# Seaweed Extract and Different Complete Fertilizer Rates on *Zea mays* Under MSU-Buug Soil and Climatic Conditions

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## ABSTRACT

This study was conducted to determine the yield of *Sweet Corn* using different rates of *Complete Fertilizer* and *Seaweed Extract* under the prevailing soil and climatic conditions in Buug, Zamboanga Sibugay. The experimental area was laid out using Randomized Complete Block Design (RCBD) with nine combined treatments replicated three replications. An area of 324m$^2$ excluding alley ways and canals was utilized in this study. Based on the findings of the study, there was no significant difference on the average length, average circumference, average weight and total number of corn ears per plot per treatment, however there is a highly significant difference on the total weight of corn ears using different rates of seaweed extract. For the different rates of complete fertilizer and on treatment combinations, there were no significant differences on the average length, average circumference, average weight, total weight and total number of corn ears per plot per treatment. Thus, the adoption of any rates of complete fertilizer and seaweed extract to obtain longer length, bigger circumference, heavier corn ears, and more number of corn ears is highly recommended.



**Keywords :** Sweet Corn; Saccharata; Seaweed Extract; Corn Ears; Fertilizer Rates

## 1 INTRODUCTION

Sweet Corn (*Zea mays*) is observed as one of the important agronomical crops in the Philippines. It is produced by most Filipinos due to its nutritive value. However, the production of this commodity is found costly because it requires high nutrient demand. Hence, to achieve high yield performance, the application of different fertlizers types and levels play an important role.

Sweet corn is one of the most popular crop in the Philippines. It is becoming popular in Asian countries. Sweet corn differs from other corns because the kernels have a high sugar content in the milk on early dough stage. It is consumed in the immature stage of the crop. The kernels of sweet corn taste much sweeter than normal corn, especially at 25-30% maturity. In the Philippines, sweet corn industry is expanding because of increasing consumption of most Filipinos. It is an attractive crop for producers to grow because the plant grows quickly and is considered a valuable rotational crop and farming operation can be mechanized. Planting usually commences in spring when soil temperature reaches above 12°C. In warmer regions with longer growing season allows two crops to be planted each year, however taking the major constraints of shorter growing period together with cold stress at early and late stages of crop development restricts it to mono-cropping under temperate conditions. The potential of the sweet maize crop is not being exploited satisfactorily due to many constraints among which inappropriate nutrient supply ranks first. Others are pest problems at maturity, low fertility status of the soils and the high cost of the scarce inorganic fertilizers with their potential polluting effects on the environment following continuous usage. Soils of the agro-ecology are generally low in organic matter as a result of the rapid mineralization and the fact that very little organic matter is added to the soil during and after cropping [6]. The need to use renewable forms of energy has rekindled interest in the use of organic fertilizers such as seaweed extract, cow dungs, poultry droppings and crop residues as alternatives for inorganic fertilizer worldwide.

*Zea mays* is identified as one of the most important staple food crops in West and Central Africa. The Savanna of West and Central Africa has one of the greatest potential for its major production because of relatively higher incident of solar radiation and lower incident of pest and diseases during the cropping season [2]. In 2008, the world production was 822.7 million tonnes, 53.4 million tonnes for Africa and 7.5 million tonnes for Nigeria [4]. its production has expanded dramatically in the Northern Guinea Savanna of West Africa where it has replaced traditional cereals and serves as both a food and a cash crop. In West Africa, [8] assessed maize as one of the five main crops of the farming systems in 124.7 million hectare

or 72% of West Africa. The Northern Guinea Savanna alone took about 92% of total area grown in Nigeria. It is also widely believed to have the greatest potential among food crops for attaining the technological breakthroughs that will improve food production in the region [5].

