Organic Based Glutinous Corn (*Zea maize*) Supplemented With Seaweeds Emulsion

Asia Pacific Journal of Multidisciplinary Research
Vol. 5 No.4, 56-63
November 2017
P-ISSN 2350-7756
E-ISSN 2350-8442
www.apjmr.com

Jayrome S. Butay (MSA)
Cagayan State University- Gonzaga Campus, Gonzaga, Cagayan, Philippines
gilbertmagulod_rdecsulasam46@yahoo.com

Date Received: August 8, 2017; Date Revised: October 9, 2017

Abstract: *The study was therefore design to generate scientific information that are vital for organic farming advocates as it uses natural organic farm inputs in the production of corn. It was conducted because of the insurmountable rising cost of inorganic fertilizers perspective the farmers have to look for alternative measures to sustain the profitability of their farming business by evaluating the efficacy of seaweeds emulsion (Carrageenan) as nutrient supplement to organic fertilizer on glutinous corn production, a study was conducted at the Cagayan State University – Lal-lo, Cagayan from July 17 to September 25, 2016with the following treatments: T_1- Control, T_2 – 3 tons Organic Fertilizer, T_3 - 1.5 liters Seaweeds Emulsion ha^{-1}, T_4 - 3 liters Seaweeds Emulsion ha^{-1}, T_5 - 4.5 liters Seaweeds Emulsion $ha^{-1}$and T_6 - 6 liters Seaweeds Emulsion ha^{-1} arranged in Randomized Complete Block Design with three replications. The treatments have no significant effect on plant height. Application of seaweed emulsion affected the grain development as manifested by longer and heavier corn ear. Higher rates (3-6 li ha^{-1}) proved to more efficient as indicated by the bigger ear, highest yield and ROI of 909.62 percent. The study revealed that 3 tons Organic Fertilizer with liters of seaweed emulsion improved glutinous corn production. Further study is recommended to validate the result and come up with a more reliable conclusion.*

Keywords— *scientific information, seaweeds emulsion, organic fertilizer, carrageenan, organic farming*

INTRODUCTION

Corn is an important crop in the Philippines as staple food, livestock feed and raw materials for starches used in food processing and other industries. It is one of the major crops grown in the country with over million Filipino farmers depending on it as their main source of income and employment. Most farmers are interested to raise green corn because of the price and high demand in the market.

Through the years, farmers have optimized yield using inorganic fertilizers. Typically, the essential nutrients from fertilizer inputs forms part of the optimum production of crops but it also contributes to the significant portion of total crop input cost leading many farmers having dilemma of financing the agricultural inputs.

Optimizing yield is an important component of economical corn production. Managing fertilizer inputs is essential as it can be a significant portion of total crop input costs. Typically, the soil source is for adequate supply and plant uptake of essential nutrients in corn production [1].

Researches also showed that dependency to inorganic fertilizers to nourish agricultural lands resulted to soil pollution and imbalances. Due to excessive application of inorganic fertilizers, the pH value of soil has shown a significant change. This has made most agricultural land become stressed and unproductive. Because of the major disadvantage of inorganic fertilizers, several researches have focus on managing fertilization need through organic farming to reduce long-term input costs and bring back the fertility of the soil.

Most researches focus on managing fertilization needs through this nutrient supply system. Organic farming is considered a vital solution in revitalizing the fertility of the soil and bringing back its humus and productivity. Farm inputs specially inorganic chemicals and fertilizers are now sky high and income of farmers is getting smaller every year due to the production cost of the inorganic inputs [2]. With the increased health awareness, there is a high demand for organically grown crops. These crops are claimed to be produced through the use of organic

fertilizers which are free from chemicals and other synthetic substances. Furthermore, with the increasing prices of chemical fertilizers, these cause the shift of farmers to the use of organic fertilizer. In addition, farmers are becoming aware of the depletion of organic matter in the soil resulting to less soil fertility and find ways to restore the fertility to sustain crop production.

