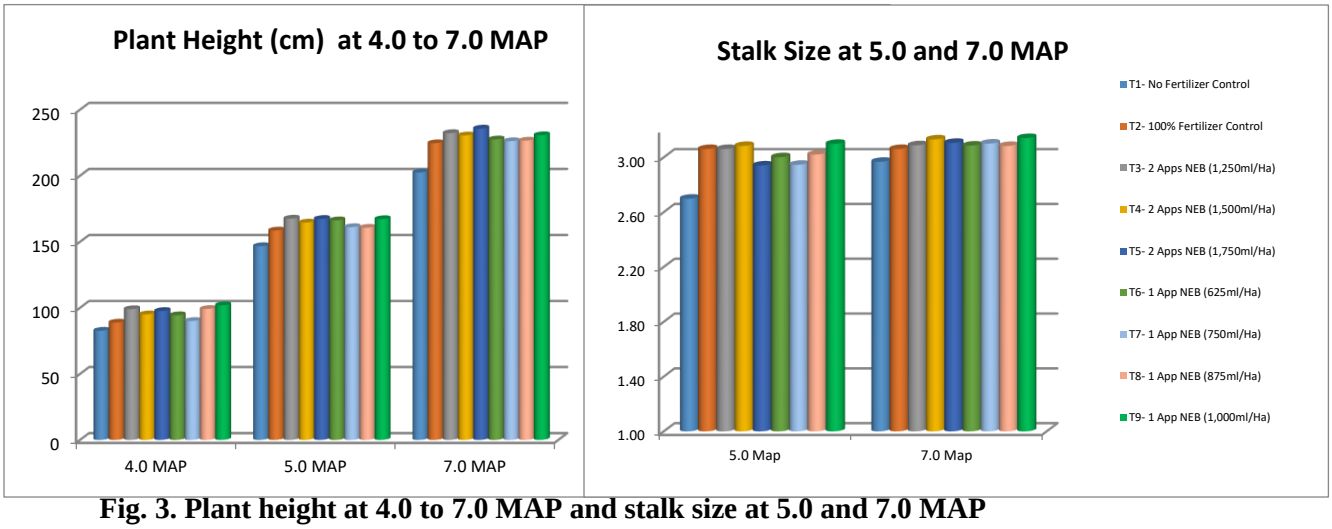

Fig. 3. Plant height at 4.0 to 7.0 MAP and stalk size at 5.0 and 7.0 MAP

3. **Root length and weight at 4.0 and 5.0 MAP**

No significant difference in root length was noted among all treatments at 4.0 and 5.0 MAP. However, root weight was significantly better in NEB-treated plots over the Unfertilized Control (Treatment 1) at both observation times. When compared to 100% NPK alone (Treatment 2), all NEB-treated plots were generally numerically higher in root weight over it both at 4.0 and 5.0 MAP. Moreover, Treatment 9 (100% NPK + 1 App NEB (1,000ml/Ha) showed significantly heavier root weight over 100% NPK alone and some of the NEB treatments at 5.0 MAP (Table 3 and Figure 4).

Table 3. Root length and weight at 4.0 and 5.0 MAP

Treatments	Root length (cm)		Root weight (g)	
	4.0 MAP	5.0 MAP	4.0 MAP	5.0 MAP
T1- No Fertilizer Control	**25.2** a	**41.7** a	**195.5** b	**300.8** c
T2- 100% Fertilizer Control	**24.3** a	**38.7** a	**330.4** a	**348.1** bc
T3- 2 Apps NEB (1,250ml/Ha)	**22.6** a	**42.0** a	**337.8** a	**390.4** bc
T4- 2 Apps NEB (1,500ml/Ha)	**23.6** a	**38.0** a	**341.8** a	**376.0** bc
T5- 2 Apps NEB (1,750ml/Ha)	**23.1** a	**38.0** a	**355.0** a	**461.7** ab
T6- 1 App NEB (625ml/Ha)	**23.2** a	**41.0** a	**338.5** a	**403.2** bc
T7- 1 App NEB (750ml/Ha)	**24.4** a	**38.7** a	**349.6** a	**437.5** ab
T8- 1 App NEB (875ml/Ha)	**26.4** a	**42.3** a	**346.2** a	**405.0** bc
T9- 1 App NEB (1,000ml/Ha)	**24.9** a	**41.7** a	**384.9** a	**527.7** a
%CV	*10.84*	*13.13*	*18.69*	*15.49*
F-test	*ns*	*ns*	*s*	*s*

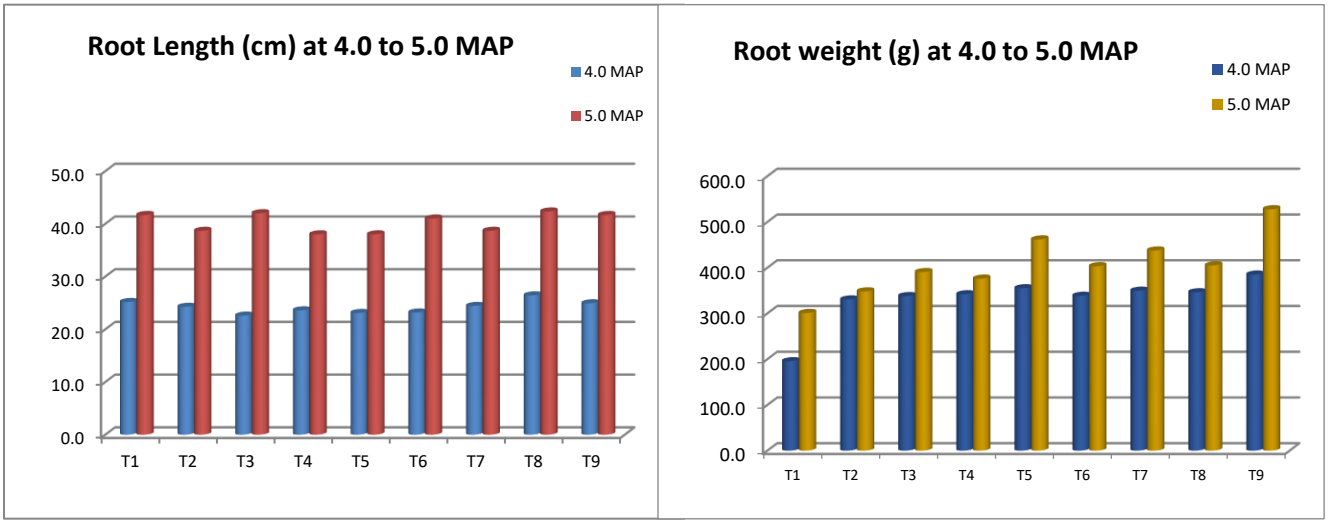

Fig 4. Root length and weight at 4.0 and 5.0 MAP

4. Stalk parameters at harvest

At harvest, the Unfertilized Control significantly showed the smallest, shortest, lightest stalks and the least number of stalk population. On the other hand, all NEB-treated plots were either numerically or statistically better in stalk length, size and average weight compared to 100% NPK alone (Treatment 2). Remarkably, higher rates of Neb at 1,500ml/ha and 1,750 ml/ha applied twice with 100% NPK (Treatments 4 and 5 respectively) were significantly longer and bigger, resulting to having significantly heavier stalks compared to 100% NPK alone (Treatment 2). Other NEB treatments with longer stalks than the 100% NPK alone were Treatment 3 (100% NPK with 1,250ml/ha applied twice) and Treatment 9 (100% NPK with 1,000ml/ha applied once). The latter two treatments however, were statistically similar in size and weight with the100% NPK alone. Stalk population at harvest were numerically higher in NEB treatments with 1,250, 1,500 and 1,750 ml/ha applied twice; but these were statistically similar with the rest of the fertilized treatments (Table 4 and Figure 5).

Table 4. Stalk length, size, average weight and stalk number per m^2 at harvest.

Sugarcane stalk size, length, average weight and stalk/meter at harvest				
Treatments	Length	Size	Ave. weight	Stalk/meter
T1- No Fertilizer Control	**237.8** d	**2.78** c	**1.53** c	**4.7** b
T2- 100% Fertilizer Control	**261.6** c	**2.99** ab	**1.93** b	**6.6** a
T3- 2 Apps NEB (1,250ml/Ha)	**281.2** ab	**3.02** ab	**2.14** ab	**7.0** a
T4- 2 Apps NEB (1,500ml/Ha)	**281.0** ab	**3.11** a	**2.17** a	**7.1** a
T5- 2 Apps NEB (1,750ml/Ha)	**294.5** a	**3.06** ab	**2.23** a	**7.1** a
T6- 1 App NEB (625ml/Ha)	**271.9** bc	**2.98** ab	**2.01** ab	**6.5** a
T7- 1 App NEB (750ml/Ha)	**273.3** bc	**3.00** ab	**2.02** ab	**6.9** a
T8- 1 App NEB (875ml/Ha)	**275.9** abc	**3.03** ab	**2.00** ab	**6.7** a
T9- 1 App NEB (1,000ml/Ha)	**283.2** ab	**3.00** ab	**2.09** ab	**6.8** a
%CV	*4.30*	*2.47*	*6.95*	*12.10*
F-test	*s*	*s*	*s*	*s*

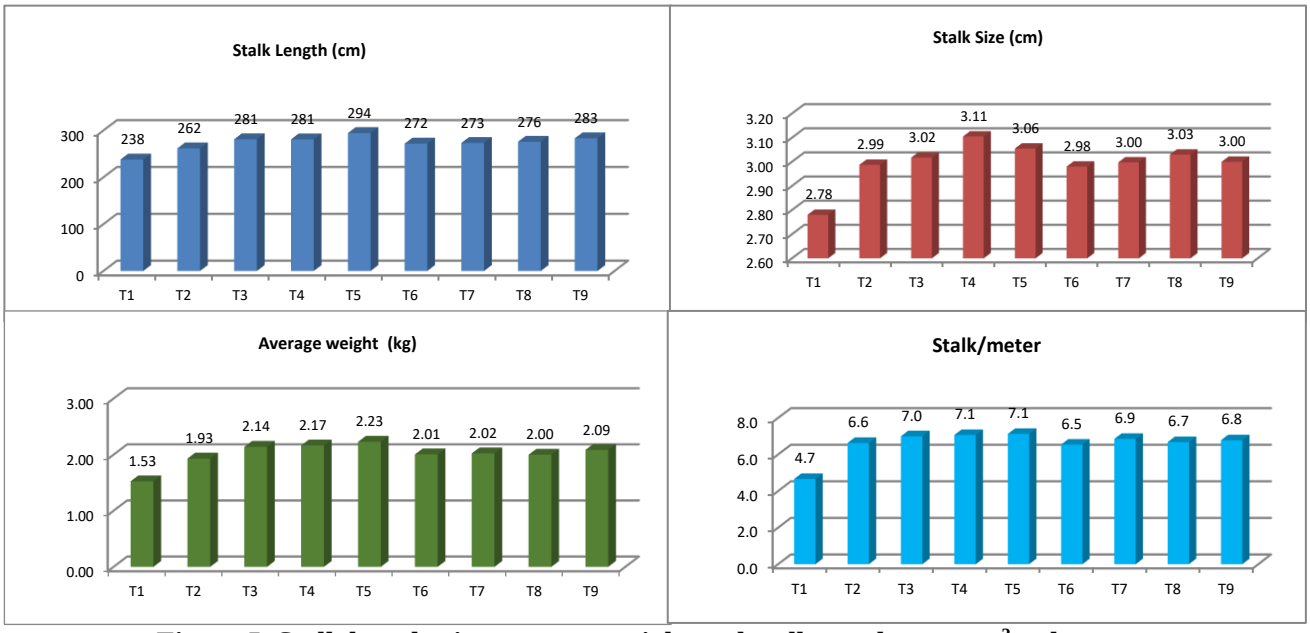

Figure 5. Stalk length, size, average weight and stalk number per m^2 at harvest.