There are several factors affecting the growth and yield of maize such as spacings, fertilizers, and the environment. Growing the crop at appropriate spacing is one of the bases for higher yield, whereas intra-row spacing at sub optimum is a major constrain to attaining the yield potential of the crop [1]. Intra-row spacing for maximum grain yield in maize varies from 20 to 45 cm [9]. There is no single recommendation for all environments and all *Zea mays* types and varieties because optimum spacing for optimum *Zea mays* yield could vary depending on climatic factors such factors as soil fertility, variety and type, planting date and planting pattern among others [7]. Because of the high nutrient demand by *Zea mays*, its production requires high inputs of fertilizer. However, because of high cost, unavailability and low levels of soil organic matter, alternative organic sources of nutrients particularly N needs to be included in *Zea mays* fertilization. The use of seaweed extract is needed to ensure an efficient nutrient management in the *Zea mays*-based cropping systems in the Northern Guinea Savanna. Research conducted in Northern Guinea Savanna and elsewhere had shown great improvement in the yield of crop as a result of improvement in organic fertilizer [3].

In this study, it aimed to determine the effect of seaweed extract and various complete fertilizers' (14-14-14) rates on the yield of sweet corn.

## 2 METHODOLOGY

### 2.1. Materials

Materials used in conducting the study are carabao drawn plow, harrow, bolo, sprayer, meter stick, plastic straw, treatment indicators, sign boards, shovel, weighing scale, tape measure, cellophanes, record notebook, ball pen and camera. *Macho F1,* a hybrid corn variety was used in this study. It is a very promising variety for the livelihood of farmers. It can be harvested 65-75 days after planting. Complete (14-14-14) Muriate Potash (0-0-60) and Urea (46-0-0) were the inorganic fertilizers used in the study. *Brodan* was the chemical used to control insect pest.

### 2.2. Reseach Design

A total area of 324m$^2$ was utilized in the experiment replicated three (3) times. Each block is divided into nine (9) combined treatments. Each plot was measured two (2) meters in width and six (6) meters in length. One (1) meter space was provided between blocks and experimental plots. In addition, the experiment was laid out using Randomized Complete Block Design (RCBD).



### 2.3. Cultural Practices and Management

The field was plowed using animal drawn mold board plow and harrowing was done to further pulverize larger soil aggregates and destroy emerging weeds. The area was fenced to prevent the entry of stray animals. Planting was done with the distance of 75 cm between rows and 20 cm between hills, sowing three seeds per hill with the depth of 2 cm. Seeds were covered thinly with soil. Thinning was done 7 days after the seedling has completely emerged. The strongest seedlings were saved and excess plants were removed using hand trowel. Cultivation and weeding were done simultaneously 20 days after planting to keep the soil in good tilth and free from weeds. Hand weeding was done 25 days after planting to remove newly sprouted weeds and to aerate the soil.

Corn plants were watered evenly especially during dry period. The field was irrigated after planting using sprinkler. The first irrigation was done 3 days after planting and the following irrigation was done with the interval of 7 days depending on the actual rainfall condition in the area. Insect pests attacking the corn plants were corn *earworms*, *armyworms*, and *cutworms*. They were controlled by spraying 2.5ml of *Brodan* mixed with 16 liters. This was applied 25 days after planting. Seaweed fertilizer was prepared by washing the seaweed and was sliced into small pieces, blended until it becomes gritty in texture. After blending, seaweed extract was placed into a container and refrigerated for 24 hours to produce a considerable amount of liquid. After mixing the blended seaweeds and molasses, 1 liter of seaweed was added for every 1 liter of molasses. It was placed then into three different containers that contains 1.5 liters, 2.0 liters and 2.5 liters for application.

Complete fertilizer was applied basally before planting with the amount of 3g per plant for $F_1$, 4g for $F_2$, and 5g for $F_3$. The seaweed extract was applied trice. First application was done during the 6 inches growth stage, second application was done when the plants attained the average height of 14 inches, and third application was done just before tasseling after planting with the amount of 7.5225 milliliter per plant with 1.5 liters/ha of seaweed extract and 500 L of water concentration for $S_1$, 7.53 milliliter per plant with 2.0 liters/ha of seaweed extract and 500 L of water concentration for $S_2$, and 7.5375 milliliter per plant with 2.5 liters/ha of seaweed extract and 500 L of water concentration. 120 grams of Urea (46-0-0) was applied (side dressing) 25 days and 45 days after planting with the amount of 1.5 grams per plant.

The ears of *Macho F1* were harvested 75 days after planting. At this stage, the ears are early dough stage. It was picked up or harvested while the husk was still green in color and the silk had already turn brown and firmed. The number of sample per plot was determined by getting 30 percent of total plant per plot in every fourth plant in a row.