Most farmers cannot grow corn for market purposes because of the high cost of commercial fertilizer. However, the Department of Agriculture (DA) of the Philippines is aware of detrimental effect of the continuous application of the chemically manufactured inorganic fertilizer. One of their aims is to restore the organic matter content of soils by advocating the application of organic fertilizers and other soil ameliorants which are organic in nature. This is to improve the soil structure and aggregate stability, water holding capacity and enhance biological activities in the soil. The Department of Agriculture has been promoting organic farming for growing the plants through the use of organic or natural fertilizers. One newly discovered organic fertilizer is seaweed emulsion know as Carrageenan. Carrageenan comes from red edible seaweed usually used as food additive. When this undergoes radiation, it develops natural bioactive agents. The process produces oligo-carrageenan, polymers with shorter chains, which had been shown to have antibiotic, antioxidant and plant growth promoting (PGP) properties.

According to DOST-PCAARRD [3], Carrageenan plant growth promoter (PGP), extracted from red edible seaweeds, proved to be beneficial. In a 6,000 square meter rice field. It was observed that rice yield has increased from 2.4 tons last year to 3.9 tons or an increase of 62.5%. The application of carrageenan PGP was harvested earlier at 100 days after transplanting, instead of the standard harvesting time of 120 days. Panicle was robust, the grains were uniform, and there were minimal and almost no unfilled grains. The rice plants were also disease-free, uniform in height, and did not lodge even after a strong rain. A total of 4.5 L of carrageenan PGP was used in the farm, which he combined with three bags of inorganic fertilizer. Carrageenan PGP was applied 10 days after transplanting, followed by the second application two weeks after the first application, and 26 days after second application.

However, no data available yet for glutinous corn, thus, the study was conducted to evaluate the effect of seaweed emulsion on the growth performance of glutinous corn. The study was therefore design to generate scientific information that are vital for organic farming advocates as it uses natural organic farm inputs in the production of corn. It was conducted because of the insurmountable rising cost of inorganic fertilizers perspective the farmers have to look for alternative measures to sustain the profitability of their farming business.

OBJECTIVES OF THE STUDY

Generally, this study was conducted to evaluate the efficacy of seaweed emulsion as supplement to organic fertilizer on glutinous corn production. Specifically, it was conducted to: 1) Evaluate the growth and yield of glutinous corn with addition of varying rates of seaweed emulsion combined with organic fertilizer; 2) Identify the optimum rate of seaweed emulsion effective for organic corn production; 3) Evaluate which of the combination of seaweed emulsion and organic fertilizer has the highest return on investment.

MATERIALS AND METHODS

Research Design

This study is an experimental research using Randomized Complete Block Design (RCBD). The RCB is the standard design for agricultural experiments. The field or orchard is divided into units to account for any variation in the field. Treatments are then assigned at random to the subjects in the blocks-once in each block [4].

Securing of Seeds, Fertilizers and Biological Control Agents

The seeds of Open Pollinated Variety (OPV) glutinous corn (NSIC Cn 2004-162 commercially known as IES Glut 4) was secured from DA-NVES, Bagabag, Nueva Vizcaya, one of the Research Outreach Stations of the Department of Agriculture RFO No. 02. The biological control agents such as trichogramma cards (*Trichogramma evanescence and Trichogramma chilonis*), earwigs *(Euborellia annulata)* and Metarhizium anisopliae were secured at SCRC, Iguig, Cagayan.

Land Preparation

The experimental area of 410 square meters was thoroughly prepared for uniform seedling emergence and good root development. Plowing was done using

4-wheel drive tractor and harrowing the area was also undertaken one week after plowing using an animal-drawn plow implement to break the soil clods for effective weed control.

Laying-out the Experimental Area and Experimental Design

The prepared area was divided into three equal blocks, each block has a dimension of 6 meters x 20.5 meters. Each block was subdivided into six equal plots measuring into 6 meters x 3 meters and with a spacing of .5 meters between plots. The experimental treatments was randomly allocated following the randomization procedure for Randomized Complete Block Design (RCBD).

Experimental Treatments

The experimental treatments used the following treatments: T_1 – Control; T_2 – 3 T Organic Fertilizer ha^{-1} , T_3 – 1.5 L Seaweeds Emulsion ha^{-1} , T_4 – 3 L Seaweeds Emulsion ha^{-1} , T_5 – 4.5 L Seaweeds Emulsion ha^{-1} , T_6 – 6 L Seaweeds Emulsion ha^{-1} .

