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Agronomic, Physiological, and Economic Efficiencies of Sweet Corn (*Zea mays* L. var. saccharata) Applied with Varying Levels of Indigenous Microorganisms (IMO) 7 and Organic Nutrient Supplements

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Abstract

Indigenous microorganisms (IMO) 7 is an organic fertilizer produced from a series of aerobic and anaerobic fermentations. This study investigated the effects of levels of indigenous microorganisms (IMO) 7 such as control (N:P:K: 120:90:60), IMO 7 at 7.5 t ha^{-1}, 15 t ha^{-1}, and 22.5 t ha^{-1} and organic nutrient supplements (ONS) - fish amino acid (FAA), fermented plant juice (FPJ), and fermented seaweed (FS) on the different agronomic, physiological and economic parameters of sweet corn. The experimental plots were arranged using a 4 x 4 factorial in Randomized Complete Block Design (RCBD) with three replicates. The results revealed that the IMO 7 significantly improved the ear height, net assimilation rate (NAR) 55-65 days after planting (DAP), dry matter yield (DMY), and return on investment (ROI). The ONS influenced the ear yield, leaf area index (LAI) at 65 DAP, NAR (45-55, and 55-65 DAP), and ROI. The control (N:P:K: 120:90:60), and the IMO 7 at 22.5 t ha^{-1} gave the highest DMY 10.58 and 10.37 t ha^{-1}, respectively. Among the ONS, FS obtained the highest ear yield at 13 t ha^{-1} and NAR of 0.091 - 0.131 gm^{-2} day^{-1}. Economically, control (N:P:K: 120:90:60) achieved the highest ROI at 392.1%, followed by IMO 7 at 7.5 t ha^{-1} at 287%. FS got the highest ROI at 269.8% among the ONS. The results provide vital information on IMO 7 and ONS's effects on sustainable sweet corn production in Aurora, Zamboanga del Sur, Philippines.

Keywords: agronomic efficiency, indigenous microorganisms, physiological performance, return-on-investment, sweet corn

Introduction

There is growing popularity of sweet corn (*Zea mays* L. var saccharata) throughout the world because of its palatability and antioxidant activity (Dewanto *et al*., 2002). The ears are rich in vitamins, minerals, and carbohydrates (Nuss & Tanumihardjo, 2010). The boiled ears contain an antioxidant protein that is good for the heath (Xu *et al*., 2010). The harvested stalk can be processed into silage, which can be used for livestock, and this will help address the feed shortage in the locality (Chaudhary *et al*., 2011). Sweet corn provides employment and generates income to the farmers as it has value as a cash crop (Idukut *et al*., 2009). Sweet corn is more comfortable to grow, needs lesser time and labor, and is more profitable than growing corn for grain (Lucas & Salacup, 2018).

The planting of sweet corn is a challenging venture for farmers because of inevitable constraints like adverse weather conditions, the occurrence of pests and diseases, poor soil fertility, low production and income, and low germination. The success of farmers dramatically depends on how they manage their crops from planting, harvesting, and marketing aspects (Veisi *et al*., 2017). In the municipality of Aurora, Zamboanga del Sur, the farmers started to invest in sweet corn production because of its promising demand. The general problems they have encountered during production are low production, higher cost of inputs, pests and diseases, and low return on investment. Farmers used hybrid seeds like macho F1, Sugar king F1, and sweet fortune F1. Farmers also used synthetic fertilizers and chemical pesticides. Other farmers used organic fertilizers like indigenous microorganisms (IMO) 7, chicken dung, cattle manure, vermicompost, bokashi, and organic foliar fertilizers like FPJ, FFJ, FAA, and FS.

Farmers used pesticides as a last resort to combat pests and diseases. They also used synthetic fertilizers to improve their crop yield. Improper use of fertilizers and pesticides is dangerous to our environment. Chemical residues are harmful to the consumers' health (Edwards, 2013), useful microorganisms, and other beneficial insects (Altieri, 2018). The continuous use of pesticides aggravates climate change (Boxall *et al*., 2008) and global warming (Noyes *et al*., 2009).

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Healthy soil is a need for crop production (Ella *et al*., 2016). Feeding the soil with organic fertilizers would positively result in standing crops (Diacono and Montemurro, 2011). The IMO and other ONS applications can be the best option for the farmers as an alternative to commercial fertilizers because it improves soil fertility without any harmful effects on the environment.