5. Yield parameters and sugar yield

Significant differences in yield parameters were also noted among treatments. Treatment 5 with 100% NPK added with the highest rate of 1,750 ml NEB/ha applied twice showed the advantage of longer and heavier weight per stalk which resulted to significantly higher tonnage or TC/Ha over the 100% NPK alone (Treatment 2). Sweetness or LKg/TC was similar among fertilized treatments; hence, Treatment 5 eventually showed the highest sugar yield or LKg/Ha. It was significantly higher in LKg/Ha over the two Control treatments and over the NEB treatments applied once with 625 ml/ha, 750 ml/ha and 875 ml/ha added to 100% NPK.

On the other hand, Treatment 4 with 100% NPK + 1,500 ml NEB/ha applied twice also showed significantly longer, bigger and heavier stalks over the 100% NPK alone. Although, its tonnage was statistically similar with the latter, it was significantly higher over the 100% NPK alone in LKg/Ha. Additionally, Treatment 9 (100% NPK with 1,000ml NEB/ha applied once) had shown numerically higher TC/Ha and LKg/TC over Treatment 2 (100% NPK alone) which resulted to significantly higher LKg/Ha over the latter.

The rest of the NEB-treated plots showed slightly better tonnage over the 100% NPK alone treatment. These also showed numerically higher sugar yield over this Control but the increases were not statistically significant (Table 5 and Figure 6).

Table 5. Cane yield (TC/Ha), sweetness (LKg/TC) and sugar yield (LKg/Ha) at harvest.

Treatments	TC/HA	LKg/TC	LKg/Ha
T1- No Fertilizer Control	**62** c	**1.77** b	**110** d
T2- 100% Fertilizer Control	**93** b	**2.08** a	**192** c
T3- 2 Apps NEB (1,250ml/Ha)	**102** ab	**2.17** a	**222** abc
T4- 2 Apps NEB (1,500ml/Ha)	**109** ab	**2.18** a	**237** ab
T5- 2 Apps NEB (1,750ml/Ha)	**111** a	**2.29** a	**254** a
T6- 1 App NEB (625ml/Ha)	**95** ab	**2.10** a	**199** bc
T7- 1 App NEB (750ml/Ha)	**99** ab	**2.10** a	**207** bc
T8- 1 App NEB (875ml/Ha)	**100** ab	**2.13** a	**213** bc
T9- 1 App NEB (1,000ml/Ha)	**107** ab	**2.21** a	**236** ab
%CV	*10.52*	*7.53*	*11.84*
F-test	*s*	*s*	*s*

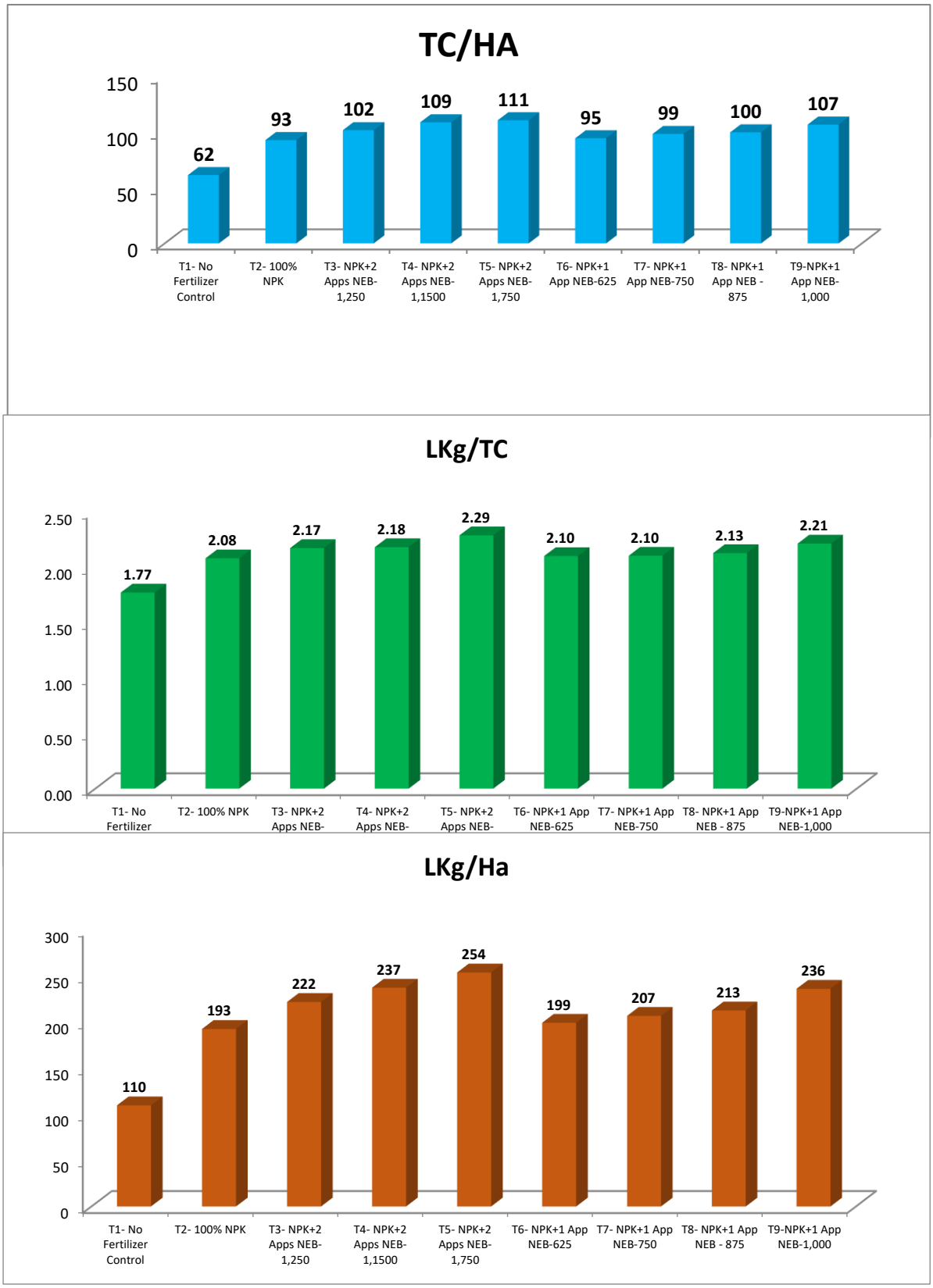

Figure 6. TC/Ha, LKg/TC and LKg/Ha at harvest.

SUMMARY and RECOMMENDATIONS

A trial was conducted to measure the effect of NEB applied with the normal quantity of fertilizer, applied with either one or two applications of NEB. The trial was conducted from March 3, 2018 to February 9, 2019 at Hda. Luisita, Cadiz City, Negros Occidental.

Results showed that the Unfertilized Control significantly exhibited the lowest population, the shortest, smallest and lightest stalks at all observation times and the lowest cane and sugar yield at harvest. On the other hand, all fertilized plots were statistically similar in germination, tillering and stalk population from 1.5 until 7.0 MAP regardless of NEB treatments. It was noted that plots applied with higher rates of NEB showed numerically longer stalks over 100% NPK alone from 4.0 MAP until 7.0 MAP. This advantage in height, however, was not significant when statistically compared. Likewise, stalk size was generally comparable among fertilized treatments at 5.0 and 7.0 MAP.

Root length at 4.0 and 5.0 MAP was generally similar among all treatments; but root weight was significantly better in NEB-treated plots over the Unfertilized Control at both observation times. Roots of NEB-treated plots were also generally numerically heavier over that of the 100% NPK alone treatment.

At harvest (11.0 MAP), significant effects on stalk parameters were noted. The highest rate of NEB at 1,750 ml/ha applied twice with 100% NPK was significantly longer and heavier compared to 100% NPK alone. This resulted to significantly higher tonnage or TC/Ha over the latter. Since sweetness was similar among fertilized treatments, the 1,750ml NEB/ha treatment eventually showed the highest sugar yield or LKg/Ha. It was significantly higher in LKg/Ha over the two Control treatments and over the NEB treatments applied once with 625 ml/ha, 750 ml/ha and 875 ml/ha added to 100% NPK.

Moreover, NEB at 1,500 ml/ha applied twice also showed significantly longer, bigger and heavier stalks over the 100% NPK alone. Although, its tonnage was statistically similar with the latter, it was significantly higher over it in LKg/Ha. On the other hand, 1,000ml NEB/ha applied once also showed significantly higher LKg/Ha over 100% NPK alone but its average weight and TC/Ha were only comparable with it. The rest of the NEB-treated plots showed slightly better tonnage over the 100% NPK alone treatment. These also showed numerically higher sugar yield over this Control but the increases were statistically insignificant

Thus, from these results, it could be recommended that NEB at 1,500 to 1,750 ml/ha in addition to 100% NPK should be applied twice to attain significantly higher tonnage and sugar yield at harvest over the conventional NPK fertilization alone.

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Documentation of activities during the conduct of NEB Fertilization Trial 2.

Figure 1. Lay-outing and marking of plots for the treatments (a), basal fertilization (b), seedpiece distribution (c) and planting (d).

Figure 2. Measurement of Urea fertilizer (a) and preparation for mixing of Neb (b) before the 1st dose application.

Figure 3. First dose application of Urea with varied levels of Neb (a and b). Supervision of fertilizer application (c) and the researchers present during the application (d).

