Balanced Fertilization and Rate of Organic Foliar Fertilizer on the Yield and Biomass of Sweet Corn

Corpuz, Onofre S[1], J.P. Liong[2], H.T. Liong[2]

***Abstract*— This study was conducted to determine the yield and biomass of sweet corn (Zea mays) applied with balanced fertilization and organic fertilizer. The field trials was laid out in RCBD factorial design with 5 treatments and 3 replications.**

The findings revealed that balanced fertilization plus 75% to 125% of vermicast significantly higher on yield but insignificantly different with biomass.

The return of investment showed insignificant difference on both treatments. However, the highest percentage of the highest return of investment is the balanced fertilization strategy plus compost based on the recommended rate of Bureau of Soils and Water Management.

Balanced fertilization plus rate of vermicast of 100-125% gave the best and significant performance in sweet corn yield. Through chemical analyses, Vermicast fertilizer have a composition of 2%Nitrogen, 12%P_2O_5, 2%K_2O, 6%Calcium, 9%Magnesium, 0.45%Zinc, 2.5%Sulfur, 0.2%Manganese, 5%Iron, 0.2%Copper, 0.1% Boron, 1%Molybdenum, 1% Chloride, and about 29% organic matter that promotes best growth in Zea mays. Thus, it is concluded that balanced fertilization plus vermicast with a rate of 100-125% is the best fertilization strategy to increase the yield of sweet corn of about 25% as compared to balanced fertilization alone

***Keywords*— organic foliar fertilizer, vermicast, sweet corn, yield, biomass, Davao del Norte**

I. INTRODUCTION

Balanced fertilization is the key to efficient fertilizer utilization and for sustainable high yields. It is the only way to ensure a sustainable agriculture that can provide the world population with quality food while minimizing the impact on the environment. All available knowledge about the crop and the environment where it will be grown must be combined to get up the right combination of the nutrients to be applied at each step of the fertilization program.

Foliar applications are often timed to coincide with specific vegetative or fruiting stages of growth, and may also be used to aid plants recovery from transplant shock, hail damage, or the results of other weather extremes.

This study aimed to answer three objectives; a). to determine the effect of balanced fertilization strategy (BFS) with different rates of Bio-Soil Organic Fertilizer versus Fermented Plant Juice (FPJ) fertilizer on the growth and yield performance of sweet corn; b). To determine the appropriate rate and choice of the different organic foliar fertilizers on the growth and yield of sweet corn, and; 3c). To determine the interaction between Bio-soil organic and Fermented Plant Juice.

[1]Professor VI, College of Agriculture, Cotabato Foundation College of Science and Technology, Doroluman Arakan, Cotabato

[2]Agricultural Extensionist, Department of Agriculture, Davao del Norte

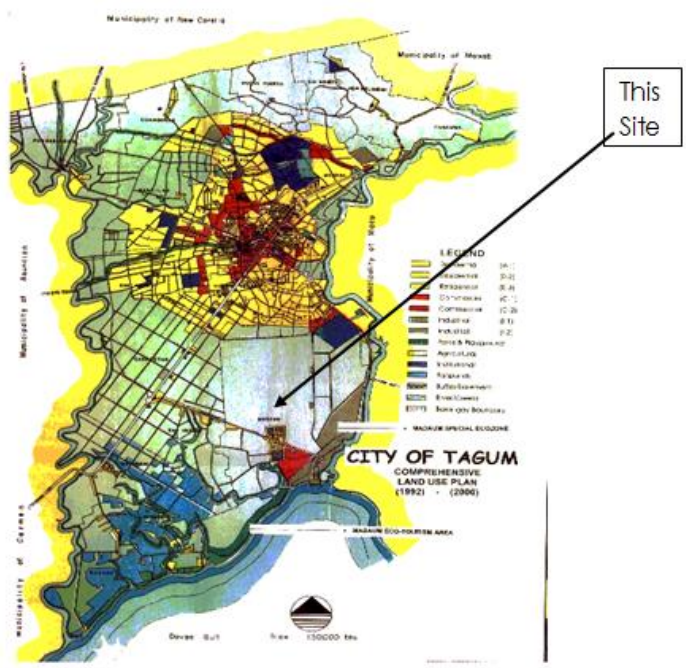

Fig.1 Map indicating the place of the study

II. METHODOLOGY

Soil Sampling. Soil sample was taken from the experimental area before land preparation was implemented. Soil sample will be collected randomly using soil auger. After collecting the sample, these were mixed thoroughly, air-dried, pulverized and sieved. The sample was analyzed at the Department of Agriculture, Bureau of Soil and Water Management (BSWM) Laboratory; Agdao, Davao City.