At present, the farmers in Aurora are still using synthetic fertilizers and chemical pesticides thus; the soil's fertility is declining. There is a need for intervention to improve soil fertility and mitigate climate change and global warming. The best technology that is ecologically friendly and appropriate at the farmers' level should be given more attention. Farmers in Aurora lacked the technology for organic farming. They are not educated on producing the best organic fertilizer and their timely and effective usage for crops.

A study reported that sweet corn (*Z. mays* L. var. saccharata) produced more yield, quality marketable ears, high sugar content, and high shelf life when applied with biopesticides and organic nutrient supplements (Canono, 2013). Yet, there is still a need to investigate more organic fertilizers using farmers' resources.

This study analyzes the agronomic, physiological, and economic efficiencies of sweet corn (*Zea mays* L. var. saccharata) in response to the levels of IMO 7 and ONS. This study's results would be useful for farmers as the use of IMO 7 and ONS can be the best alternative to commercial fertilizers in improving yield and soil fertility.

Materials and Methods

Location and time of the study

This study was conducted at the Crop Science Experimental Area of the Zamboanga del Sur Provincial Government College, Aurora, Zamboanga del Sur from September 1, 2018, to December 30, 2018.

Source of the materials and design of the experiment

Hybrid sweet corn was obtained from the seed retailer and materials for IMO 7 and ONS were procured from local suppliers in the test area. IMO 7 contains predominantly white moulds that grow in the materials during the fermentation process. White moulds are formed due to thermophilic actinomycetes (Fergus, 1964). Although, actinomycetes can be the predominant microbes in IMO 7. Other species of whitemoldss like *Aspergillus sp.*, *Cladosporiumsp.*, and *Penicillum sp*. also have attention (Naegele *et al*., 2016). The total land area of 1,332 square meters was divided into three blocks representing the combinations of rates of IMO 7 and ONS. Each block contains sixteen plots. Each plot has eight rows with a dimension of 6 m x 4 m. Plants were spaced at a distance of 75 cm between rows and the distance between hills of 25 cm in a row. This study was conducted using a 4 x 4 factorial in RCBD. Factor A includes the levels of IMO 7 like control (N:P:K: 120:90:60), 7.5 t ha^{-1}, 15 t ha^{-1}, and 22.5 t ha^{-1} and factor B comprises the ONS such as control, FAA, FPJ, and FS. Each treatment was replicated three times with 10 plants per plot taken from the six inner rows

Preparations of IMO

The methods were adopted and practices by Cho and Cho, (2010), (Catholic Relief Services, 2008), Villaver and Borres, (2018) as cited by Villaver, (2019). This was used as the standard for the formulation of IMO 7 as organic fertilizer. IMO 7 was processed by mixing the materials such as six sacks IMO 6, two sacks vermicompost, and 8 liters of water with 180 ml FPJ and 180 ml FAA for additional indigenous microorganisms.

Application of IMO 7 and ONS

The IMO 7 was applied as a base for the experimental plots according to the rates assigned for each treatment, three (3) days before planting. The amount of IMO 7 was computed per plot to assure equal distribution. No side-dressing was done except for the control treatment. ONS (FAA, FPJ, and FS) were diluted to 20 ml/l concentration. ONS were applied as foliar fertilizer on 14, 21, 28, 35, and 42 days after planting (DAP) with the dilution rate of 15.36 ml/768 ml per plot or 6.4 L/10 tank loads in a 16 L. capacity knapsack sprayer per hectare.

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Harvesting

The ears of sweet corn were harvested 75 DAP. Husks were taken out to determine the quality and size. After de-husking, products were classified as small, medium, and large.

Data gathered

A. Agro-Meteorological Data

Agro-meteorological data such as rainfall, temperature (minimum, maximum, and mean), relative humidity, and wind speed (minimum, maximum, and mean) were recorded from an automatic weather station (AWS).

B. Agronomic Parameters

Plant Height (cm). In every plot, ten (10) representative plants were randomly selected 70 DAP, and the plant height was measured using steel tape from the ground level to the base of the tassel.

Ear Height (cm). The mean ear height was measured from the base to the node bearing the first ear of 10 plants randomly from the six inner rows per plot.

