Synthetic Chemical Nutrient Application and Seaweed Extract Supplement on *Zea mays* under MSU-Buug Soil and Climatic Conditions

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Abstract. This study was conducted to determine the yield performance of sweet corn applied with synthetic chemical nutrients and supplemented with different levels of 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 four treatments and four replications. An area of 168m^2 excluding alley ways and canals was utilized in this study. Based on the findings of the study, there was no significant difference among the average length, average weight and total weight of sweetcorn ears per plot per treatment. However, the average circumference and the total number of sweetcorn ears per plot per treatment showed significant differences being applied with inorganic fertilizer and supplemented with different rates of seaweed extract. Hence, adoption of T_4 is recommended to obtain bigger circumference and more number of sweetcorn ears is further recommended.

Keywords: Sweet Corn, Seaweed Extract Supplement, Synthetic Chemical Nutrients, Yield Performance

Introduction

Philippines agricultural food production is considered to be one major sources of income among Filipinos. Farmers continue to look for avenues to gain profit with less expenses incurred. With the help of Agricultural Extension Workers (AEWs) who transfer farming technology, the latter tend to see more opportunities of exploring new agricultural venture. Corn production, though, a tradition in the country raising sweet corn can be considered a new endeavour that interests our brethren in the countryside since it denotes additional livelihood.

Sweet corn (*Zea mays*) is one popular, important agronomical crops being raised among Filipino farmers. It is produced by most Filipinos because of its nutritive value and for its expected profit. However, its production is costly since it requires high nutrient demand. To minimize production cost yet achieve high yield performance, the application of synthetic chemical nutrients and different levels of seaweed extract supplements is deemed worthy of this present study to possibly help farmers profit better with lesser financial cost.

Sweet corn is not only one of the most popular crops in the Philippines but also in some other Asian countries. Sweet corn differs from other corns because the kernels have high sugar content of its milk in 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. The corn's sweetness remains 3-4 days after harvest and it yields 12 to 14 tons per hectare. It can be harvested 75 days after planting.

Planting usually commences in spring when soil temperature reaches above 12°C. In warmer regions with longer growing season, two cropping can happen each year. However, taking into account 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 because of many constraints one of which is inappropriate nutrient supply ranking first. Others are pest problems at maturity, low fertility status of the soils and the high cost of 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 of the fact that very little organic matter is added to the soil during and after cropping (Lal & Greenland, 1979). 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.

Sweet corn (*Zea mays var. saccharata*) also called sugar corn is a variety of maize with a high sugar content. It is the result of naturally occurring recessive mutation in the genes which control conversion of sugar to starch inside the endosperm of the corn kernel. It is picked when immature (milk stage) and prepared and eaten as a grain (Hemphill, 2010).

Seaweed extract is a new generation of natural organic fertilizer containing highly effective nutritious and promotes faster germination of seeds and improves plant resistance to frost, drought and increases crop yields. Plants sprayed with seaweed extract are also characterized with higher resistance to pest and pathogens and more efficient consumption of nutrients from soil. It can also contribute to the recovery of damages caused by insects and bacterial or fungal disease (Stephenson, 1968).

With dearth of studies conducted on sweet corn production in the locality, this study serves to fill the research gap. With this undertaking, the researchers had to establish a demo farm to show the effectiveness of different rates of seaweed extract to possibly see results of yield performances. Thus, this study offers insights to farmers as to sweet corn production and even contributes to the existing literature.

Methodology

Materials

Materials used in conducting the study were carabao drawn plow, harrow, hand trowel, bolo, sacks, steel tape, plastic straw, tape measure, ruler, bamboo stick, knapsack sprayer, water container, water sprinkler, sign boards, weighing scale, notebook, ballpen, calculator, and camera. Sweet Grande F1, a hybrid corn variety was used in the study. Urea (46-0-0), Complete fertilizer (14-14-14), and Muriate of Potash (0-0-60) were the inorganic fertilizers used in the study. Karate EC was used to control cutworms and aphids and Dithane for fungal diseases.

Research Design

A total area of 168m^2 was utilized in the experiment replicated four (4) times. Each block was divided into four (4) treatments. Each plot was measured one and a half (1.5) 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).

Cultural Practices

The first plowing was done after the area was thoroughly prepared by cutting the tall grasses using the sharp bolo. Three days after, second plowing followed. To pulverize larger soil aggregate first harrowing was done after 7 days before planting and second harrowing followed 3 days before planting. Direct seeding was applied with the distance of 75 cm between rows and 30 cm between hills, sowing two viable seeds per hill with the depth of 2 cm. Seeds were covered thinly with soil. Thinning was done 10 days after sowing. The strongest seedlings were saved and excess plants were removed. 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 sprouting weeds and to aerate the soil. Hilling-up followed 30 days after planting.