Experimental Design. The study was conducted using the factorial Randomized Complete Block Design (RCBD) with five (5) treatments, each factor replicated three (3) times. Each plot, having a dimension of 4x3 meters and measure 12 sq.m, with an alley of 1.5 meters between plots to be provided with a total of 30 plots laying in 604.8 square meters.

The experimental treatments were as follows;

Factor A (Bio-Soil Organic Fertilizer)

T1f1 – Unfertilized
T2f1 – RR of Bio-Soil alone
T3f1 – BFS + 75 % of RR of Bio-Soil Organic Fertilizer
T4f1 – BFS + 100 % of RR of Bio-Soil Organic Fertilizer
T5f1 - BFS + 125 % of RR of Bio-Soil Organic Fertilizer

https://doi.org/10.17758/URUAE.AE09172003

Factor B (Fermented Plant Juice Organic Fertilizer)

T1f2 – Fermented Plant Juice Fertilizer alone
T2f2 – BFS alone (based on the routine analysis of BSWM)
T3f2 – BFS + 75 % of RR of FPJ Organic Fertilizer
T4f2 – BFS + 100 % of RR of FPJ Organic Fertilizer
T5f2 - BFS + 125 % of RR of FPJ Organic Fertilizer

Land Preparation. The experimental site was thoroughly prepared by plowing and harrowing alternately 10-14 days before planting. This operation pulverized the soil to kill the weeds and make nutrients available to plants.

Field lay – out. A total of 663 square meters field study area and laid-out into 30 plots with a 12 square meter per plot and an alley of 1.5 meters between plots excluding the buffer used in this experimental.

Fertilization. For the BFS (Balanced fertilization strategy) treatments, the amount of fertilizer and kind of fertilizer materials that used in the study was based on the routine analysis of the Bureau of Soil and Water Management Laboratory in Davao City.

On the other hand, the recommended rate of Bio-Soil and Fermented Plant Juice applied in its different rates, except treatment 1 of factor 1 and treatment 2 of factor 2.

Planting. The Sweet Corn was sown manually at the rate of 1-2 seeds per hill at a depth of 25 cm and 25 cm apart using calibrated bamboo stick and with the distance of 75 cm between furrows.

Thinning. First thinning was done at seven to ten days after planting and one plant per hill remained.

Weeding and Cultivation. Weeding was done at 15 days interval DAP. At 15 days after planting, off-baring was done to cultivate the soil and control the weeds. After 30 days after planting, hilling up was done to promote soil aeration to the plants.

Pest and Disease Control. Integrated Pest Management was applied, depending on the severity of pest and disease incident, using of insecticide and fungicide served as last recourse. The dosage used considered the manufacturer's recommendations.

Harvesting. Harvesting was took place at the appropriate stage depending on the maturity date. Harvest of Sweet Corn ranged from 68-75 DAP.

Statistical Analysis. The statistical analysis of the different data gathered were analyzed using the Analysis of Variance (ANOVA) and the difference among the treatments mean were compared using the Duncan's Multiple Range Test (DMRT).

III. Results And Discussion

Green Yield

Table 1 shows the green yield of sweet corn as affected by the application of balanced fertilization strategy with rates of foliar fertilizer.

Result of the study reflects that factor A got the highest grand mean yield of 19.69 t/ha compared to factor B (18.84 t/ha). Computed data indicates that there was a highly significant difference among treatment and factors. Using of balanced fertilization strategy enhances crop yield (Khaskheli, 2007). Furthermore, foliar application of N, P, K and S at the four–five-leaf stages significantly increased the N and P contents of maize seedlings and resulted in an increased final grain yield (Giskin and Efron 1986). This was supported by the study of Haytova, D. (2013) the application of foliar sprays is an important crop management strategy, which may help maximizing crop yield and quality.

TABLE I. GREEN YIELD OF SWEET CORN USING BALANCED FERTILIZATION STRATEGY WITH RATES OF FOLIAR FERTILIZER

Treatments	N	Yield (t/ha.)
Factor A (Bio-Soil Organic Fertilizer)		
T_1f_1 – Unfertilized	90	12.65d
T_2f_1 – RR of Bio-Soil	90	13.38c
T_3f_1 – BFS + 75% Bio-Soil	90	20.66b
T_4f_1 – BFS + 100% Bio-Soil	90	22.02a
T_5f_1 – BFS + 125% Bio-Soil	90	22.70a
Mean Green Yield (A)	90	**19.69a**
Factor B (Fermented Plant Juice Organic Fertilizer)		
T_1f_2 – RR of FPJ	90	12.81d
T_2f_2 – BFS	90	20.59b
T_3f_2 – BFS + 75% FPJ	90	20.59b
T_4f_2 – BFS + 100% FPJ	90	20.74b
T_5f_2 – BFS + 125% FPJ	90	21.21a
Mean Green Yield (B)		**18.84b**

Mean with the same letter subscript are not significantly different

Biomass

Table 2 shows the biomass of sweet corn *(Zea mays)*. Result of the study indicates no significant difference among factors used. However, with the addition of bio-soils and fermented plant juice, biomass of the plant showed significant increases.