Percentage of marketable ears. The percentage of marketable ears was determined by counting the marketable ears produced by each plot based on the classification of the ear as small medium and large and the number of non-marketable ears. The percentage of marketable ears was computed using the formula below:

$$\text{\% of marketable ears} = \frac{\text{Total no. of ears} - \text{non-marketable ears}}{\text{Total no. of ears}} \times 100$$

Ear yield (t ha^{-1}). The ear yield was taken by harvesting and weighing all ears in every plot at the green stage and was expressed in kg/ha using the formula below:

$$\text{Yield (ears t ha}^{-1}) = \text{yield/plot (kg)} \times \frac{10{,}000\ m^2}{\text{Sample area}}$$

C. Physiological Parameters

Leaf Area Index (LAI). Two plants in each plot were subjected to LAI analysis 45, 55, 65, and 75 DAP. All functional leaves were measured (length and the widest part). The leaf area was calculated as leaf length x maximum width x correction factor (CF) of a value of 0.75. The LAI was computed using the formula below:

$$LAI = \frac{L \times W \times \text{Number of leaves/plant} \times C.F.}{\text{The ground area allotted per plant}}$$

Net Assimilation Rate (NAR). It is the dry matter accumulation or increment in plant dry weight per unit leaf area per unit time and it is expressed in gm^{-2} of leaf area per day ($gm^{-2}\ d^{-1}$). NAR was calculated 45-55 and 55-65 using the formula below:

$$NAR = \frac{(W_2 - W_1)(\text{In } LA_2 - \text{In } LA_1)}{(LA_2 - LA_1)(T_2 - T_1)}$$

Where, W_1= plant dry weight of the first sampling time, W_2= plant dry weight on the second sampling time, ln = normal logarithm, LA_1 = leaf area on the first sampling time, LA_2= leaf area of the second sampling time, T_1= time of the first sampling, and T_2 = time of the second sampling.

Dry Matter Yield (DMY). This includes the dry weight of the leaves, stems, and ears taken at 45, 55, 65, and during harvest at 75 DAP.

D. Economic Parameter

ROI was calculated based on the existing price of sweet corn ears and stover in the market. The cost of production per hectare was deducted from the gross sales to obtain the net income. The ROI was computed using the formula below:

$$ROI = \frac{\text{Net income}}{\text{Total Expenses}} \times 100$$

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Statistical Analysis

Data were analyzed using Minitab 17. Analysis of variance and Tukey's or honestly significant difference (HSD) test was used to compare the mean differences.

Results and Discussion

Climatic Elements

The meteorological data during the conduct of the study from September 2018 to December 2018 at daily basis are shown in Figures 1 and 2. Rainfall and temperature (minimum, average, and maximum) are presented in Figure 1. During the conduct of the study, the highest rainfall was recorded in November (335 mm), followed by September (303 mm), October (292 mm) and December (258 mm). Recorded maximum temperature, minimum temperature, and average temperature were consistent in the entire cropping period. The maximum temperature ranged 30.4 - 30.8 °C, the minimum temperature ranged 21.1 – 21.3°C, and the mean temperature ranged between 25.7 – 26 °C. Corn grows within a temperature range of 14 - 40°C with optimal temperatures between 24 - 32°C, minimum temperature range from 18 to 24 °C, and a maximum temperature range from 26 to 29°C. Corn performs well when the temperature in the warm month's range is 21 to 27°C. Sufficient rainfall is necessary for corn because it is sensitive to moisture stress from the beginning of flowering until the end of the kernel formation (Li *et al*., 2012).

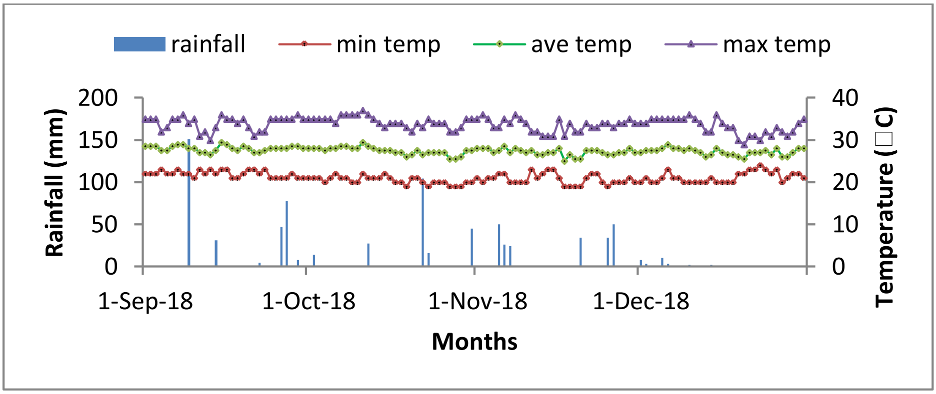

Figure 1. **Daily rainfall data, minimum temperature, average temperature and maximum temperature in the locality from the period of September to December 2018.**