Construction of Furrows and Application of Fertilizer

Furrows at 75 centimetres apart were established before basal application of fertilizer. Three tons per hectare green friends fertilizer was weighed using an organic fertilizer was used to increase the organic matter in soil for the soil structure, particles or aggregation improvement in one time application. The fertilizer was covered with top soil to prevent the exposure of microorganisms to heat. The Seaweed emulsion was measured using a graduated cylinder and mixed with 16 liters water per sprayload (25 sprayloads per hectare) based on the imposed treatments. It was sprayed on the leaves of the plants at 15, 30 and 50 days after planting.

Planting and Thinning

Three seeds were planted per hill in a furrow with a distance of 20 centimetres between hills and 75 centimetres between rows using a jabber planter. Thinning was done at 15 days after planting to maintain two healthy plants per hill.

Care and Management of the Crop

Cultivation and Weeding. Off-barring was done at 18 days after planting. Hilling- up was also done at 33 days after planting. Cultivation was done to loosen the root zone of the plants to initiate the entry of oxygen in the roots and to control the growth of weeds.

Crop Protection. Regular monitoring of the area was conducted. The occurrences of pests were controlled using biological control agents such as trichogramma, earwigs and Metarhizium anisopliae.

Two hundred trichogramma cards per hectare was hanged at the fourth strongest leaves of the plants starting from the base at 22 and 30 days after planting. Two colonies at 5,000 pieces earwig per colony per hectare was released on the base of the plants at 30 and 40 days after planting. Twenty sachets of Metarhizium anisopliae mixed with 16 liters water per sprayload (10 sprayloads per hectare) was sprayed on plants at 33 days after planting.

Harvesting

The corn ears were harvested when it reaches soft dough stage. The ears of the sample plants were harvested one by one, placed in plastic sack, and properly labeled.

Data Gathered

Plant Height at 30 and 60 Days after Planting (DAP). The height of the 10 samples randomly selected will be measured from the base to the tip of the meristem by using a measuring meter stick at 30 days after planting, while the plant height at 60 days after planting was measured up to first node of the tassel.

Weight of Unhusk and Husked Ear (g). The 10 sample ears unhusk were weighed after harvest. The husks were removed and weighed. The weight was divided by ten to obtain the weight per ear. The weights were determined using a digital weighing balance.

Length of Corn Ear (cm). The length of husked ear from the 10 representative plants was measured by using a foot ruler from end to end.

Diameter of Ear (cm). The sample ear that was used in determining the length of husked ear was used to determine the diameter using a Vernier caliper

Yield from 6 m^2 Sampling Area (kg). All harvested ears in each sampling area with and without husk were weighed and use as the basis for the computation of yield per hectare.

Computed Yield per Hectare (kg). The yield per hectare was computed based on the yield obtained from the sampling area.

Statistical Analysis

All the data gathered and analyzed following the Analysis of Variance for the Randomized Complete Block Design. The Duncan's Multiple Range Test (DMRT) was used for the comparison of means with significant results.

OBSERVATION AND DISCUSSION OF RESULTS

Observation

Chemical and Physical Properties of the Experimental Area. The soil in the experimental area was clay loam with OM-4.5%, P-10 ppm, K–135 ppm and soil pH of 5.3.

Stand and Vigor of the Crop. All plants applied with vermicast organic fertilizer exhibited good stand with robust and greener leaves. However, it was observed further that the plants applied with 6 L carrageenan ha^{-1} (T_6) differed in growth and development from the plants in the other treatments. These plants showed excessive and prolific vegetative growth which was noticeable few days after the second application of carrageenan.

Occurrence of Insect Pests. It was observed that earworms *(Helicoverpa armigera)*, cutworms (*Spodoptera litura*) and flea beetle (*Chaetochnema pulicaria*). Leaf spot were also noticed in Treatment 1, 2, 3, and Treatment 5 at 34 days after planting. The above-mentioned pests were managed through application of biological control agents such as trichogramma, earwigs and *Metarhizium anisopliae*.

Number of Days to Tasseling and Silking. It was observed that plants applied with lower concentrations (1.5 to 4.5 liters per hectare) of carrageenan had 50% tasseling at 40 days after planting and 50% silking at 45 days after planting. However, it was noticed that the plants applied with carrageenan 6 liters per hectare had 50% tasseling at 50 days after planting and 50% silking at 55 days after planting.