Figure 4. Taking of representative stalk samples for juice analysis (a) and weighing of experimental canes per plot (b).

Comparative Stand at 1.5 MAP

T1- No Fertilizer Control

T2- 100% Fertilizer Control

T3- 2 Apps NEB (1,250ml/Ha)

T4- 2 Apps NEB (1,500ml/Ha)

T5- 2 Apps NEB (1,750ml/Ha)

T6- 1 App NEB (625ml/Ha)

T7- 1 App NEB (750ml/Ha)

T8- 1 App NEB (875ml/Ha)

T9- 1 App NEB (1,000ml/Ha)

Comparative Stand at 3.0 MAP

T1- No Fertilizer Control

T2- 100% Fertilizer Control

T3- 2 Apps NEB (1,250ml/Ha)

T4- 2 Apps NEB (1,500ml/Ha)

T5- 2 Apps NEB (1,750ml/Ha)

Comparative Stand at 3.0 MAP

T6- 1 App NEB (625ml/Ha)

T7- 1 App NEB (750ml/Ha)

T8- 1 App NEB (875ml/Ha)

T9- 1 App NEB (1,000ml/Ha)

Comparative Stand at 4.0 MAP

T1- No Fertilizer Control

T2- 100% Fertilizer Control

T3- 2 Apps NEB (1,250ml/Ha)

T4- 2 Apps NEB (1,500ml/Ha)

T5- 2 Apps NEB (1,750ml/Ha)

T6- 1 App NEB (625ml/Ha)

T7- 1 App NEB (750ml/Ha)

T8- 1 App NEB (875ml/Ha)

T9- 1 App NEB (1,000ml/Ha)

Comparison of Plant Height and Root Mass at 5.0 MAP

T1 versus T2 versus T3

T1 versus T2 versus T4

T1 versus T2 versus T5

T1 versus T2 versus T6

T1 versus T2 versus T7

T1 versus T2 versus T8

T1 versus T2 versus T9

Comparison of Harvested Plots at 11.0 MAP

T1- No Fertilizer Control

T2- 100% Fertilizer Control

T3- 2 Apps NEB (1,250ml/Ha)

T4- 2 Apps NEB (1,500ml/Ha)

T5- 2 Apps NEB (1,750ml/Ha)

T6- 1 App NEB (625ml/Ha)

T7- 1 App NEB (750ml/Ha)

T8- 1 App NEB (875ml/Ha)

T9- 1 App NEB (1,000ml/Ha)

Comparison of Juice Samples at Harvest


T1R2
T6R2


T1R2
T7R2


T1R2
T8R2


T1R2
T9R2

RESULT OF ALTERNATE

NEB LIQUID FORMULA STUDY

Aroman, Carmen, Cotabato (Study 106)

REGION XII

Aroman, Carmen, Cotabato
(Study # 106)

Variety used: USM var 10

Distance of planting: 75 x 25 cm

Population density: 53,333/ha.

Comments from Agmor (manufacturer of NEB-26)

Central Mindanao Integrated Agricultural Research Center (CMIARC) conducted a research study to evaluate the efficacy of NEB-26 on corn in October 2012. This study was referred to by Agmor as CORN #106. The final report by the researcher included all the data and tables, but no narrative was included. The information on this page is provided to clarify the final report from CMIARC.

The objective of this study was to (1) measure the yield increase when NEB is coated onto urea, and (2) measure the yield to determine the efficacy of Agmor's seed treatment formulation (a secondary NEB product applied directly to the seed).

Two studies were conducted:

1. CORN #106 was conducted on open pollinated variety to determine the impact on a lower yielding variety.
2. CORN #107 was conducted on a recommended hybrid variety to determine the impact on a higher yielding variety.

The NEB seed treatment formulation had a positive impact on yield, however Agmor is focusing on NEB applied on urea only as a simple method that allows scale. For this reason, the treatments to consider when reviewing this study are as follows:

T1, the untreated control (normal rate of fertilizer without NEB) compared to
T6, NEB coated onto urea (without the seed treatment NEB formulation)
Both treatments include the normal rate of fertilizer, the only difference was the NEB
These relevant treatments are highlighted in green below:

Treatment Summary

	Seed treatment	Fertilizer App #1 (at planting)	Fertilizer App #2 (15-20 DAP)	Fertilizer App #3 (25-30 DAP)
T1	CONTROL (No Seed Treatment)	-----	-----	-----
T2	No Seed Treatment		500 ml NEB-1XT	500 ml NEB-1XT
T3	No Seed Treatment	-----	500 ml NEB- FF2-1XT	500 ml NEB- FF2-1XT
T4	NEB-108LST-8 seed treatment	-----	500 ml NEB-1XT	500 ml NEB-1XT
T5	NEB-108LST-8 seed treatment	-----	500 ml NEB- FF2-1XT	500 ml NEB- FF2-1XT
T6	No Seed Treatment	375 ml NEB-FF2-1XT	375 ml NEB-FF2-1XT	375 ml NEB-FF2-1XT
T7	NEB-108LST-8 seed treatment	375 ml NEB-1XT	375 ml NEB-1XT	375 ml NEB-1XT
T8	NEB-108LST-8 seed treatment	375 ml NEB-FF2-1XT	375 ml NEB-FF2-1XT	375 ml NEB-FF2-1XT

Grain Yield (t/ha)

Treatments	Replication				Total	Mean
	I	II	III	IV		
T1 (untreated control)	2.50	2.58	3.02	2.56	10.66	**2.67 tons/ha**
T6 (NEB on urea)	4.44	4.25	4.36	4.36	17.41	**4.35 tons/ha**

Comparing these relevant treatments, NEB increased corn grain production by 1.68 tons/ha

CORN # 106
LIQUID SEED TREATMENT
CEMIARC XII - AROMAN, CARMEN, COTABATO

No. of Plants

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	234	240	228	218	920	230
2	256	258	248	258	1020	255
3	242	238	245	235	960	240
4	250	238	240	252	980	245
5	256	248	254	242	1000	250
6	258	248	258	256	1020	255
7	287	282	293	294	1156	289
8	284	278	300	278	1140	285

No. of Ears

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	234	240	228	218	920	230
2	256	258	248	258	1020	255
3	242	238	245	235	960	240
4	250	238	240	252	980	245
5	256	248	254	242	1000	250
6	258	248	258	256	1020	255
7	287	282	293	294	1156	289
8	284	278	300	278	1140	285

Grain Yield (t/ha)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	2.5	2.58	3.02	2.56	10.66	**2.67**
2	2.96	3.2	3.25	3.24	12.65	3.16
3	3.7	3.24	3.6	3.85	14.39	3.60
4	3.24	3.41	3.15	3.5	13.3	3.33
5	3.33	3.18	4.1	3.52	14.13	3.53
6	4.44	4.25	4.36	4.36	17.41	**4.35**
7	4.07	3.89	4.12	3.65	15.73	3.93
8	4.88	5.7	4.73	4.59	19.9	4.98

Fresh weight of 10 ears (kg)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	630	628	647	635	2540	635
2	1020	1028	1025	1027	4100	1025
3	1124	1129	1126	1101	4480	1120
4	1215	1207	1220	1206	4848	1212
5	1300	1301	1304	1303	5208	1302
6	1456	1467	1460	1449	5832	1458
7	1500	1449	1525	1530	6004	1501
8	1432	1500	1418	1370	5720	1430

Grain Yield of 10 ears (kg)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	450	451	453	470	1824	456
2	829	820	830	801	3280	820
3	859	854	853	858	3424	856
4	793	790	803	794	3180	795
5	1000	1100	1000	912	4012	1003
6	1156	1200	1112	1100	4568	1142
7	1324	1302	1318	1256	5200	1300
8	1249	1134	1200	1257	4840	1210

Grain Moisture

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	30.2	24.8	23.9	19.3	98.2	24.55
2	24.6	28.3	19.7	21.6	94.2	23.55
3	23.4	29.3	28.8	23.6	105.1	26.28
4	25.4	21.8	26.8	23.7	97.7	24.43
5	29.2	24.3	26.5	23.8	103.8	25.95
6	23.3	28.1	20.3	20.8	92.5	23.13
7	28.4	24.7	24.4	26.3	103.8	25.95
8	22.2	22.9	25.6	26.1	96.8	24.20

Plant Height (cm)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	189	200	195	203	787	196.75
2	200	207	215	209	831	207.75
3	180	200	205	187	772	193.00
4	198	213	203	205	819	204.75
5	188	209	208	198	803	200.75
6	201	197	206	201	805	201.25
7	200	205	184	214	803	200.75
8	206	218	212	206	842	210.50

Ear Height (cm)

Treatments	Replication				Total	Mean
	1	II	III	IV		
1	92	95	100	99	386	97.00
2	95	92	105	98	390	98.00
3	94	96	103	88	381	95.00
4	97	105	105	101	408	102.00
5	102	101	113	100	416	104.00
6	98	95	99	95	387	97.00
7	101	100	100	108	409	102.00
8	99	104	105	102	409	102.00

Ear Diameter (cm)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	3.1	3	2.8	2.6	11.5	2.88
2	3.4	3.2	3	3	12.6	3.15
3	3	2.4	3.6	3.2	12.2	3.05
4	3	3.8	3.5	2.8	13.1	3.28
5	2.8	2.8	3.5	3.5	12.6	3.15
6	3.4	3.8	3	3	13.2	3.30
7	3.5	3.2	3	3.8	13.5	3.38
8	3.5	3	3.2	3.2	12.9	3.23

Ear Length (cm)