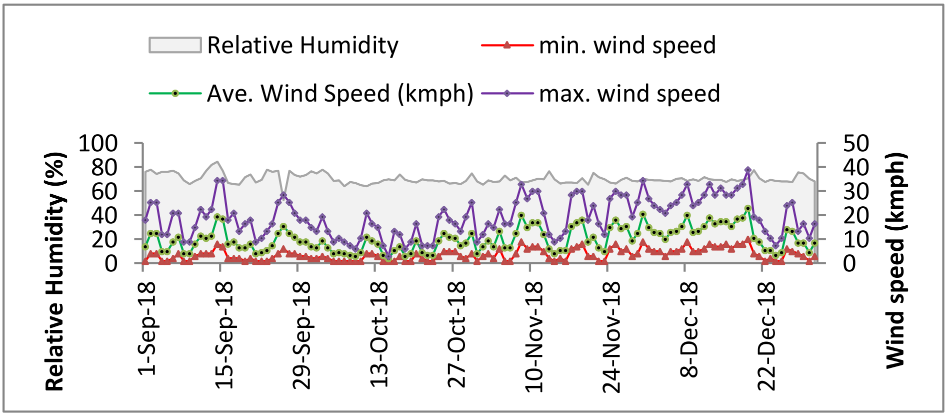

Figure 2. **Graph showing the daily climatic data on relative humidity, minimum wind speed, average wind speed and maximum wind speed in the locality from September to December 2018.**

Relative humidity and wind speed (maximum, minimum, and average) are shown in Figure 2. Highest relative humidity was recorded in September at 79.98%, followed by December (69.85%), November (69.25%), and October (69.22%). Relative humidity that ranges from 73

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to 98% is very important for the viability of the corn seeds in the field (Volenik *et al*., 2007). There is a possibility that pests and diseases spread at high relative humidity. In a study (Tamiru *et al*., 2012), *Chilo partellus* infects maize at the most suitable condition of 26 -30 °C and 60 - 80% relative humidity. Wind speed was recorded in the whole cropping season in which the maximum wind speed ranges from 8.25-13.13 km h^{-1}, minimum wind speed ranged from 1 to 2.88 km h^{-1}, and average wind speed ranged from 4.05 – 7.63 km h^{-1}. If the wind is too strong, the plants are disturbed until the roots are impaired. Cereals and other herbaceous crops can often recover after wind damage if there is sufficient access to water and nutrients (Gardiner *et al*., 2016).

Growth Parameters

Plant Height and Ear Height (cm) of Sweet Corn. The difference of the plant height and ear height of sweet corn as influenced by levels of IMO 7 and ONS are presented in Table 1. The data revealed that sweet corn applied with 120-90-60 obtained the highest plant height and ear height at about 213.25 and 106.90 cm, respectively. Among the ONS, the FAA got the tallest plant height at about 212.4 cm, while control obtained the most top ear height at about 105.97. The level of 7.5 t ha^{-1} is significantly lower compared to synthetic fertilizers (120 – 90 – 60). Ear height may also be affected by the genetic variation of sweet corn plants (Kashiani *et al*., 2010). The study (Arif *et al*., 2012), reported that maize plant height and ear height are increased when applied with pure synthetic fertilizers (NPK) compared to biochar and farmyard manure alone. Likewise, the study of Alcantara (2015) mentioned that the highest ear height and plant height of sweet corn obtained when applied with nitrogen is at 120 kg ha^{-1}. The level of nitrogen and phosphorus also affects the ear height by increasing the size of the nodes and internodes (De Grazia *et al*. 2003), which is further confirmed in the studies of Alimohammadi *et al*. (2011), and Moraditochaee *et al*. (2012). In the study of Lazcano *et al*. (2011), sweet corn applied with vermicompost at 25 t ha^{-1} had the highest ear height. The study of Muktamar *et al.* (2017) confirmed the positive effects of vermicompost in a combination of liquid organic fertilizers on the ear height of sweet corn.