Number of Days to Soft Dough Stage. The plants in T_1 (control), T_2 (3 tons vermicast organic fertilizer per hectare), T_3 (3 liters carrageenan per hectare) and T_4 (1.5 liters carrageenan per hectare) reached soft dough stage at 68 days after planting while plants in Treatment 5 and 6 with the application of 4.5 and 6 liters carrageenan reached up to 70 days after planting.

Discussion of Results

Plant Height (cm) at 30 and 60 Days after Planting (DAP). The plant height of glutinous corn at 30 and 60 days after planting as influenced by organic-based supplemented with seaweeds emulsion is presented in Table 1. Result showed no variation among the different treatments on the plant height at 30 days after planting with mean values ranging from 71.37 to 75.68 centimeters.

However, significant differences were observed on the height of the plants at 60 days after planting wherein the plants applied with 3 liters Seaweeds Emulsion ha^{-1} (T_4), 4.5 liters Seaweeds Emulsion ha^{-1} (T_5) and 6 liters Seaweeds Emulsion ha^{-1} (T_6) produced the tallest plants having mean values ranging from 214.30 to 215.20 centimeters, respectively. These were followed by the application of 3 tons Organic (T_2), and 1.5 liters Seaweeds Emulsion ha^{-1} (T_3) with mean values of 182.50 and 184.20 centimeters. Shortest plants were found on the control plants (T_1) with mean value of 155.07 centimeters. The variation in plant height is attributed to the application of seaweed emulsion. Seaweed products exhibit growth-stimulating activities, and the use of seaweed formulations as biostimulants in crop production is well established. Biostimulants are defined as ''materials, other than fertilizers, that promote plant growth when applied in small quantities'' and are also referred to as ''metabolic enhancers'' [5]. Seaweed components such as macro- and microelement nutrients, amino acids, vitamins, cytokinins, auxins, and abscisic acid (ABA)-like growth substances affect cellular metabolism in treated plants leading to enhance growth and crop yield [6].

Table 1. Plant Height (cm) of Organic-based Glutinous Corn Supplemented with Seaweeds Emulsion.

TREATMENTS	PLANT HEIGHT (cm	
	30 DAP	60 DAP
T_1 – Control	71.37	155.07c
T_2 – 3 T Organic Fertilizer ha^{-1}	74.50	182.50b
T_3 – 1.5 L Seaweeds Emulsion ha^{-1}	73.27	184.20b
T_4 – 3 L Seaweeds Emulsion ha^{-1}	75.68	215.20a
T_5 – 4.5 L Seaweeds Emulsion ha^{-1}	75.53	215.13a
T_6 – 6 L Seaweeds Emulsion ha^{-1}	74.85	214.87a
ANOVA RESULT	Ns	**
C.V. (%)	9.40	2.83

Note: Means with common letter/s are not significantly different with each other using DMRT.

Weight of Unhusk and Husked Ear (kg). The weight of unhusk and husked ear of organic-based glutinous corn supplemented with seaweeds emulsion are shown in Table 2. Significant differences among the treatment means were recorded on the weight of unhusked ear. Heaviest unhusk ear was obtained by the application 6 liters Seaweeds Emulsion ha^{-1} (T_6) with a mean 236.77 grams. This was followed by the plants fertilized with 4.5 liters Seaweeds Emulsion ha^{-1} (T_5) with 190.18 grams. The application of 3 liters Seaweeds Emulsion ha^{-1} (T_4) and 1.5 liters Seaweeds Emulsion ha^{-1} (T_3) obtained 185.22 and182.65 grams. The plants applied with 3 tons Organic Fertilizer (T_2) had 168.90 grams. The lightest unhusk ear was found on the control plants (T_1) with mean value of 155.10 grams.

Table 2. Weight (g) of Unhusk and Husked of Organic-based Glutinous Corn Supplemented with Seaweeds Emulsion.