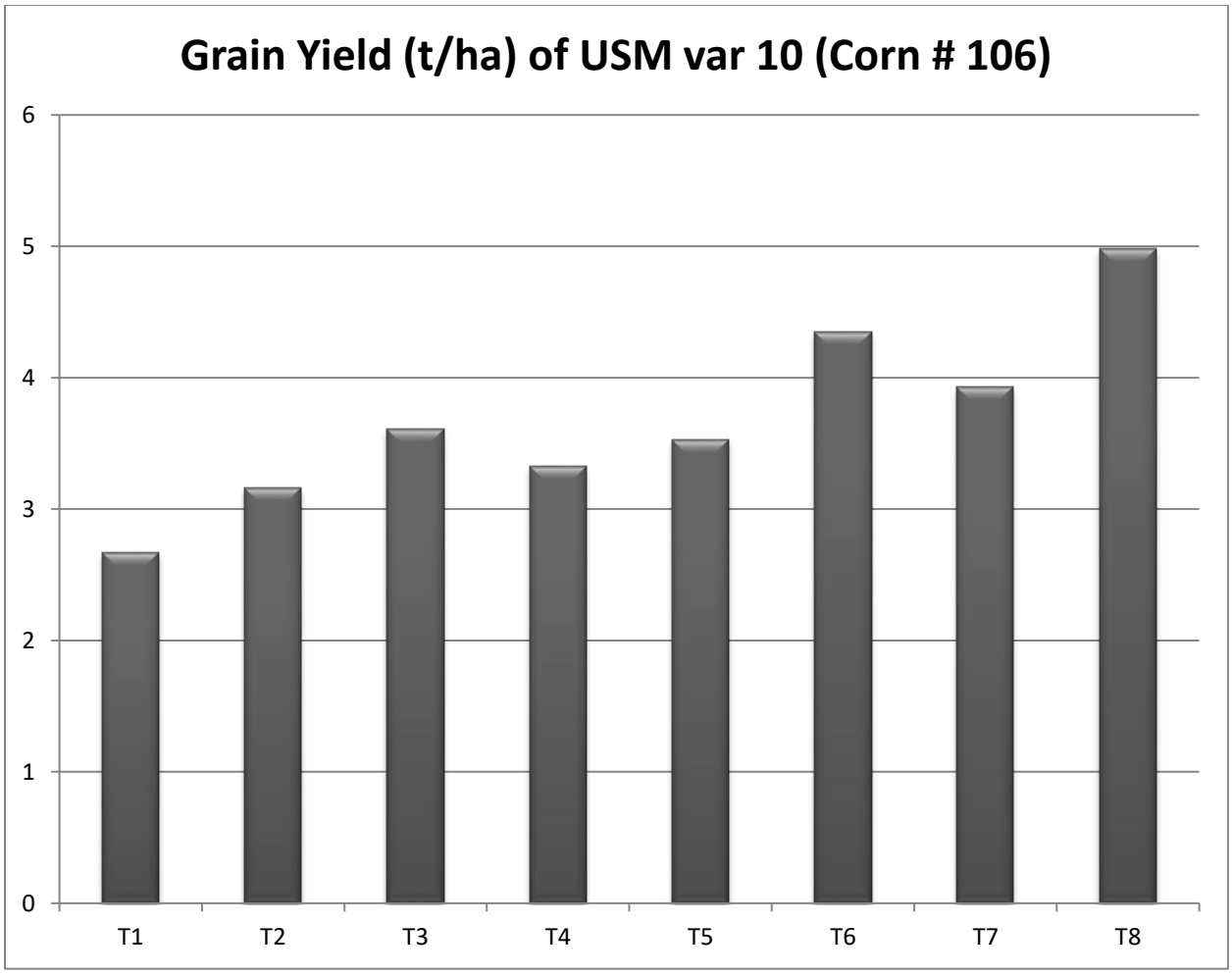
Treatments	Replication				Total	Mean
	I	II	III	IV		
1	9.5	12	10.6	9.8	41.9	10.48
2	11.5	13.5	12.5	9.6	47.1	11.78
3	10.3	10	11.8	7.9	40	10.00
4	10.6	12.1	11.9	10.1	44.7	11.18
5	11.7	11.7	11.5	10	44.9	11.23
6	11.2	11.7	12.9	9.5	45.3	11.33
7	11.3	12.3	12.1	10.6	46.3	11.58
8	11.2	13.1	10	10	44.3	11.08

Kernel Rows

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	12	12	12	12	48	12.00
2	12	12	12	12	48	12.00
3	14	14	14	14	56	14.00
4	14	14	14	14	56	14.00
5	14	14	14	14	56	14.00
6	14	14	14	14	56	14.00
7	12	12	12	12	48	12.00
8	14	14	14	14	56	14.00

Shelling Recovery (%)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	71.43	71.82	70.02	74.02	287.28	72
2	81.27	79.77	80.98	77.99	320.01	80
3	76.42	75.64	75.75	77.93	305.75	76
4	65.27	65.45	65.82	65.84	262.38	66
5	76.92	84.55	76.69	69.99	308.15	77
6	79.40	81.80	76.16	75.91	313.27	78
7	88.27	89.86	86.43	82.09	346.64	87
8	87.22	75.60	84.63	91.75	339.20	85


Grain Yield (t/ha) of USM var 10 (Corn # 106)
6
5
4
3
2
1
0
T1
T2
T3
T4
T5
T6
T7
T8

CV: 7.9%

Cost and Return Analysis of USM var 10 (Corn # 106) Aroman, Carmen, North Cotabato. 2012

Parameters	Treatments							
	T1	T2	T3	T4	T5	T6	T7	T8
Yield (t/ha)	**2.67**	**3.16**	**3.61**	**3.33**	**3.53**	**4.35**	**3.93**	**4.98**
Yield difference (t/ha)		0.49	0.94	0.66	0.86	1.68	1.26	2.31
Yield difference (%)		18.35	35.21	24.72	32.21	62.92	47.19	86.52
Fertilizer N (FN, kg N/ha)	111	111	111	111	111	111	111	111
Fertilizer P (FP, kg P_2O_5/ha)	42	42	42	42	42	42	42	42
Fertilizer K (FK, kg K_2O/ha)	42	42	42	42	42	42	42	42
NEB Liquid fertilizer applied (ml/ha)		1,000	1,000	1,000	1,000	1125	1125	1125
Cost of N from inorganic source (PhP/ha)	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Cost of P_2O_5 from inorganic source (PhP/ha)	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Cost of K_2O from inorganic source (PhP/ha)	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Cost of NEB Liquid fertilizer (PhP/ha)	0	1,500	1,500	1,500	1,500	1,125	1,125	1,125
Total Fertilizer cost (PhP/ha)	**4,500**	**7,000**	**7,000**	**7,000**	**7,000**	**6,375**	**6,375**	**6,375**
Plant spacing	25 x 75	25 x 75	25 x 75	25 x 75	25 x 75	25 x 75	25 x 75	25 x 75
Plant popn (plants/ha)	53,333	53,333	53,333	53,333	53,333	53,333	53,333	53,333
Seed cost (PhP/ha)	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Farmgate price of corn (Php/kg)	14.50	14.50	14.50	14.50	14.50	14.50	14.50	14.50
Gross benefit (Php/ha)	**38,715**	**45,820**	**52,345**	**48,285**	**51,185**	**63,075**	**56,985**	**72,210**
Total variable cost* (PhP/ha)	**5,700**	**8,200**	**8,200**	**8,200**	**8,200**	**7,575**	**7,575**	**7,575**
Net benefit (PhP/ha)	**33,015**	**37,620**	**44,145**	**40,085**	**42,985**	**55,500**	**49,410**	**64,635**
Difference in net benefit (PhP/ha)		4,605	11,130	7,070	9,970	22,485	16,395	31,620
Difference in net benefit (%)		13.9	33.71	21.41	30.20	68.11	49.66	95.77
Marginal benefit cost ratio		1.84	4.45	2.83	3.99	11.99	8.74	16.86
Return on Investment	5.8	4.6	5.4	4.9	5.2	7.3	6.5	8.5

CORN #107

RESULT OF ALTERNATE

NEB LIQUID FORMULA STUDY

Del Carmen, Pres. Roxas, Cotabato

REGION XII

Del Carmen, Pres. Roxas, Cotabato (Study # 107)

Variety used: P30T80YG

Distance of planting: 75 x 25 cm

Population density: 53,333/ha.

Comments from Agmor (manufacturer of NEB-26)

Central Mindanao Integrated Agricultural Research Center (CMIARC) conducted a research study to evaluate the efficacy of NEB-26 on corn in October 2012. This study was referred to by Agmor as CORN #107. The final report by the researcher included all the data and tables, but no narrative was included.
The information on this page is provided to clarify the final report from CMIARC.

The objective of this study was to (1) measure the yield increase when NEB is coated onto urea, and (2) measure the yield to determine the efficacy of Agmor's seed treatment formulation (a secondary NEB product applied directly to the seed).

Two studies were conducted:

1. CORN #106 was conducted on open pollinated variety to determine the impact on a lower yielding variety.
2. CORN #107 was conducted on a recommended hybrid variety to determine the impact on a higher yielding variety.

The NEB seed treatment formulation had a positive impact on yield, however Agmor is focusing on NEB applied on urea only as a simple method that allows scale. For this reason, the treatments to consider when reviewing this study are as follows:

T1, the untreated control (normal rate of fertilizer without NEB) compared to
T6, NEB coated onto urea (without the seed treatment NEB formulation)
Both treatments include the normal rate of fertilizer, the only difference was the NEB
These relevant treatments are highlighted in green below:

Treatment Summary

	Seed treatment	Fertilizer App #1 (at planting)	Fertilizer App #2 (15-20 DAP)	Fertilizer App #3 (25-30 DAP)
T1	CONTROL (No Seed Treatment)	-----	-----	-----
T2	No Seed Treatment		500 ml NEB-1XT	500 ml NEB-1XT
T3	No Seed Treatment	-----	500 ml NEB- FF2-1XT	500 ml NEB- FF2-1XT
T4	NEB-108LST-8 seed treatment	-----	500 ml NEB-1XT	500 ml NEB-1XT
T5	NEB-108LST-8 seed treatment	-----	500 ml NEB- FF2-1XT	500 ml NEB- FF2-1XT
T6	No Seed Treatment	375 ml NEB-FF2-1XT	375 ml NEB-FF2-1XT	375 ml NEB-FF2-1XT
T7	NEB-108LST-8 seed treatment	375 ml NEB-1XT	375 ml NEB-1XT	375 ml NEB-1XT
T8	NEB-108LST-8 seed treatment	375 ml NEB-FF2-1XT	375 ml NEB-FF2-1XT	375 ml NEB-FF2-1XT

Grain Yield (t/ha)

Treatments	Replication				Total	Mean
	I	II	III	IV		
T1 (control)	4.05	4.25	4.5	4	16.8	**4.20 tons/ha**
T6 (with NEB)	7.14	7.98	8.18	8.15	31.45	**7.86 tons/ha**

Comparing these relevant treatments, NEB increased corn grain production by 3.66 tons/ha.