Table 1. Plant height and ear height (cm) of sweet corn as influenced by levels of IMO 7 and ONS.

Treatments	Plant Height (cm)	Ear Height (cm)
A – Levels of IMO 7		
Control (N;P;K;, 120:90:60)	213.25	106.90[a]
7.5 t ha^{-1}	209.68	101.40[b]
15 t ha^{-1}	211.10	104.87[ab]
22.5 t ha^{-1}	210.17	103.72[ab]
B – ONS		
Control	210.70	105.97
FAA	212.24	103.48
FPJ	209.67	102.77
FS	211.61	104.66
F- test:		
A	ns	*
B	ns	ns
A x B	ns	ns
C.V. (%)	3.29	4.25

ns - non-significant;* - significant at 5% level of Tukey's test

Yield Data

Percentage of Marketable Ears and Ear Yield (t ha^{-1}). The percentage of marketable ears and ear yield are presented in Table 2. The sweet corn applied with 22.5 t ha^{-1} had the highest marketable ears at 94.52% and ear yield at 12.15 t ha^{-1} as compared to the rests of treatments. For the ONS, sweet corn applied with FS had the highest marketable ears at 94.77% and ear yield at 13 t ha^{-1}. Nitrogen from seaweed maintains the green color of the leaves to capture photons of lights to produce photosynthates and assimilates (Teasdale *et al*. 2008). Boron in seaweed improves the development of the ear (Kaur and Nelson, 2015). The sufficient amount of potassium improves the kernel and ear formation (Rivera-Hernández *et al*., 2010) and the presence of macro and micronutrients in the seaweed improved the ear yield (Possinger and Amador, 2016). A pattern of increase in the marketable ear and ear yield

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was observed when the rate of IMO 7 is further increased. The use of foliar fertilizer like FS is of great benefit since it gave the highest percentage of marketable ears and ear yield.

Table 2. Percentage (%) of marketable ears and ear yield of sweet corn as influenced by levels of IMO 7 and ONS.

Treatments	Marketable Ears (%)	Ear Yield ($t\ ha^{-1}$)
A – Levels of IMO 7		
Control (N:P:K, 120:90:60)	94.12	11.60
7.5 $t\ ha^{-1}$	91.25	10.80
15 $t\ ha^{-1}$	93.10	11.35
22.5 $t\ ha^{-1}$	94.52	12.15
B - ONS		
Control	92.46	12.20^{ab}
FAA	92.13	10.59^{b}
FPJ	93.63	11.35^{b}
FS	94.77	13.00^{a}
F- test:		
A	ns	ns
B	ns	*
A x B	ns	ns
C.V. (%)	5.42	10.15

ns - non-significant; * - significant at 5% level of Tukey's test

Physiological Parameters

LAI at 45, 55, 65, and 75 DAP. Table 3 presents the effects of levels of IMO 7 and ONS on the LAI of sweet corn at 45, 55, 65, and 75 DAP. The level of 120-90-60 gave the highest LAI at 45, 55, and 65 DAP. The rates of 15 $t\ ha^{-1}$ and 22.5 $t\ ha^{-1}$ obtained the highest LAI at 75 DAP. For the effects of ONS, FS had the highest LAI at 45, 55, and 65 DAP. Statistical analysis revealed significant results on the impacts of ONS on the LAI of sweet corn at 65 DAP. Using FS significantly improved the LAI of sweet corn at 65 DAP. As reported by Muktmar *et al*. (2016), local-based liquid organic fertilizer concentrations with seaweed influenced the LAI of sweet corn. The presence of macro and microelements from the seaweeds improved the sizes (thickness and width) of the leaf area of sweet corn (Singh *et al.*, 2016). The LAI of sweet corn decreased as the plants reach their physiological maturity because some of its functional leaves declined. The maximum leaf area is achieved at 55 to 65 DAP (Williams, 2008).

Table 3. LAI of sweet corn at 45, 55, 65, and 75 DAP as influenced by levels of IMO 7 and ONS.