TREATMENTS	Ear Weight (g)	
	Unhusk	Husked
T_1 – Control	155.10e	113.33e
T_2 – 3 T Organic Fertilizer ha^{-1}	168.90d	128.88d
T_3 – 1.5 L Seaweeds Emulsion ha^{-1}	182.65c	123.62d
T_4 – 3 L Seaweeds Emulsion ha^{-1}	185.22c	134.28c
T_5 – 4.5 L Seaweeds Emulsion ha^{-1}	190.18b	141.90b
T_6 – 6 L Seaweeds Emulsion ha^{-1}	236.77a	178.33a
ANOVA RESULT	**	**
C.V. (%)	6.62	7.48

Note: Means with common letter/s are not significantly different with each other using DMRT.

Similarly, the weight of husked ear was significantly influenced by seaweeds emulsion supplementation. Consistently, the plants applied with 6 liters Seaweeds Emulsion ha^{-1} (T_6) gave the heaviest husked ear with a mean 178.33 grams. It was followed by the plants applied with 4.5 liters Seaweeds Emulsion ha^{-1} (T_5) with a mean of 141.90 grams. The plants applied with 3 liters Seaweeds Emulsion ha^{-1} (T_4) had a mean of 134.28 grams. Next in rank was obtained by the application of 3 tons Organic ha^{-1} (T_2) and 1.5 liters Seaweeds Emulsion ha^{-1} (T_3) with mean values of 128.88 and 123.62 grams. The plants with no fertilization (T_1) exhibited the lightest ear husked with mean value of 113.33 grams.

The result indicates that the application of seaweed extracts trigger the growth of beneficial soil microbes and secretion of soil conditioning substances by these microbes. As mentioned, alginates affect soil properties and encourage growth of beneficial fungi. Ishii *et al.*, [7] observed that alginate oligosaccharides, produced by enzymatic degradation of alginic acid mainly extracted from brown algae, significantly stimulated hyphal growth and elongation of arbuscular mycorrhizal (AM) fungi and triggered their infectivity on trifoliate orange seedlings. Extracts of various marine brown algae [Laminaria japonica Areschoug and Undaria pinnatifida (Harvey) Suringar] could be used as an AM fungus growth promoter [8].

Ear Length and Diameter (cm). The organic-based glutinous corn supplemented with seaweeds emulsion influenced the length of corn ear (Table 4). Result showed that the plants applied 1.5 liters Seaweeds Emulsion ha-1 (T4), 4.5 liters Seaweeds Emulsion ha-1 (T5) and 6 liters Seaweeds Emulsion ha-1 (T6) produced the longest ear with 18.83 and 19.60 centimeters, respectively. However, the application of 4.5 liters Seaweeds Emulsion ha-1 (T5) was comparable to the plants applied with 3 liters Seaweeds Emulsion ha-1 (T3) and 1.5 liters Seaweeds Emulsion ha-1 (T4) with mean values of 18.83, 18.07 and 17.07 centimeters. The latter was comparable to the application of 3 tons Organic Fertilizer ha-1 (T2) with a mean 16.33 centimeters. The plants with no fertilization (T1) obtained the shortest ear with mean value of 13.27 centimeters.

Table 3. Ear (cm) Length and Diameter (cm) of Organic-based Glutinous Corn Supplemented with Seaweeds Emulsion.

TREATMENTS	Ear Length (cm)	Ear Diameter (cm)
T_1 – Control	13.27d	4.42c
T_2 – 3 T Organic Fertilizer ha^{-1}	16.33c	4.88c
T_3 – 1.5 L Seaweeds Emulsion ha^{-1}	17.07bc	4.78c
T_4 – 3 L Seaweeds Emulsion ha^{-1}	18.07b	5.55b
T_5 – 4.5 L Seaweeds Emulsion ha^{-1}	18.83ab	5.75b
T_6 – 6 L Seaweeds Emulsion ha^{-1}	19.60a	6.25a
ANOVA RESULT	**	**
C.V. (%)	4.01	8.69

Note: Means with common letter/s are not significantly different with each other using DMRT.