CORN # 107
LIQUID SEED TREATMENT
CEMIARC XII - PRES. ROXAS, COTABATO

No. of Plants

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	289	268	280	291	1128	282
2	294	290	296	288	1168	292
3	285	302	298	295	1180	295
4	287	288	290	295	1160	290
5	293	294	290	291	1168	292
6	288	285	292	287	1152	288
7	302	300	299	291	1192	298
8	285	286	283	282	1136	284

No. of Ears

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	289	268	280	291	1128	282
2	294	290	296	288	1168	292
3	285	302	298	295	1180	295
4	287	288	290	295	1160	290
5	293	294	290	291	1168	292
6	288	285	292	287	1152	288
7	302	300	299	291	1192	298
8	285	286	283	282	1136	284

Grain Yield (t/ha)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	4.05	4.25	4.5	4	16.8	**4.20**
2	6.18	6.2	7.18	6.18	25.74	6.44
3	7.18	8.7	7.15	6.25	29.28	7.32
4	6.2	7.2	6.2	8.22	27.82	6.96
5	8.33	7.06	6.12	7.15	28.66	7.17
6	7.14	7.98	8.18	8.15	31.45	**7.86**
7	7.48	7.45	7.12	7	29.05	7.26
8	8.12	8.15	8.73	8.6	33.6	8.40

Fresh weight of 10 ears (kg)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	1300	1302	1294	1284	5180	1295
2	1405	1400	1410	1385	5600	1400
3	1540	1389	1550	1685	6164	1541
4	1370	1368	1382	1380	5500	1375
5	1590	1582	1600	1576	6348	1587
6	1430	1410	1425	1415	5680	1420
7	1620	1600	1636	1640	6496	1624
8	1320	1332	1294	1294	5240	1310

Grain Yield of 10 ears (kg)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	1090	1084	903	1091	4168	1042
2	1186	1187	1141	1155	4669	1167
3	1371	1089	1288	1401	5149	1287
4	1182	1183	1175	1056	4596	1149
5	1326	1302	1350	1320	5298	1325
6	1234	1150	1162	1214	4760	1190
7	1400	1406	1402	1400	5608	1402
8	1122	1045	1104	1133	4404	1101

Grain Moisture

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	30.2	24.8	23.9	19.3	98.2	24.6
2	24.6	28.3	19.7	21.6	94.2	23.6
3	23.4	29.3	28.8	23.6	105.1	26.3
4	25.4	21.8	26.8	23.7	97.7	24.4
5	29.2	24.3	26.5	23.8	103.8	26.0
6	23.3	28.1	20.3	20.8	92.5	23.1
7	28.4	24.7	24.4	26.3	103.8	26.0
8	22.2	22.9	25.6	26.1	96.8	24.2

CORN #107

Plant Height (cm)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	256	285	275	260	1076	269.00
2	320	322	270	290	1202	300.50
3	301	290	300	300	1191	297.75
4	282	299	300	299	1180	295.00
5	300	295	285	252	1132	283.00
6	295	275	288	300	1158	289.50
7	289	300	310	305	1204	301.00
8	276	284	298	295	1153	288.25

Ear Height (cm)

Treatments	Replication				Total	Mean
	1	II	III	IV		
1	140	145	146	152	583	146.00
2	163	157	154	156	630	158.00
3	159	158	152	148	617	154.00
4	158	175	169	149	651	163.00
5	150	160	156	147	613	153.00
6	150	144	163	150	607	152.00
7	145	149	158	148	600	150.00
8	149	159	132	156	596	149.00

Ear Diameter (cm)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	3.3	2.9	2.9	2.8	11.9	2.98
2	4.5	4	4.2	4.4	17.1	4.28
3	4.6	4.1	4.7	4	17.4	4.35
4	4.8	4.1	4	4.2	17.1	4.28
5	4.2	4.2	4.5	4.4	17.3	4.33
6	4.8	4.2	4	4.5	17.5	4.38
7	4.8	4.5	4.5	5	18.8	4.70
8	4	4.2	4.2	4.8	17.2	4.30

Ear Length (cm)

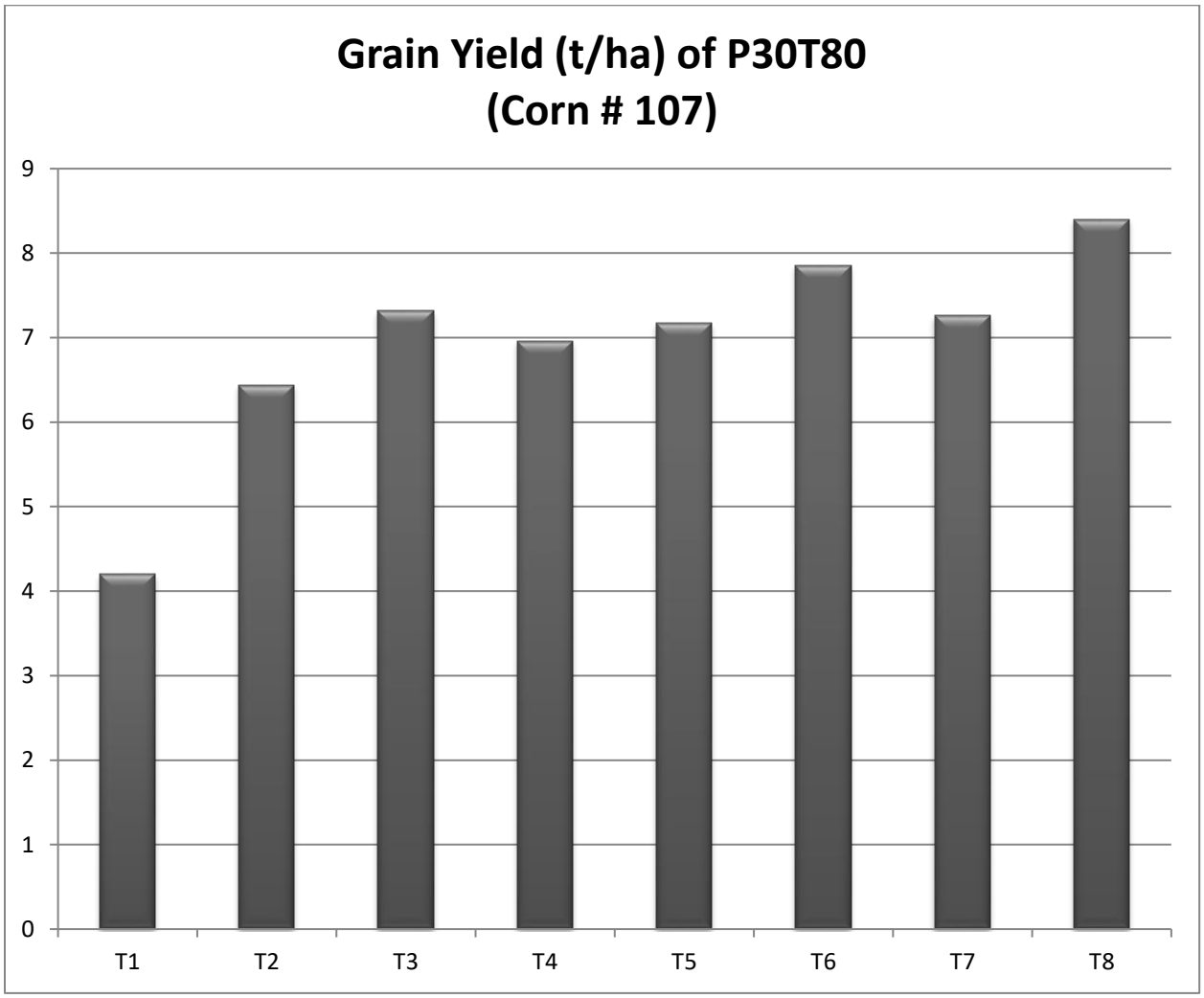
Treatments	Replication				Total	Mean
	I	II	III	IV		
1	10.9	11.5	10.5	10	42.9	10.73
2	14.1	16.6	16.5	16.5	63.7	15.93
3	16.7	15.8	17.3	16.1	65.9	16.48
4	16.8	16.4	15.7	16.5	65.4	16.35
5	15.8	16.5	16.1	14.7	63.1	15.78
6	16.4	16.1	16.3	14	62.8	15.70
7	17.3	17.6	18	17.2	70.1	17.53
8	14.5	16.7	15.8	16.4	63.4	15.85

Kernel Rows

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	16	16	16	16	64	16.00
2	16	16	16	16	64	16.00
3	18	18	18	18	72	18.00
4	16	16	16	16	64	16.00
5	18	18	18	18	72	18.00
6	16	16	16	16	64	16.00
7	18	18	18	18	72	18.00
8	16	16	16	16	64	16.00

Shelling Recovery (%)

Treatments	Replication				Total	Mean
	I	II	III	IV		
1	83.85	83.26	69.78	84.97	321.86	80
2	84.41	84.79	80.92	83.39	333.51	83
3	89.03	78.40	83.10	83.15	333.67	83
4	86.28	86.48	85.02	76.52	334.30	84
5	83.40	82.30	84.38	83.76	333.83	83
6	86.29	81.56	81.54	85.80	335.19	84
7	86.42	87.88	85.70	85.37	345.36	86
8	85.00	78.45	85.32	87.56	336.33	84



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Legend:

T1 = 4.20 t/ha
T2 = 6.44 t/ha
T3 = 7.32 t/ha
T4 = 6.96 t/ha
T5 = 7.17 t/ha
T6 = 7.86 t/ha
T7 = 7.26 t/ha
T8 = 8.40 t/ha

Cost and Return Analysis of P30T80 (Corn # 107) Del Carmen, Pres. Roxas, North Cotabato. 2012

Parameters	Treatments							
	T1	**T2**	**T3**	**T4**	**T5**	**T6**	**T7**	**T8**
Yield (t/ha)	**4.2**	**6.44**	**7.32**	**6.96**	**7.17**	**7.86**	**7.26**	**8.4**
Yield difference (t/ha)		2.24	3.12	2.76	2.97	3.66	3.06	4.20
Yield difference (%)		53.33	74.29	65.71	70.71	87.14	72.86	100.00
Fertilizer N (FN, kg N/ha)	111	111	111	111	111	111	111	111
Fertilizer P (FP, kg P_2O_5/ha)	42	42	42	42	42	42	42	42
Fertilizer K (FK, kg K_2O/ha)	42	42	42	42	42	42	42	42
NEB Liquid fertilizer applied (ml/ha)	-	1,000	1,000	1,000	1,000	750	750	750
Cost of N from inorganic source (PhP/ha)	1,400	1,400	1,400	1,400	1,400	1,400	1,400	1,400
Cost of P_2O_5 from inorganic source (PhP/ha)	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500
Cost of K_2O from inorganic source (PhP/ha)	1,600	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Cost of NEB Liquid fertilizer (PhP/ha)	0	1,500	1,500	1,500	1,500	1,125	1,125	1,125
Total Fertilizer cost (PhP/ha)	**4,500**	**7,000**	**7,000**	**7,000**	**7,000**	**6,375**	**6,375**	**6,375**
Plant spacing	25 x 75	25 x 75	25 x 75	25 x 75	25 x 75	25 x 75	25 x 75	25 x 75
Plant popn (plants/ha)	53,333	53,333	53,333	53,333	53,333	53,333	53,333	53,333
Seed cost (PhP/ha)	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500
Farmgate price of corn (Php/kg)	11.00	11.00	11.00	11.00	11.00	11.00	11.00	11.00
Gross benefit (Php/ha)	**46,200**	**70,840**	**80,520**	**76,560**	**78,870**	**86,460**	**79,860**	**92,400**
Total variable cost* (PhP/ha)	**9,000**	**11,500**	**11,500**	**11,500**	**11,500**	**10,875**	**10,875**	**10,875**
Net benefit (PhP/ha)	**37,200**	**59,340**	**69,020**	**65,060**	**67,370**	**75,585**	**68,985**	**81,525**
Difference in net benefit (PhP/ha)		22,140	31,820	27,860	30,170	38,385	31,785	44,325
Difference in net benefit (%)		59.5	85.54	74.89	81.10	103.19	85.44	119.15
Marginal benefit cost ratio		8.86	12.73	11.14	12.07	20.47	16.95	23.64
Return on Investment	4.13	5.16	6.00	5.66	5.86	6.95	6.34	7.50

CORN #116

THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF MAIZE

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JULY - OCTOBER 2016

I. INTRODUCTION

Maize (Zea mays) is a substitute to paddy rice in terms of human consumption. This serves as major foods in the Visayas and Mindanao regions. Additionally, maize provides an important role as animal feeds in poultry, piggery and livestock industries.