The data gathered were the following: (1) Average circumference of husked corn ears in cm per plot per treatment. The circumference of each corn ear from the sample plants in every plot was measured using tape measure. (2) Average length of husked corn ears in centimeter per plot per treatments. The husk corn ear from the sample plant in every plot was measured and were added. The total were divided by the total number of samples to get the average length in centimeter per plot per treatment. (4) Average weight of husked corn ears in gram per plot per treatment. The harvested corn was weighed, added and divided by the total number of samples to get the

average length using digital weighing scale. (4) Total weight of husked corn ears in kilogram per plot treatment. The harvested husked corn ear per plot per treatment was weighed using weighing scale. (5) Total number of husked corn ears per plot per treatment. The harvested husked corn ears was counted per plot per treatment. The data collected were added to get the total number of husked corn ear per plot per treatment.

### 2.4. Statistical Analysis

Analysis of variance (ANOVA) for Two-Way classification with interaction was used in the study to determine if there was a significant difference among the yield of sweet corn using different rates of complete fertilizer and rates of seaweed extract. Scheffe method was utilized to determine which of the different rates of complete fertilizer and rates of seaweed extract was recommended. Table below were the treatments:

### 2.5. Treatments and Treatment combinations

**Table 1.**
**Treatments, Variables' Combinations, Description (Amount of Complete Fertilizer per Plant in gram (F) and Amount of Seaweed Extract (S))**

| Treatments | Variables' Combinations | Description | |
|---|---|---|---|
| | | Amount of Complete Fertilizer per Plant in gram (F) | Amount of Seaweed Extract (S) |
| $T_1$ | $F_1S_1$ | 3 grams of complete fertilizer | 7.5225 milliliter per plant with 1.5 liters/ha of seaweed extract and 500 L of water concentration |
| $T_2$ | $F_1S_2$ | 3 grams of complete fertilizer | 7.53 milliliter per plant with 2.0 liters/ha of seaweed extract and 500 L of water concentration |
| $T_3$ | $R_1F_3$ | 3 grams of complete fertilizer | 7.5375 milliliter per plant with 2.5 liters/ha of seaweed extract and 500 L of water concentration |
| $T_4$ | $F_2S_1$ | 3.75 grams of complete fertilizer | 7.5225 milliliter per plant with 1.5 liters/ha of seaweed extract and 500 L of water concentration |
| $T_5$ | $F_2S_2$ | 3.75 grams of complete fertilizer | 7.53 milliliter per plant with 2.0 liters/ha of seaweed extract and 500 L of water concentration |
| $T_6$ | $F_2S_3$ | 3.75 grams of complete fertilizer | 7.5375 milliliter per plant with 2.5 liters/ha of seaweed extract and 500 L of water concentration |
| $T_7$ | $F_3S_1$ | 4.5 of grams complete fertilizer | 7.5225 milliliter per plant with 1.5 liters/ha of seaweed extract and 500 L of water concentration |
| $T_8$ | $F_3S_2$ | 4.5 of grams complete fertilizer | 7.53 milliliter per plant with 2.0 liters/ha of seaweed extract and 500 L of water concentration |
| $T_9$ | $F_3S_3$ | 4.5 of grams complete fertilizer | 7.5375 milliliter per plant with 2.5 liters/ha of seaweed extract and 500 L of water concentration |

*Treatments (T); Row Spacings (R); Schedule of Application (F)*



## 3 RESULT AND DISCUSSION

### 3.1. Average Circumference of Corn (in cm)

Figure 1 presents the average circumference of corn ears in centimeter per plot per treatment. In complete fertilizer, it shows that $f_2$ obtained the highest total circumference with 180.340cm followed by $f_1$ with 176.920cm and $f_3$ obtained the lowest total with 175.550cm. For seaweed extract, $S_2$ obtained the highest total with 179.560 followed by $S_1$ with 177.960 and $S_3$ obtained the lowest total with 175. In addition, $T_2$ reveals the highest average circumference with 60. 61cm (*see Figure 1*)