The ear diameter was significantly influenced by seaweeds emulsion supplementation. The plants applied with 6 liters Seaweeds Emulsion ha-1 (T6) gave the biggest ear having mean of 6.25 centimeters. It was followed by 3 liters Seaweeds Emulsion ha-1 (T4) and 4.5 liters Seaweeds Emulsion ha-1 (T5) with mean values of 5.55 and 5.75. Smallest ear was observed by the application of 3 tons Organic ha-1

(T2), 1.5 liters Seaweeds Emulsion ha-1 (T3) and no fertilization (T1) with 4.88, 4.78 and 4.42 centimeters. The result of the study implied that seaweed emulsion from seaweeds emulsion proved plays a very important role in grain development of glutinous corn because it composed the macro and micro elements [9].

Yield of Unhusk and Husked Ear per 6 m2 Sampling Area. The yield of unhusk and husked organic based glutinous corn per 6 m2 sampling area supplemented with seaweeds emulsion is shown in Table 5. Significant result was revealed on the yield of unhusk ear per sampling area wherein the heaviest unhusk ear was obtained by the plants applied with 6 liters Seaweeds Emulsion ha-1 (T6), 4.5 liters Seaweeds Emulsion ha-1 (T5) and 3 liters Seaweeds Emulsion ha-1 (T4) 12.14, 12.18 and 12.60 kilograms. Next in rank was attained by the application of 3 tons Organic Fertilizer ha-1 (T2), 1.5 liters Seaweeds Emulsion ha-1 (T3) with 19.18 and 9.30 kilograms. The plants with no fertilization (T1) produced the lightest ear with mean value of 7.76 kilograms.

Table 4. Yield (kg) of Unhusk and Husked Ear per 6 m^2 Sampling Area of Organic-based Glutinous Corn Supplemented with Seaweeds Emulsion.

Treatments	Yield of 6 m^2 Sampling Area (kg)	
	Unhusk	Husked
T_1 – Control	7.76c	5.83c
T_2 – 3 T Organic Fertilizer ha^{-1}	9.18b	8.20b
T_3 – 1.5 L Seaweeds Emulsion ha^{-1}	9.30b	8.24b
T_4 – 3 L Seaweeds Emulsion ha^{-1}	12.14a	9.05a
T_5 – 4.5 L Seaweeds Emulsion ha^{-1}	12.18a	9.15a
T_6 – 6 L Seaweeds Emulsion ha^{-1}	12.60a	9.93a
ANOVA RESULT	**	**
C.V. (%)	5.27	6.36

Note: Means with common letter/s are not significantly different with each other using DMRT.

Likewise, significant result was observed on the ear yield of husked ear wherein the supplementation of 3 liters Seaweeds Emulsion ha-1 (T4), 4.5 liters Seaweeds Emulsion ha-1 (T5) and 6 liters Seaweeds Emulsion ha-1 (T6) having mean values of 9.93, 9.15 and 9.05 kilograms, respectively. It was followed by the plants fertilized with 3 tons Organic Fertilizer ha-1 (T2), and 1.5 liters Seaweeds Emulsion ha-1 (T3) with 8.20 and 8.24 kilograms. While the lightest was found on the control plots (T1) having mean value of 5.83 kilograms. The result of the study proved the findings of DOST-PCAARRD [3] that Carrageenan plant growth promoter (PGP), extracted from red edible seaweeds is beneficial to increased crop yield.

Computed Yield of Unhusk and Husked. Table 5 showed the computed yield per hectare of organic-based glutinous corn unhusk and husked ear supplemented with seaweeds emulsion**.** The unhusk ear yield are arranged in descending order: T_6 – 21000.00 kilograms (21.00 tons), T_5 – 20300.00 kilograms (20.30 tons), T_4 – 20233.33 kilograms (20.30 tons), T_6 – 8638.67 kilograms (8.64 tons), T_3 – 6820.00 kilograms (6.82 tons) and T_1 – 5687.00 kilograms (5.69 tons) .

Table 5. Computed Yield of Unhusk and Husked Ear per Hectare of Organic-based Glutinous Corn Supplemented with Seaweeds Emulsion.