This study aimed to determine the rate of NEB-26 (eNEBler) applied with the recommended rate of urea that would give the largest grain increase in maize production.

II. OBJECTIVES

a. To determine the quantity of NEB-26 (eNEBler) applied with the recommended rate of urea to produce the largest yield increase on hybrid maize (variety P3774) of grain production.

b. Evaluate the yield response of several quantities of NEB-26 (eNEBler) to determine the optimal rate, based on the grain yield.

III. RESEARCHER — RODRIGO B. ESPAÑA
RBE Research / Breeding Station San Jose, General Santos City

IV. TARGET CROP PLANTED — Hybrid Maize, Variety P3774

V. DURATION OF THE STUDY — July to October 2016

VI. METHODOLOGY

The maize trial was conducted at RBE Research Station, Vineyard Barangay San Jose, General Santos City, Philippines with an area of THREE THOUSAND EIGHT (3,008) square meters. The actual maize variety planted was a hybrid maize P3774 being certified by the **National Seeds Industry Council (NSIC)** of the Department of Agriculture, Philippines.

LAND PREPARATION/PLANTING/FERTILIZATION

An area of **THREE THOUSAND EIGHT (3,008)** square meters was plowed and harrowed thoroughly with the used of tractor.

There were THREE (3) scheduled fertilizer applications. The first fertilizer application was during the date of planting (July 5, 2016) which was the basal application of 125 kgs of 16-20-0 per hectare plus 50 kgs of muriate of potash (MOP) per hectare. The second fertilizer application was applied during the hilling up (25-30 DAP) which was August 3, 2016 of 225 kg urea per hectare. The third and last fertilizer application was August 24, 2016. The foliar fertilizer (Power Grower Foliar Fertilizer with ANAA wettable Powder) was sprayed at the rate of 1.5 liters per hectare at 50 DAP.

The area was furrowed at a distance of 70cm by 20cm apart. Before planting 16-20-0 and MOP was applied. The fertilizer was covered with 5 cm soil before planting to avoid damages on the part of the seed maize, as recommended. The trial consists of eight (8) treatments with four (4) replications, using a plot size of 6m by 10m. Plots were replicated using **RANDOMIZED COMPLETE BLOCK DESIGN (RCBD).**

NEB-26 (eNEBler) was applied with the urea application only at the 25-30 DAP fertilizer application. All treatments (except T1) received the same quantity of 16-20, MOP and urea. The treatments were:

T1 – No Fertilizer, No eNEBler (no fertilizer control)

T2- 225 kgs urea/ha, NO eNEBler (full RR fertilizer control)

T3- 225 kgs urea/ha plus 135 ml/ha eNEBler

T4- 225 kgs urea/ha plus 202.5 ml/ha eNEBler

T5- 225 kgs urea/ha plus 270 ml/ha eNEBler

T6- 225 kgs urea/ha plus 337.5 ml/ha eNEBler

T7- 225kgs urea/ha plus 405 ml/ha eNEBLer

T8- 225kgs urea/ha plus 472.5 ml/ha eNEBler

HARVESTING

An hour before harvesting, we gathered the plant height. Stand counts as well as the number of ears within a plot were collected and we measured the ear length of cobs per plot. After harvesting, the cobs were weighed with husk cover and also dehusked. Then, we weighed again the ears (dehusked). Ears were dried for two (2) days, and then all yield samples were unshelled on the same day. After shelling, we dried it again for three (3) successive sunny days. During the weighing the grains had FOURTEEN PERCENT (14%) moisture content. The shelling recovery rate was approximately SEVENTY-EIGHT (78%) percent.

IV. RESULTS AND DISCUSSION

The study was conducted at RBE Research Station Vineyard, San Jose, General Santos City Philippines, during the period from July to October 2016. The area is generally plain with fine sandy loam soil with gravity irrigation system. The occurrence of pest and diseases were able to be controlled with normal practices.

The test product, NEB-26, marketed as "eNEBler" by Advanced AgriSolutions Philippines Corporation, based in Manila, Philippines.

The results of the trial show a difference of average plant height of T1 control (no fertilizer control) and T2 (recommended fertilizer rate control) which has a difference of 46.75 cms and 40.50 cms respectively with that of T8, the treatment with 472.5 ml/ha of eNEBler. T3 with lesser quantity of eNEBler application produced a plant height difference of 27cm and 20 cm to T1 and T2. T8 has a difference of T3 = 20.5 cm, T4 = 17.25 cm, T3 = 12.5 cm, T6 = 9cm, T7 = 2.25 cm respectively.

In table 4, the average grain yield of T8 was 10,964.59 kg per hectare which is almost triple the yield of the no fertilizer control (T1) of 2,864.58 kg per hectare and almost double the yield of of the recommended fertilizer rate control (T2) of 4,745.84 kg per hectare. All rates of NEB-26 produced positive yield increases that were higher than the T2 full fertilizer control. The grain yield for T3 was 5,939.59 kg per hectare, T4 was 6,525.00 kg per hectare, T5 was 7,081.25 kg per hectare, T6 was 8,281.25 kg per hectare, T7 was 10,108.33 kg per hectare and T8 was 10,964.59 kg per hectare.

August 3, 2016 when the hilling up was done with the side dressing application of urea plus the application of eNEBler. August 13, 2016, the leaves of the corn plants at T2 became greenish but those applied with eNEBler T3, T4, T5, T6, T7 and T8 had shown a very dark green leaves. In August 28, 2016 the leaves of T2 became lighter green, but the plots treated with eNEBler did not start to turn lighter color until September 10, 2016, the leaves of T3, T4, T5, T6, T7 and T8

slightly turned to a lighter green. Although their leaves were still a darker green compared to T2. It was very evident that the T2 plots the leaves became more lighter green in color compared to the eNEBled treatments earlier.

V. SUMMARY AND CONCLUSION

Based on this study, it was concluded that the application of eNEBler to maize hybrid (P3774) could increase the yield by 6,218.75 kg per hectare when compared to the recommended rate of urea T2. We further concluded that a maize plant applied with eNEBler could obtain and maintained its green color on leaves longer, until harvesting which could give a very large volume of grain yield. It was further concluded that application of eNEBler could give the highest plant height of the maize.

The effect of NEB-26 the yield of maize was highly significant (alpha 0.01). Based on these statistically significant positive yield increases it is recommended that farmers in the Philippines apply eNEBler on maize to maximize grain production.

Further research is also recommended as the data trend suggests that higher quantities of eNEBler may produce higher grain yields.

CORN #116

TABLE 1.

DATA SET: AVERAGE PLANT HEIGHT (IN CM) OF MAIZE

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF MAIZE (CORN 116).

JULY – OCTOBER 2016.

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	247	241	245	242	975	243.75
2	251	247	250	252	1000	250.00
3	269	273	268	270	1080	270.00
4	272	276	274	271	1093	273.25
5	275	278	280	279	1112	278.00
6	277	281	283	285	1126	281.50
7	284	288	291	290	1153	288.25
8	291	289	290	292	1162	290.50
TOTAL	**2166**	**2173**	**2181**	**2181**		
GRAND TOTAL					**8701**	
GRAND MEAN						**271.90**

***= Treatment means having a common letter superscript are statistically the same at 0.05 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	19.59	3508.24	30.38 ** HS	3.07	4.87
Treatment	7	8080.47	1154.35	9.99 **	2.49	3.65
Error	21	2424.66	115.46			
TOTAL	31	10524.72				

CV = 3.95%

*** * = Highly Significant at 1% and 5% level**

TABLE 2.

DATA SET: AVERAGE STAND COUNT (IN CM) OF MAIZE

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF MAIZE (CORN 116).

JULY – OCTOBER 2016.

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	398	397	400	399	1594	398.50
2	399	400	397	397	1593	398.25
3	400	399	397	398	1594	398.50
4	399	399	398	399	1595	398.75
5	398	400	397	399	1594	398.50
6	397	399	398	400	1594	398.50
7	400	400	398	400	1598	399.95
8	399	400	399	399	1597	399.25
TOTAL	**3190**	**3194**	**3184**	**3191**		
GRAND TOTAL					**12759**	
GRAND MEAN						**398.77**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	6.60	22.00	1.88 NS	3.07	4.87
Treatment	7	5.22	0.75	0.64 NS	2.49	3.65
Error	21	24.65	1.17			
TOTAL	31	36.47				

CV = 0.27%

NS= No Significant

TABLE 3.

DATA SET: AVERAGE NUMBER OF EARS HARVESTED

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF MAIZE (CORN 116).
JULY – OCTOBER 2016

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	230	232	229	231	922	230.50
2	360	372	383	385	1500	375.00
3	398	395	397	400	1590	397.50
4	399	397	403	405	1604	401.00
5	407	411	415	408	1641	410.25
6	412	418	415	412	1657	414.25
7	415	419	420	420	1682	417.75
8	418	421	423	420	1682	420.50
TOTAL	**3039**	**3065**	**3085**	**3078**		
GRAND TOTAL					**12267**	
GRAND MEAN						**383.34**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F 05	TABULAR F 01
Replication	3	184.10	61.37	3.55 *	3.07	4.87
Treatment	7	112745.97	16106.57	931.55 **	2.49	3.65
Error	21	363.15	17.29			
TOTAL	31	113293.22				

CV = 1.08%

*** * = Highly Significant, Significant at 5% level**

*** = Significant**

TABLE 4.