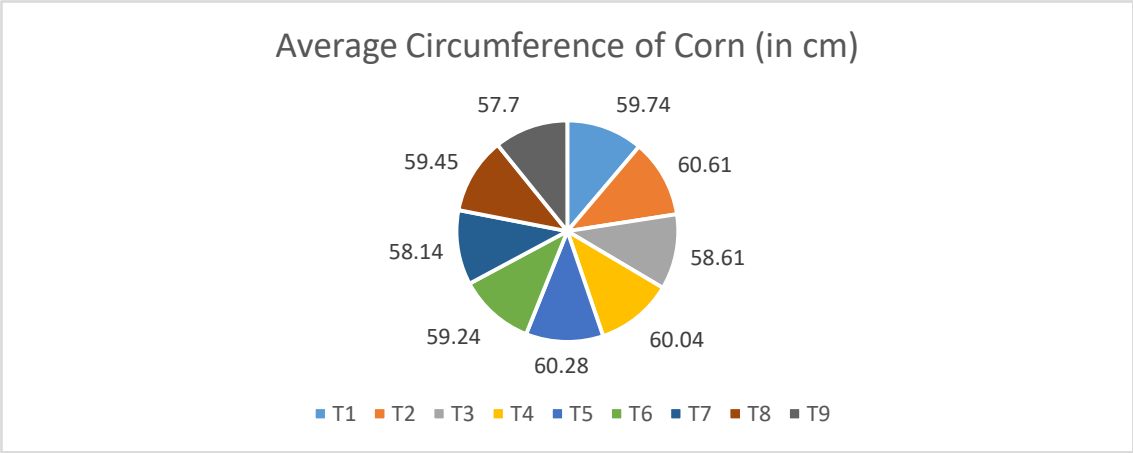


**Figure 1. Average Circumference of Corn Measured in Centimeter per Plot per Treatment**

### 3.2. Average Length of Corn (in cm)

Figure 2 presents the average legth of corn ears in centimeter per plot per treatment. In complete fertilizer, it shows that $f_2$ obtained the highest total length with 262.760cm followed by $f_3$ with 258.850cm and $f_1$ obtained the lowest total length with 258.530cm. For seaweed extract, $S_2$ obtained the highest total length with 265.970cm followed by $S_1$ with 258.750cm and $S_3$ obtained the lowest with 255.420cm. However, $T_6$ shows the highest average length of corn with 88.78cm.



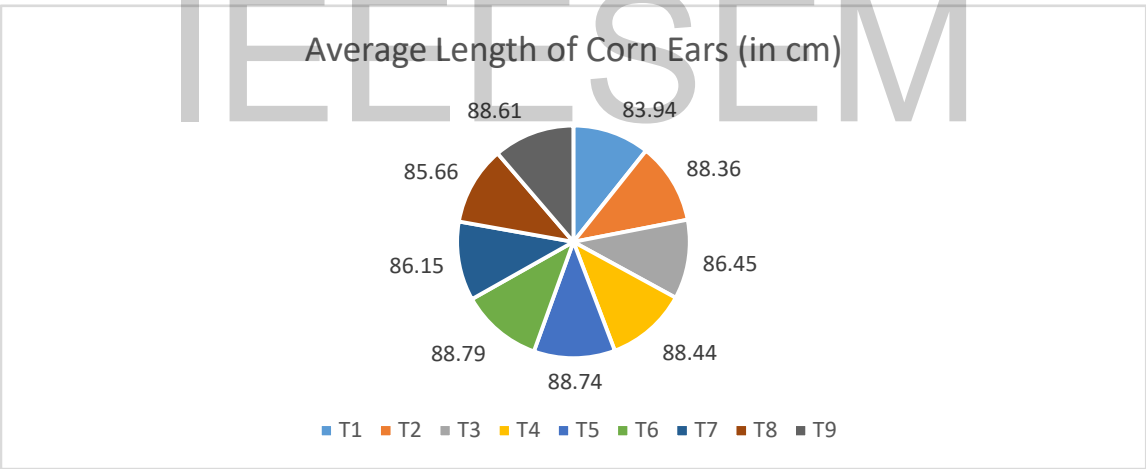


**Figure 2 Average Length of Corn (in cm)**

### 3.3. Average Weight of Corn (in gram)

Figure 3 presents the average weight of corn ears in grams per plot per treatment. In complete fertilizer, it shows that $f_3$ obtained the highest average with 2872.250g followed by $f_2$ with 2824.920g and $f_1$ obtained the lowest average with 2804.970g. For seaweed extract, $S_2$ obtained the highest average with 2969.540g followed by $S_1$ with 2777.160g and $S_3$ obtained the lowest average with 3755.440g. In this study, $T_4$ reveals the highest average weight of corn with 1002.65g.