TREATMENTS	Computed Ear Yield Per Hectare			
	Unhusk		Husked	
	kilograms	tons	kilograms	tons
T_1 – Control	12933.33	12.93	9716.67	9.72
T_2 – 3 T Organic Fertilizer ha^{-1}	15300.00	15.30	13666.67	13.67
T_3 – 1.5 L Seaweeds Emulsion ha^{-1}	15500.00	15.50	13733.33	13.73
T_4 – 3 L Seaweeds Emulsion ha^{-1}	20233.33	20.23	15083.33	15.08
T_5 – 4.5 L Seaweeds Emulsion ha^{-1}	20300.00	20.30	15250.00	15.25
T_6 – 6 L Seaweeds Emulsion ha^{-1}	21000.00	21.00	16550.00	16.55

On the other hand, the yield of husked ear are: T_4 – 6538.89 kilograms (6.54 tons), T_5 – 6534.00 kilograms (6.53 tons), T_6 – 6520.56 kilograms (6.52 tons), T_2 – 6505.89 kilograms (6.51 tons), T_3 – 5531.78 kilograms (5.53 tons) and T_1 – 4404.89 kilograms (4.40 tons) on the unhusked ear.

Cost and Return Analysis. The cost and return analysis of one hectare organic based glutinous corn production is shown in Table 8. The return of investment obtained in the different treatments are arranged in descending order: Treatment 6 had 909.62 percent, Treatment 3 had 884.10, Treatment 5 had 881.62 percent, and Treatment 4 had 659.43 percent. The lowest was obtained by Treatment 1 with 397.42 percent.

Table 6. Cost and Return Analysis.

Treatments	Cost Of Production	Gross Income	Net Income	ROI (%)
T_1 – Control	26000	129330	103330	397.42
T_2 – 3 T Organic Fertilizer ha^{-1}	99800	765000	665200	666.53
T_3 – 1.5 L Seaweeds Emulsion ha^{-1}	102050	775000	672950	659.43
T_4 – 3 L Seaweeds Emulsion ha^{-1}	102800	1011650	908850	884.10
T_5 – 4.5 L Seaweeds Emulsion ha^{-1}	103400	1015000	911600	881.62
T_6 – 6 L Seaweeds Emulsion ha^{-1}	10400	1050000	946000	909.62

CONCLUSION AND RECOMMENDATION

Generally, this study was conducted to evaluate the efficacy of seaweed emulsion as supplement to organic fertilizer on glutinous corn production. Specifically, it was conducted to evaluate the growth and yield of glutinous corn with addition of varying rates of seaweed emulsion combined with organic fertilizer, to identify the optimum rate of seaweed emulsion for organic corn production and to evaluate which of the combination of seaweed emulsion and organic fertilizer has the highest return on investment. The study was conducted at the Cagayan State University – Lal-lo, Cagayan from July 17 to September 25, 2016. The different treatments used were T_1 – Control, T_2 – 3 tons Organic Fertilizer, T_3 – 1.5 liters Seaweeds Emulsion ha^{-1}, T_4 – 3 liters Seaweeds Emulsion ha^{-1}, T_5 – 4.5 liters Seaweeds Emulsion $ha^{-1}$and T_6 – 6 liters Seaweeds Emulsion ha^{-1}. The experiment was laid out in Randomized Complete Block Design with three replications.

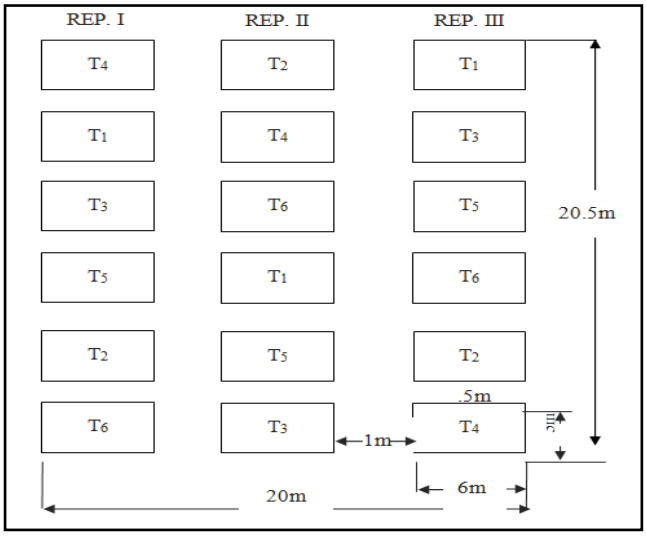
The result of the study are summarized as follows: 1) Height of plants at 60 days after planting was not affected by the application of seaweed emulsion. However, it was observed that the application of 3, 4.5 and 6 liters Seaweeds Emulsion per hectare obtained the tallest plants at 60 days after planting; 2) Heaviest unhusk and husked ear was obtained by the application of 6 liters Seaweeds Emulsion per hectare while the heaviest husked ear were obtained 6 liters Seaweeds Emulsion per hectare; 3) Longest ear were obtained by the plants applied with 4.5 and 6 liters Seaweeds Emulsion per hectare; 4) Biggest corn ear was produced by the plants applied 6 liters Seaweeds Emulsion per hectare; 5) The application of 3, 4.5 and 6 liters Seaweeds Emulsion per hectare had the highest unhusk and husked ear yield per sampling area; 6) Highest return on investment was obtained by the application of 6 liters Seaweeds Emulsion per hectare with 909.62 percent.