The study of Yuncai *et al*. (2008) supported the findings which reported that application of foliar fertilization increase plant growth as in fresh and dry weight.

TABLE II: BIOMASS OF SWEET CORN USING BALANCED FERTILIZATION STRATEGY WITH RATES OF FOLIAR FERTILIZER

Treatments	N	Biomass (Kg)
Factor A (Bio-Soil Organic Fertilizer)		
T_1f_1 – Unfertilized	90	8.78b
T_2f_1 – RR of Bio-Soil	90	8.85b
T_3f_1 – BFS + 75% Bio-Soil	90	11.85a
T_4f_1 – BFS + 100% Bio-Soil	90	12.57a
T_5f_1 – BFS + 125% Bio-Soil	90	12.68a
Mean Green Yield (A)	90	**11.49a**
Factor B (Fermented Plant Juice Organic Fertilizer)		
T_1f_2 – RR of FPJ	90	8.56b
T_2f_2 – BFS	90	12.41a
T_3f_2 – BFS + 75% FPJ	90	12.39a
T_4f_2 – BFS + 100% FPJ	90	12.40a
T_5f_2 – BFS + 125% FPJ	90	12.55a
Mean Green Yield (B)		**11.48a**

Return of Investment

In Table 3 presented the data on the return on investment of sweet corn using balanced fertilization strategy with rates of foliar fertilizer. It discloses that the highest return on investment is at factor A with a grand mean of 292.90 compared to factor B having a grand mean of 269.64. Bio-soil and FPJ contains nutrients needed by the plant growth.

The result shows that FPJ is lesser amount of available nutrients compared to bio-soil which has macro-micro elements and contains blue green algae that promotes plant growth and yield. In terms of cost, bio-soil is commends higher price compared to FPJ but it doesn't affect the ROI of sweet corn production as bio-soil has the highest return on investment.

https://doi.org/10.17758/URUAE.AE09172003

TABLE III: RETURN OF INVESTMENT OF SWEET CORN USING BALANCED FERTILIZATION STRATEGY WITH RATES OF FOLIAR FERTILIZER.

Treatments	Gross income (Php)	Production Cost (Php)	Income (Php)	Net ROI (%)
Factor A (Bio-Soil Organic Fertilizer)				
T_1f_1 (Unfertilized)	189,777.60	54,690.00	135,087.60	247.00
T_2f_1 (RR of Bio-Soil)	199,999.80	53,250.00	146,749.80	275.59
T_3f_1 (BFS + 75% Bio-Soil)	310,518.19	81,896.00	228,622.19	279.16
T_4f_1 (BFS + 100% Bio-Soil)	330,295.98	82,076.00	248,219.10	302.43
T_5f_1 (BFS + 125% Bio-Soil)	340,518.16	82,166.00	258,352.16	314.43
Grand Mean				**292.90**
Factor B (Fermented Plant Juice Organic Fertilizer)				
T_1f_2 (RR of FPJ)	192,147.97	56,580.00	135,567.97	239.60
T_2f_2 (BFS)	308,814.49	79,916.00	228,898.49	286.43
T_3f_2 (BFS + 75% FPJ)	308,814.49	81,806.00	227,088.49	271.59
T_4f_2 (BFS + 100% FPJ)	311,036.73	81,956.00	229,080.73	279.52
T_5f_2 (BFS + 125% FPJ)	318,147.82	82,031.00	236,116.82	287.84
Grand Mean				**269.64**

IV. CONCLUSION

Based from the findings, it is concluded that using bio-soil with increased the level of the recommended rate of organic foliar fertilizer using balance fertilization strategy can give additional cost of production, yet can increase the sweet corn production in terms of return of investment.

V. RECOMMENDATIONS

1. It is recommended to the sweet corn farmers to used balanced the fertilization with foliar fertilizer on their sweet corn area.
2. It is recommended that further study on the different kinds of foliar fertilizer and there frequency of the application on sweet corn production.
3. It is recommended that further study on foliar fertilizers using balanced fertilization strategy on field corn and green corn.
4. Another recommendation to be studied is the population density of sweet corn using different kinds of foliar fertilizer with balanced fertilization strategy.
5. Also recommended to be studied is the time and frequency of foliar application on sweet corn production.

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