DATA SET: GRAIN YIELD (IN METRIC TONS) PER HECTARE

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF MAIZE (CORN 116).
JULY – OCTOBER 2016

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	2700	3200	3025	2533.33	11458.33	2864.58
2	4250	4516.67	4891.67	5325	18983.34	4745.84
3	5191.67	5600	6350	6616.67	23758.34	5939.59
4	5850	6358.33	6791.67	7100	26100	6525
5	6366.67	6966.67	7316.67	7675	28325.01	7081.25
6	7408.33	8033.33	8750	8933.33	33124.99	8281.25
7	9266.67	9850	10533.33	10683.33	40333.33	10108.33
8	10183.33	10616.67	11341.67	11716.67	43858.34	10964.59
TOTAL	**51216.67**	**55141.67**	**59000.01**	**60583.33**		
GRAND TOTAL					**225941.68**	
GRAND MEAN						**6984.64**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	659305.38	2199435.13	28.13 **	3.07	4.87
Treatment	7	201506637.9	2878662.56	36.82 **	2.49	3.65
Error	21	1641747.72	78178.46			
TOTAL	31	209746691				

CV = 4%

*** * = Highly Significant to both 1% and 5% level**

TABLE 5.

DATA SET: AVERAGE EAR LENGTH (IN CM)

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF MAIZE (CORN 116).
JULY – OCTOBER 2016

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	9	8	13	11	41	10.25
2	14	10	15	13	52	13.00
3	16	15	18	20	69	17.25
4	19	18	20	17	74	18.50
5	20	22	19	21	82	20.50
6	21	20	21	21	83	20.75
7	22	21	23	21	87	21.75
8	21	23	22	23	89	22.25
TOTAL	**142**	**137**	**151**	**147**		
GRAND TOTAL					**577**	
GRAND MEAN						**18.03**

***= Treatment means having a common letter superscript are statistically the same at 0.01 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	13.85	4.62	2.11 NS	3.07	4.87
Treatment	7	527.22	75.32	34.40 **	2.49	3.65
Error	21	45.9	2.19			
TOTAL	31					

CV = 8.20%

*** * = Highly Significant**

NS = No Significant

TABLE 6.

DATA SET: AVERAGE WEIGHT OF CORN STALKS

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF MAIZE (CORN 116).
JULY – OCTOBER 2016

TREATMENT	REPLICATION				TOTAL	MEAN
	I	II	III	IV		
1	14833.33	15166.66	14166.66	14500.45	58666.94	14666.74
2	21500.43	24167./15	23000.46	22500.45	91168.49	22792.12
3	26333.86	28167.23	27667.22	28333.90	110502.21	27625.55
4	28167.23	30500.61	28833.91	28000.56	115502.31	28875.58
5	31000.62	30000.60	29833.93	31333.96	122169.11	30542.28
6	29833.93	31833.97	30833.95	31167.29	123669.14	30917.29
7	33167.33	31500.63	33667.34	32500.65	130835.954	32708.99
8	35500.71	36834.07	36500.73	37167.41	146002.92	36500.73
TOTAL	**220337.44**	**228170.92**	**224504.20**	**225504.51**		
GRAND TOTAL					**898517.07**	
GRAND MEAN						**28078.66**

***= Treatment means having a common letter superscript are statistically the same at 0.05 level DMRT**

ANOVA

SOURCE OF VARIATION	Df	SS	MS	Comp. F	TABULAR F	
					05	01
Replication	3	396809.63	132269.88	1.22 NS	3.07	4.87
Treatment	7	126066397.3	18009485.33	1.66 NS	2.49	3.65
Error	21	2272079188				
TOTAL	31	2398542395				

CV = 37.04%

NS = No Significant

TABLE 7a.

DATA SET: AVERAGE WEIGHT OF CORN STALKS (IN KG) FOR BIOMASS, ACTUAL WEIGHT PER PLOT

STUDY: THE EFFECT OF NEB-26 (eNEBler) ON THE GRAIN PRODUCTION OF MAIZE (CORN 116).

JULY – OCTOBER 2016

TREATMENT	I	II	III	IV
1	89	91	85	87
2	129	145	138	135
3	158	169	166	170
4	169	183	173	168
5	186	180	179	188
6	179	191	185	187
7	199	189	202	195
8	213	221	219	223

Table 7b. AVERAGE WEIGHT IS CONVERTED INTO TONS PER HECTARE OF BIOMASS

TREATMENT	I	II	III	IV
1	14833.33	15166.66	14166.66	14500.29
2	21500.43	24167.15	23000.46	22500.45
3	26333.86	28167.23	27667.22	28333.90
4	28167.23	30500.61	28833.91	28000.56
5	31000.62	30000.60	29833.93	31333.96
6	29833.93	31833.97	30833.95	31167.29
7	33167.33	31500.63	33667.34	32500.65
8	35500.71	36834.07	36500.73	37167.41

CORN #117

EFFICACY AND RATE DETERMINATION OF eNEBler ON CORN (EVOGEN 747) PRODUCTION

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DA-Tupi Research & Experiment Station
Bololmala, Tupi, South Cotabato

OCTOBER 2016

I. OBJECTIVES:

To determine the efficacy of eNEBler when applied to corn and to determine the rate of eNEBler applied with the normal quantity of urea that produces the largest yield increase on corn (EVOGEN 747).

II. INTRODUCTION:

Southern Mindanao is leading in corn production in terms of production and area. In South Cotabato alone, de Leon (1990) reported that the province was the biggest corn producer in the country, which comprises 80% of the national output. Bureau of Agricultural Statistics (BAS, 1997) reported that total production of corn in SOCSKSARGEN (South Cotabato, Sultan Kudarat, Sarangani Province and General Santos City) area alone is about 773,249 MT and 434,024 MT in 1996 and 1997 respectively. The decline in production is directly proportional to the decrease in hectarage, 1996 – 388,717 hectares and 1997 – 368,715 hectares. The decrease in hectarage and production is due to several factors and one of this might be the improper and incorrect usage of fertilizer.

Corn like any other crops need sustainable supply of fertilizer (either soil applied or foliar spray), preferably organic ones. It is timely that one program of the government through the Department of Agriculture is the promotion of the use of farm waste and remains made into fertilizer or the organic farming. Researches in the field of plant nutrition are very much devoted to the correct and proper way of fertilizer application to boost production and keep the soil in sustaining productivity.

The study aimed to evaluate the yield response of hybrid corn to different rates and combination of fertilizer additive and inorganic fertilizer.

III. RESEARCHER: ROEL C. DE RAMOS/PNT 025
DA-CEMIARC For Upland & Lowland
Tupi, South Cotabato

IV. TARGET CROP: Corn (EVOGEN 747)

V. DURATION OF THE STUDY: June to October 2016

VI. METHODOLOGY:

The corn trial was conducted at Tupi research and Experiment Station, Bololmala, Tupi, South Cotabato with an area of about three thousand eight (3,008) square meters. The product was tested using hybrid corn (EVOGEN 747) as test crop.

TREATMENT SUMMARY:

eNEBler was applied at different rates, as shown:

T1 No fertilizer control (no fertilizer, no eNEBler)
T2 RR fertilizer control (no eNEBler)
T3 RR fertilizer + 135 ml/ha eNEBler
T4 RR fertilizer + 202.5 ml/ha eNEBler
T5 RR fertilizer + 270 ml/ha eNEBler
T6 RR fertilizer + 337.5 ml/ha eNEBler
T7 RR fertilizer + 405 ml/ha eNEBler
T8 RR fertilizer + 472.5 ml/ha eNEBler

LAND PREPARATION:

An area approximately three thousand eight (3,008) square meters was prepared for the trial, to ensure good land preparation and control of weeds, thorough plowing and harrowing was done using carabao drawn implements.

PLOTS PREPARATION AND DESIGN OF EXPERIMENT:

A six by ten meters (6m X 10m) plot was prepared thoroughly for each site and ready for planting. These were arranged into eight (8) furrow treatments ten (10) meters in length. Treatment plots were replicated four (4) times using randomized complete block design (RCBD).

APPLICATION OF FERTILIZER AND PLANTING:

The recommended rate of fertilizer was applied at the rate of 124-25-30 (kg of nitrogen, phosphorous and potassium respectively) was applied per hectare. A mixture of 16-20-0 and 0-0-60 was made and immediately applied/spread evenly in the designated rows in every plots and cover with fine soil before planting. Plant two (2) seeds per hill, to ensure a good stand count on the trial. Thinning was done ten (10) days after planting leaving one (1) seed per hill. Second application of fertilizer was done during hilling up (25-30 DAP) by applying urea only. The third application was done through spraying of foliar fertilizer at the rate of 1.5 liters per hectare, fifty (50) days after planting.

CARE AND MAINTENANCE:

A keen observation of insect pest and diseases was done for proper/correct application of insecticide and fungicide. No chemical spraying was done a week before harvesting.

HARVESTING:

Harvesting was done when corn plant reach maturity (105 DAP). All corn ears in the six (6) middle rows per plots were harvested, leaving one row in both sides of the plot.

VII. PARAMETERS GATHERED:

1. Average plant height in centimeters was gathered before harvesting, using ten (10) plants samples randomly selected per treatment plots.

2. Number of plants harvested per plot. Six middle rows plant per plot was harvested, leaving one row in both side as to serve as borders.

3. Number of ears per harvest area per plot was counted and recorded.

4. Biomass (kg), weight of ten (10) plants samples per treatment plot. Whole plant was selected randomly and uprooted before harvest.

5. Weight of fresh ears (gms) with husk. From the harvested fresh ears, weighing and recording was done.

6. Weight of fresh ears (gms) without husk. Harvested ears were dehusked and weighed for recording.

7. Dry weight of corn kernels in tons per hectare. Harvested ears per treatment plots were manually shelled and dried, upon reaching 14% moisture, weighing was done. These were finally transformed into grain yield in tons per hectare.

All data was gathered at the designated rows/plant per plot.

VIII. RESULTS AND DISCUSSION:

The trial was conducted in the Department of Agriculture; Research Experiment Station based at Bololmala, Tupi, South Cotabato during the period from July 14 to October 29, 2016. The area is generally plain with a fine sandy loam soil. Soil sampling in the area was done prior to land preparation; result revealed that the area has a pH of 5.6 (soil pH meter). Hybrid corn seeds (EVOGEN 747) was used as the test crop in the trial. Total rainfall was recorded (July 2016 = 14.09 mm, August 2016 = 8.07 mm, September 2016 = 10.51 mm and October 2016 = 9.89 mm) during the trial period, because of these some of the corn plant incurred stalk rot as early as silking stage but the spraying of fungicide controlled the spread of the disease. There was a negligible occurrence of insect pest and diseases observed.