The field after planting was irrigated with the help of a sprinkler. Corn plants were watered evenly, especially, during dry period. The first irrigation happened 3 days after emergence of the plants and succeeding irrigation followed with an interval of 3 days depending on the actual rainfall condition in the area. Insect pests attacking the sweet corn plants which were aphids and cutworms were controlled by spraying 5ml of Karate EC mixed with 16 liters of water. This was applied 25 and 30 days after planting. Fusarium stalk rot was the fungal disease which attacked the sweet corn; the attack happened during early flowering. To control the spread of the disease Dithane was used at the rate of 4 tablespoons per 16 liters of water. Seaweed fertilizer was prepared by washing the seaweeds and sliced into small pieces, then blended it until it became gritty in texture. After blending, seaweed extract was placed into a container and refrigerated for 24 hours to produce a considerable amount of liquid. The seaweed extract was then mixed with molasses; 1 liter of seaweed extract was added for every 1 liter of molasses. The mixture was then placed in a container that contains 2.1 liters with different concentration 6.3 ml, 8.4 ml and 10.5 ml for application.

Complete fertilizer was applied 15 days after planting with the amount of 8.5g per plant; urea was applied 25 days after planting with the amount of 3.57 grams per plant; and, 2.38 grams of Muriate of Potash was applied per plant for all treatments 35 days after planting. The seaweed extract was applied thrice. First application happened during germination stage (5DAP), second application at vegetative stage (25DAP), and third application was done just before tasseling (48DAP) with the amount of 6.3 milliliters of seaweed extract per 2.1 liters per plot for T_2, 8.4 milliliters of seaweed extract per 2.1 liters per plot for T_3, 10.5 milliliters of seaweed extract per 2.1 liters per plot for T_4 and no application of seaweed extract for T_1.

The ears of Sweet Grande F1 were harvested 75 days after planting. At this stage, the ears were at early dough stage. They were harvested while the husk was still green in color and the silk had already turned brown and firmed. Harvesting was done by manually removing the ears of corn and placed them in separately labelled containers to avoid misrepresentation of data. The number of sample per plot was determined by getting 30 percent of total plant per plot in every third plant in a row. The data gathered were the following: (1) Average circumference of husked sweetcorn ears in cm per plot per treatment. The circumference of each sweetcorn ear from the sample plants in every plot was measured using tape measure. (2) Average length of husked sweetcorn ears in centimeter per plot per treatment. The husk sweetcorn ear from the sample plant in every plot was measured and measurements were added. The total measurements were divided by the total number of samples to get the average length in centimeter per plot per treatment. (3) Average weight of husked sweetcorn ears in gram per plot per treatment. The harvested sweetcorn 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 sweetcorn ears in kilogram per plot treatment. The harvested husked sweetcorn ear per plot per treatment was weighed using weighing scale. (5) Total number of husked sweetcorn ears per plot per treatment. The harvested husked sweetcorn ears were counted per plot per treatment.

Statistical Analysis

Analysis of variance (ANOVA) for One-Way classification 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. Duncan's Multiple Range Test (DMRT) method was utilized to determine which of the different rates of seaweed extract would best prove worthy of recommendation. Table 1 shows the treatments.

Table 1. Treatments (T), description (amount of seaweed extract per plant in gram (f) and amount of seaweed extract (s))

Treatments	Description		
	Amount of Seaweed Extract		**Inorganic Fertilizer**
T_1	Control (No Seaweed Extract)	**x**	Complete Fertilizer (8.5g), Urea (3.57g) Muriate of Potash (2.38g)
T_2	6.3 ml of seaweed extract per 2.1 L of water	**x**	Complete Fertilizer (8.5g), Urea (3.57g) Muriate of Potash (2.38g)
T_3	8.4 ml of seaweed extract per 2.1 L of water	**x**	Complete Fertilizer (8.5g), Urea (3.57g) Muriate of Potash (2.38g)
T_4	10.5 ml of seaweed extract per 2.1 L of water	**x**	Complete Fertilizer (8.5g), Urea (3.57g) Muriate of Potash (2.38g)

Results and Discussion

Average Circumference of Sweetcorn (in cm)

Table 2 presents the average of circumference of sweetcorn ears in centimeter per plot per treatment. In this table, T_4 obtained the highest average circumference of 20.98 centimeters, followed by T_3 with 20.41 centimeters.T_2 obtained 20.40 centimeters and T_1 obtained the slowest average circumference, 19.53 centimeters.

The result of the statistical analysis revealed that the computed “f” (3.76) is greater than the tabulated “f” at 5% (3.49) but lesser than the tabulated “f” at 1% (5.95) level of significance. Therefore, the null hypothesis was rejected and the alternative hypothesis was accepted. This means that there was a significant difference on the average circumference of sweetcorn ears in centimeter per plot per treatment.