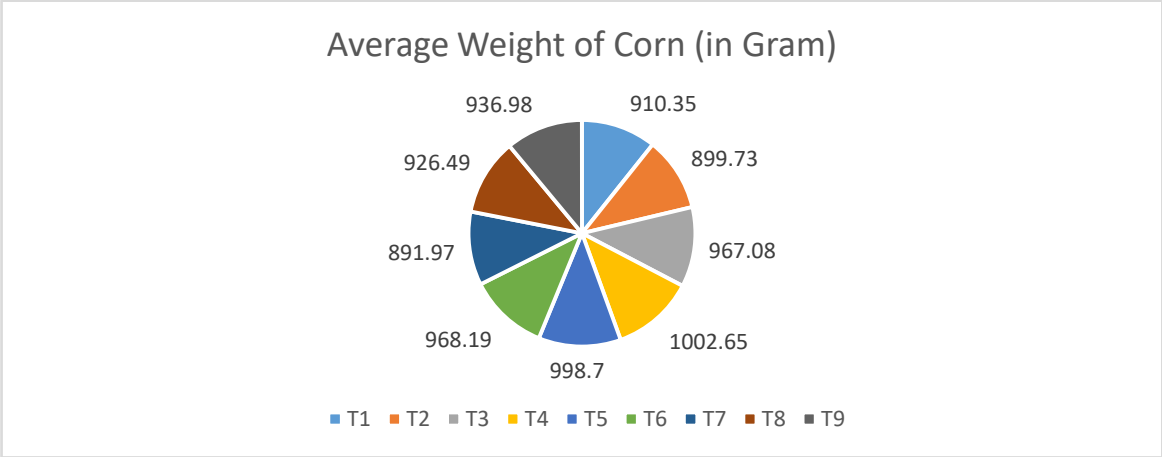


**Figure 3. Average Weight of Corn (in grams) per Plot per Treatment**

### 3.4. Total Weight of Corn (in kg)

Figure 4 presents the total weight of corn ears in kilogram per plot per treatment. In complete fertilizer, it shows that $f_3$ obtained the highest total weight with 229.630kg followed by $f_2$ with 225.970kg and $f_1$ obtained the lowest total with 224.190kg. For seaweed extract, $S_2$ obtained the highest total weight with 237.420kg followed by $S_1$ with 222.140kg and $S_3$ obtained the lowest total weight with 220.230kg. Study shows that $T_4$ obtained the highest total weight with 80.2kg.