Table 1: Average plant height of hybrid corn, no significant differences among treatment means was found. Plant height ranges from 271.33 (T_1) followed by 268.58 cm (T_4), 264.33 cm (T_5), 263.83 cm (T_6 and T_2), 263.33 cm (T_7), 259.83 cm (T_3) and 257.58 cm (T_8 - the lowest).

Table 1. Average plant height (cm) of ten plant samples/plot, as influenced by the application of eNEBler at different rate in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	264.33	232.00	290.67	298.33	1085.33	271.33
2	235.67	255.33	279.33	285.00	1055.33	263.83
3	252.00	246.33	281.00	260.00	1039.33	259.83
4	264.67	265.00	267.33	277.33	1074.33	268.58
5	263.67	269.00	262.00	262.67	1057.34	264.33
6	279.33	281.67	245.33	249.00	1055.33	263.83
7	285.33	285.33	252.00	230.67	1053.33	263.33
8	298.00	242.33	228.67	260.33	1029.33	257.58
Total	**2143.00**	**2076.99**	**2106.33**	**2123.33**	**8449.65**	**264.05**

* Treatment means having a common letter superscript are statistically the same.

Table 2: Number of plants harvested per plot ($45m^2$), also showed no significant differences among treatment means. Average number of plants harvested ranges from 274.00 (T_8), followed by 272.50 (T_7), 271.00 (T_3), 269.50 (T_6), 265.50 (T_5), 262.50 (T_4), 259.50 (T_2) and 226.75 (T_1 – the lowest).

Table 2. Number of plants harvested/plot (45m2), as influenced by the application of eNEBler at different rate in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	238	227	218	224	907	226.75
2	252	256	271	259	1038	259.50
3	267	272	268	277	1084	271.00
4	242	259	282	267	1050	262.50
5	239	278	266	279	1062	265.50
6	255	265	277	281	1078	269.50
7	261	290	261	277	1089	272.50
8	266	265	276	289	1096	274.00
Total	**2020**	**2112**	**2119**	**2153**	**8404**	**262.625**

* Treatment means having a common letter superscript are statistically the same.

Table 3: Average number of ears harvested per plot (45 m^2), a highly significant result was observed. Average number of ears rank from 219.50 (T_1) to 275.50 (T_6). Treatment 7 (405 ml eNEBler per hectare) showed significant difference from no fertilizer control (T_1) and recommended fertilizer rate only (T_2), but it showed comparable result to all treatments applied with fertilizer and eNEBler. The highest average number of ears was shown in treatment 7 (275.50) and 8 (275.50) followed by treatment 3 (269.50), treatment 6 (269.25), treatment 5 (267.75), treatment 4 (262.50), treatment 2 (249.00) and the lowest was treatment 1 (219.50).

Table 3. Number of ears harvested/plot (45m2), as influenced by the application of eNEBler at different rate in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	230	222	206	220	878	219.50^{c}
2	252	256	218	262	988	249.00^{b}
3	269	272	262	275	1078	269.50^{ab}
4	246	259	279	266	1050	262.50^{ab}
5	239	282	268	282	1071	267.75^{ab}
6	255	266	277	279	1077	269.25^{ab}
7	264	290	269	279	1102	275.50^{a}
8	267	268	279	288	1102	275.50^{a}
Total	**2022**	**2115**	**2058**	**2151**	**8346**	**260.812**

* - Treatment means having a common letter superscript are statistically the same at 1% level DMRT.

Table 4. Biomass weight (gms) of ten plant samples randomly selected per plot. Analysis showed a highly significant result from the recorded data. Highest mean weight was given by treatment 8 (6,487.50 gms), followed by treatment 7 (6,142.50 gms), treatment 6 (5,857.50 gms) and treatment 5 (5,517 gms) which were comparable statistically. Although other treatments, (treatments 2, 3 & 4), were found comparable also to treatment 7, but all of these treatments were found statistically different to treatment 1 (3,125.00 gms).

Table 4. Biomass, weight in grams of ten plant samples/plot, as influence by the application of eNEBler at different rate in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	4500	3000	2950	2050	12500	3125.00^{d}
2	4950	4550	4050	3950	17500	4375.00^{c}
3	4900	5010	5060	5050	20020	5005.00^{bc}
4	5000	5070	5200	5400	20670	5167.50^{bc}
5	5010	5300	5750	6010	22070	5517.50^{abc}
6	5250	6010	6100	6070	23430	5857.50^{ab}
7	5750	6100	6210	6510	24570	6142.50^{ab}
8	6000	6350	6600	7000	25950	6487.50^{a}
Total	**41360**	**41390**	**41920**	**42040**	**166710**	**5209.68**

* - Treatment means having a common letter superscript are statistically the same at 1% level DMRT.

Table 5. Average weight in grams of fresh ears with husks (45 m^2 plot samples), showed a highly significant difference between treatment means. Treatment 8 gave the highest average weight of 27,477.25 gms/plot, followed by treatment 7 (26,175.00 gm/plot), treatment 6 (25,512.50 gms/plot), treatment 5 (23,962.50 gms/plot), treatment 4 (22,025.00 gms/plot), treatment 3 (20,375.00 gms/plot), treatment 2 (18,687.50 gms/plot) and control with only 13,115.00 gms/plot.

Table 5. Weight of fresh ears with husk in grams taken per plot (45 m2) as influenced by eNEBler applied at different rate in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	14500	14010	12050	11900	52460	13115.00^{f}
2	20050	18050	18600	18050	74750	18687.50^{e}
3	20250	20200	20800	20250	81500	20375.00d^{e}
4	21000	22000	23050	22050	88100	22025.00^{cd}
5	23250	24250	25200	23150	95850	23962.50^{c}
6	24500	26050	26800	24700	102050	25512.50^{ab}
7	25000	26600	27050	26050	104700	26175.00^{a}
8	26500	28010	29000	26900	109910	27477.25^{a}
Total	**174550**	**179170**	**182550**	**173050**	**709320**	**22166.25**

* - Treatment means having a common letter superscript are statistically the same at 1% level DMRT.

Table 6. In terms of average weight of fresh ears without husks the application of 472.5 ml eNEBler (T_8), gave the highest weight of 24,600.00 grams/plot. It was also found that T_8 is comparable to treatments 6 (22,225.00 gms/plot) and 7 (23,075.00 gms/plot) but is significantly different to treatments 5 (20512.50 gms/plt), 4 (18,855.00 gms/plot), 3 (17,395.00 gms/plot), 2 (11,375.00 gms/plot) and 1 with only 10,712.50 gms/plot.

Table 6. Weight of fresh ears without husk in grams taken per plot (45 m2) as influenced by eNEBler applied at different rate in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	12100	10800	10900	9050	42850	10712.50^{d}
2	18000	14950	13600	15150	61700	11375.00^{d}
3	18100	16880	16800	17800	69580	17395.00^{c}
4	18520	18050	19750	19100	75420	18855.00^{c}
5	19050	20150	22800	20050	82050	20512.50^{bc}
6	20200	22850	24050	21800	88900	22225.00^{ab}
7	21200	22950	25100	23050	92300	23075.00^{ab}
8	23050	24050	27200	24100	98400	24600.00^{a}
Total	**150220**	**150680**	**160200**	**150100**	**611200**	**19100.00**

* - Treatment means having a common letter superscript are statistically the same at 1% level DMRT.

Table 7. The average yield in tons/hectare of hybrid corn, showed a highly significant result. Differences in yield among treatment means were noticed. The highest was shown in T_8 (6.98 tons/hectare), followed by T_7 (6.65 tons/hectare), T_6 (6.26 tons/hectare), T_5 (5.22 tons/hectare), T_4 (4.71 tons/hectare), T_3 (4.48 tons/hectare), T_2 (4.27 tons/hectare) and the lowest with only 2.12 tons/hectare, the fertilizer only control (T_1). Treatment 7 and 8 was found to be comparable to each other but significantly different to all other treatments, although treatment 7 (6.65 t/ha) was also comparable to treatment 6 (6.26 t/ha).

Table 7. Grain yield in tons per hectare of hybrid corn (EVOGEN 747) as influenced by eNEBler applied at different rate in combination with inorganic fert. DA-RES Tupi, November 2016.

Treatment	I	II	III	IV	TOTAL	Mean*
1	2.230	2.010	2.020	2.220	8.480	2.12^{e}
2	4.320	4.400	4.010	4.380	17.110	4.27^{d}
3	4.385	4.640	4.420	4.470	17.915	4.48^{d}
4	4.460	4.810	4.700	4.870	18.840	4.71^{d}
5	5.515	5.310	5.010	5.050	20.885	5.22^{c}
6	6.705	6.690	5.940	5.710	25.045	6.26^{b}
7	6.910	6.810	6.610	6.250	26.580	6.65^{ab}
8	7.150	6.980	6.890	6.910	27.930	6.98^{a}
Total	**41.675**	**41.650**	**39.600**	**39.860**	**162.785**	**5.087**

* - Treatment means having a common letter superscript are statistically the same at 1% level DMRT.

IX. CONCLUSION

Based on the trial conducted, it was shown that treatment 8 with the highest volume of eNEBler mixed with urea gave the highest average yield of 6.98 tons/hectare. Although treatment 7 (6.65 t/ha) was found comparable to the highest yielder (T_8), it was also comparable to treatment 6 (6.26 t/ha). These two treatments were significantly higher to the treatment without fertilizer application (T_1 – 2.12 t/ha) and to treatment 2 (4.27 t/ha) the recommended rate of fertilizer without eNEBler. The increase in yield was accounted to the higher average number of ears harvested (Table 3) from both treatment (T_7 = 275.50; T_8 = 275.50) as revealed in table 3. Another contribution was on the average biomass in (Table 4). Treatments 7 (6142.50 gm/plot) and treatment 8 (6487.50 gm/plot) gave the highest average weight. Even in average weight of fresh ears without husk (Table 6), treatments 8 (24600 gms/plot) and 7 (23075 gms/plot) gave the highest average weight. These were the probable cause of the increase in yield, wherein increase in volume of eNEBler was practiced also. A gradual increase in volume of eNEBler applied mixed with urea resulted to a parallel increase in yield of hybrid corn. The increase in the number of ears harvested, biomass, weight of fresh ears and grain yield from eNEBler were all statistically significant.

X. RECOMMENDATION

It is recommended therefore that fertilizer be supplemented with 472.5 ml/ha eNEBler to increase corn production.