The application of 3 to 6 liters Seaweeds Emulsion per hectare produced the tallest plants, longest ear length and highest ear yield per sampling area. However, the application of 6 liters per hectare produced the biggest ear diameter and weight of unhusk and husked per ear as well as it obtained the highest return on investment with 909.62 percent.

The implication of this study to the community is to minimize the cost of production since most farmers cannot grow corn for market purposes because of the high cost of commercial fertilizer.

This paper stresses that the application of 6 liters per hectare is recommended because it obtained the highest green corn ear yield and highest return on investment. Further, it also recommends that other studies should be conducted during dry season to prove the same result with the same treatment since this study was only conducted during wet season.

APPENDIX: Experimental Layout Randomized Complete Block Design



LEGEND:
Treatments:
T_1 – Control
T_2 – 3 T Organic Fertilizer ha^{-1}
T_3 – 1.5 L Seaweeds Emulsion ha^{-1}
T_4 – 3 L Seaweeds Emulsion ha^{-1}
T_5 – 4.5 L Seaweeds Emulsion ha^{-1}
T_6 – 6 L Seaweeds Emulsion ha^{-1}

P-ISSN 2350-7756 | E-ISSN 2350-8442 | www.apjmr.com
Asia Pacific Journal of Multidisciplinary Research, Vol. 5, No. 4, November 2017

Total Area . . . . . 410 square meters
Block Size . . . . . 6 m x 20.5 m
Plot Size . . . . . 6 m x 3 m
Distance between Plots . . . 0.5 m
Distance between Blocks . . . 1 m

REFERENCES

[1] Sawyer, J.E. and D. Barker . 2000. Foliar Fertilization of Corn. Department of Agronomy Iowa State University.
[2] Sharma, A.K. 2005. The Potential for Organic Farming in the Drylands**.** In Agroforestry Systems for Degraded Lands, eds. P. Singh et al., 164-167. New Delhi.
[3] DOST-PCAARRD. 2016. S&T Media Service.
[4] http://www.tfrec.wsu.edu/ANOVA/index.html
[5] Zhang, X. and R.E. Schmidt. 1997. The impact of growth regulators on the a-tocopherol status in water-stressed Poa pratensis L. Int Turfgrass Res J 8:1364–1373.
[6] Crouch, I.J., J. van Staden. 1992. Effect of Seaweed Concentrate on the Establishment and Yield of Greenhouse Tomato Plants. J Appl Phycol 4:291–296
[7] Ishii, T., J. Aikawa, S. Kirino, H. Kitabayashi, I. Matsumoto, and K. Kadoya. 2000. Effects of Alginate Oligosaccharide and Polyamines on Hyphal Growth Of Vesicular-Arbuscular Mycorrhizal Fungi and their Infectivity of Citrus Roots. In: Proceedings of the 9th International Society of Citriculture Congress, Orlando, FL, 3-7 December 2000;1030-1032.
[8] Kuwada, K., L.S. Wamocho, M. Utamura, I. Matsushita and T. Ishii. 2006. Effect of red and green algal extracts on hyphal growth of arbuscular fungi, and on mycorrhizal development and growth of papaya and passionfruit. Agron J 98:1340–1344.
[9] BIOTECH. 2014. Chemical Analysis of Carrageenan. National Institute of Molecular Biology and Biotechnology. University of the Philippines. College, Laguna.

COPYRIGHTS