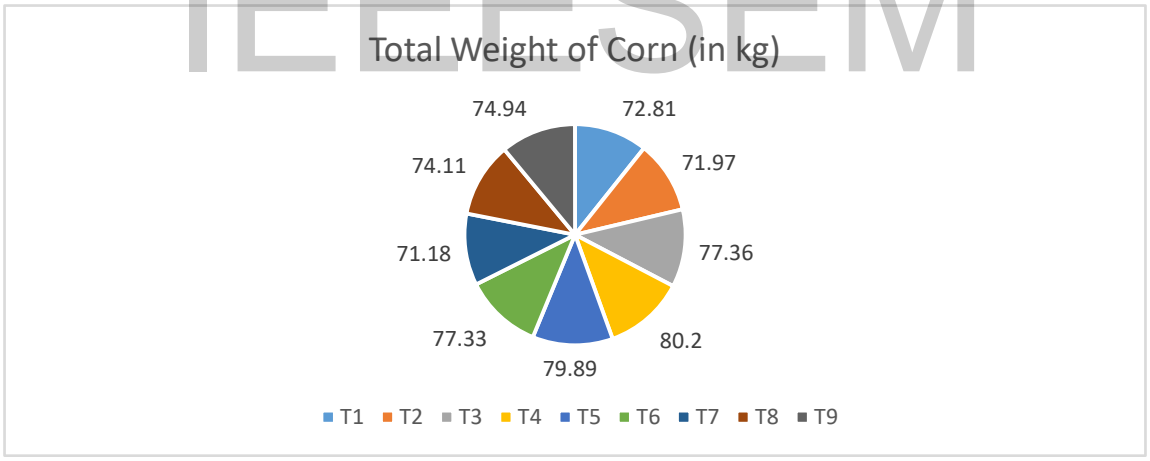


**Figure 4. Total Weight of Corn (in kg)**

### 3.5. Total Number of Corn Ears

Figure 5 presents the total number of corn ears per plot per treatment. In complete fertilizer, it shows that $f_3$ obtained the highest total number with 641.000 followed by $f_1$ with 636.000 and $f_2$ obtained the lowest total number with 624.000. For seaweed extract, $S_2$ obtained the highest total number with 645.000 followed by $S_1$ with 634.000 and $S_3$ obtained the lowest total number with 622.000. In this study, $T_5$ shows the highest total number of corn ears.

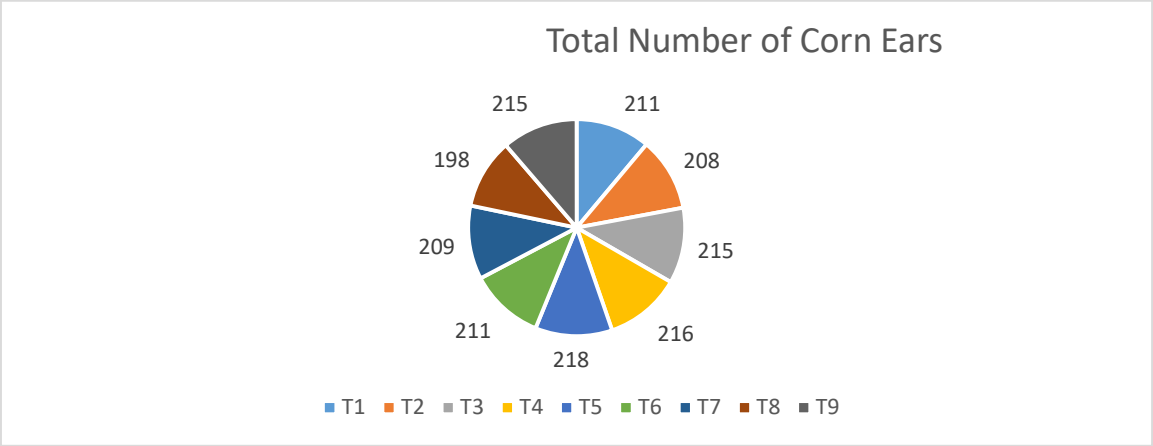


**Figure** 5. **Total Number of Corn Ears**

## 4 CONCLUSION

Based on the result of the study, there was no significant difference among the average circumference, average weight, total numbers, total weight of sweet corn ears in centimeters per plot per treatment using different rates of complete fertilizer, seaweed extract, and among the treatment combinations. In addition, there was no significant difference among the average length of sweet corn ears in centimeters per plot per treatment using different rates of complete fertilizer, and among the treatment combinations. However, there was a highly significant difference among the average length of sweet corn ears per plot treatment using different rates of seaweed extract.



## 5 RECOMMENDATION

Based on the result of the study, the following were recommended:

1. The adoption of different rates of complete fertilizer, seaweed extract and treatment combinations to obtain bigger circumference of sweet corn ears in centimeters;
2. The adoption of $S_1$ and $S_2$ to obtain longer length of sweet corn ears in centimeters;
3. The adoption of different rates of complete fertilizer, seaweed extract and treatment combinations to obtain heavier sweet corn ears in gramper plot per treatment;
4. The adoption of different rates of complete fertilizer, seaweed extract and treatment combinations to obtain more number of sweet corn ears per plot per treatment; and
5. The adoption of different rates of complete fertilizer, seaweed extract and treatment combinations to obtain higher yield of sweet corn ears per plot per treatment.

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