Table 2. Average circumference of sweetcorn measured in centimeter per plot per treatment

Replication	Treatments				
	T1	T2	T3	T4	
R_1	19.10	20.10	19.90	20.15	
R_2	19.70	20.05	19.55	20.75	
R_3	19.65	20.60	20.50	21.60	
R_4	19.65	20.85	21.70	21.40	
Total	78.10	81.60	81.65	83.90	**T_G** 325.25
Mean	19.53	20.40	20.41	20.98	**M_G** 20.33

Average Length of Sweetcorn (in cm)

Table 3 presents the average length of sweetcorn ears in centimeter per plot per treatment. It can be gleaned that T_4 obtained the longest average length of husked corn ears with 32.03 centimeters followed by T_3 with 31.91 centimeters. T_1 obtained an average of 30.93 centimeters and T_2 obtained the lowest average length of husk corn ears, 30.78 centimeters.

Table 3. Average length of sweetcorn measured in centimeter per plot per treatment

Replication	Treatments				
	T1	T2	T3	T4	
R_1	30.30	29.95	31	30.25	
R_2	30.85	30.80	32.30	32.80	
R_3	31.85	32	31.55	32	

R_4	30.70	30.35	32.80	33.05	
Total	123.70	123.10	127.65	128.10	**T_G** 502.55
Mean	30.93	30.78	31.91	32.03	**M_G** 31.41

Average Weight of Sweetcorn (in gram)

Table 4 presents the average weight of sweetcorn ears in grams per plot per treatment. In this table, T_4 obtained the highest average weight of 437.01 grams followed by T_3 413.21 grams. T_2 obtained the mean weight of 408.49 grams and T_1 obtained the lowest average of weight of 400.74 grams.

Table 4. Average weight of sweetcorn (in grams) per plot per treatment

Replication	**Treatments**				
	T1	T2	T3	T4	
R_1	377.60	386.65	400.05	409.10	
R_2	411.30	418.30	395.95	427.10	
R_3	392.95	372.55	411.80	433.75	
R_4	421.10	456.45	445.05	478.10	
Total	1,602.95	1,633.95	1,652.85	1,748.05	**T_G** 6,637.80
Mean	400.74	408.49	413.21	437.01	**M_G** 414.85

Total Weight of Sweetcorn (in kg)

Table 5 presents the total weight of sweetcorn ears in kilograms per plot per treatment. It can be seen that T_4 obtained the highest total weight of 102.39 kilograms, followed by T_3 with a total weight of 98.03. T_2 obtained a total weight of 94.33 kilograms and T_1 had the lowest total weight of 92.28.

Table 5. Total weight of sweetcorn (in kg) per plot per treatment

Replication	**Treatments**				
	T1	T2	T3	T4	
R_1	22	24	26.60	26	
R_2	23	25.25	24.53	24.69	
R_3	25.53	20.50	24	25.20	
R_4	21.75	24.58	23	26.50	
Total	92.28	94.33	98.03	102.39	**T_G** 387.03
Mean	23.07	23.58	24.51	25.60	**M_G** 24.19

Total Number of Sweetcorn Ears

Table 6 presents the total number of sweetcorn ears per plot per treatment. It can be seen that T_4 obtained the highest total number corn ears, 303 and followed by $T_{3,}$ 302 corn ears. T_2 obtained a total number of 268 corn ears and T_1 had the lowest total number, 251 corn ears.

Based on the result of the Analysis of Variance for the total number of sweetcorn ears per plot per treatment, the computed "f" (16.29) is greater than the tabulated "f" at both 5% (3.49) and 1% (5.95) levels of significance. Therefore, the null hypothesis was rejected and the alternative was accepted. This implies that there was a highly significant difference on the total number of sweetcorn ears per plot per treatment applied with inorganic fertilizer and supplemented with different rates of seaweed extract.

Table 6. Total number of sweetcorn ears per plot per treatment

Replication	Treatments				
	T1	T2	T3	T4	
R_1	61	64	79	78	
R_2	58	66	76	74	
R_3	69	70	75	77	
R_4	63	68	72	74	
Total	251	268	302	303	**T_G** 1,124
Mean	62.75	67	75.50	75.75	**M_G** 70.25

Conclusion

Based on the results of the study, there was no significant difference among the average length of sweetcorn ears per plot per treatment, average weight of sweetcorn ears in grams per plot per treatment and total weight of sweetcorn ears in kilograms per plot per treatment. However, the average circumference of sweetcorn ears in centimeter per plot per treatment and the total number of sweetcorn ears per plot per treatment showed a significant difference being applied with inorganic fertilizer and supplemented with different rates of seaweed extract. Moreover, it can be seen that treatment four proved having the best yield performance compared to other treatments. Thus, treatment four (T_4) significantly increased the yield performance of sweetcorn.

Recommendations

From the foregoing findings and conclusions, the following recommendations are advanced:

1. Adoption of T_4 to obtain bigger circumference of sweetcorn ears in centimeter per plot per treatment.
2. Adoption of any of the four treatments to obtain the longer length of sweetcorn ears in centimeter per plot per treatment.
3. Adoption of any of the four treatments to obtain uniform weight of sweetcorn ears in grams per plot per treatment.
4. Adoption of any of the four treatments to obtain heavier weight of sweetcorn ears per plot per treatment.
5. Adoption of T_4 to obtain higher total number of sweetcorn ears per plot per treatment.

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