Treatments	Leaf Area Index (LAI)			
	45 DAP	55 DAP	65 DAP	75 DAP
A – Levels of IMO 7				
Control (N;P;K;, 120:90:60)	3.00	3.49	3.03	2.63
7.5 t ha^{-1}	2.70	3.25	2.72	2.51
15 t ha^{-1}	2.88	3.28	2.75	2.64
22.5 t ha^{-1}	2.93	3.29	2.79	2.64
B – ONS				
Control	2.81	3.33	2.83[ab]	2.72
FAA	2.86	3.43	2.58[b]	2.56
FPJ	2.80	3.12	2.83[ab]	2.50
FS	3.05	3.43	3.10[a]	2.64
F- test:				
A	ns	ns	ns	ns
B	ns	ns	*	ns
A x B	ns	ns	ns	ns
C.V. (%)	10.90	10.03	14.85	10.08

ns - non-significant; * - significant at 5% level of Tukey's test

NAR (gm^{-2} day^{-1}). The NAR of sweet corn as influenced by levels of IMO 7 and ONS at 45-55 and 55-65 DAP is presented in Table 4. Data showed that the sweet corn applied with 120-90-60, and 22.5 t ha^{-1} obtained the highest NAR of about 0.082 for each at 45-55 DAP. At 55-65 DAP, 22.5 t ha^{-1} had the highest NAR of about 0.124 gm^{-2} day^{-1}. For the ONS, FS obtained the highest NAR of about 0.091 and 0.131 gm^{-2} day^{-1} at 45-55 and 55-65 DAP respectively. Nitrogen is one of the

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contributing factors that could improve the NAR of sweet corn. In the study of Hammad *et al*. (2011), sweet corn applied with a higher level of nitrogen obtained the highest NARs. Gonzaga Jr, (2018) posits that NAR is the rate of increase of dry weight per unit leaf area. NAR is dependent on the number of nutrients applied and its ability to intercept light for photosynthesis (Andonova, *et al*., 2014). IMO 7 at a higher level contains a higher amount of macro and micronutrients thus the NAR is increased. The result was proven in the study of Joshi *et al*. (2015) where sweet corn applied with the highest rate of vermicompost obtained the highest NAR. The interaction effects of levels of IMO 7 and ONS on sweet corn at 45-55 and 55-65 DAP was not statistically significant.

Table 4. NAR of sweet corn at 45-55, and 55-65 DAP as influenced by levels of IMO 7 and ONS.

Treatments	Net Assimilation Rate (NAR) gm^{-2} day^{-1}	
	45-55 DAP	**55-65 DAP**
A – Levels of IMO 7		
Control (N;P;K;, 120:90:60)	0.082	0.119^{ab}
7.5 t ha^{-1}	0.075	0.107^{b}
15 t ha^{-1}	0.077	0.117^{ab}
22.5 t ha^{-1}	0.082	0.124^{a}
B – ONS		
Control	0.074^{b}	0.106^{b}
FAA	0.076^{b}	0.113^{b}
FPJ	0.075^{b}	0.115^{b}
FS	0.091^{a}	0.131^{a}
F- test:		
A	ns	*
B	*	**
A x B	ns	ns
C.V. (%)	18.74	14.31

ns - non-significant; * - significant at 5% level of Tukey's test; **= significant at 1% level of Tukey's test

DMY (t ha^{-1}). The DMY of sweet corn at 45, 55, 65, and during harvest at 75 DAP is presented in Table 5. As shown, the control treatment (120-90-60) gave the highest DMY at 45, 55, 65, and 75 DAP. Among the ONS, FS gave the highest DMY. The sufficient amount of macroelements is the contributing factor for the improvement of DMY. The result was confirmed in the study of Marsalis *et al*. (2010) in which dry matter increased with the increasing amount of nitrogen applied to sweet corn. Nitrogen can improve the plant mechanism to intercept more light and convert it into complex sugars, thus increasing the dry matter accumulation per plant (Almodares *et al*., 2009). The study of Ghosh *et al.* (2013) proved that higher level of vermicompost could improve the DMY of sweet corn. Results were not significant in the DMY at 45, 55, 65, and 75 DAP.

Table 5. DMY of sweet corn at 45, 55, 65, and 75 DAP as influenced by levels of IMO 7 and ONS

Treatments	Dry Matter Yield (DMY) t ha^{-1}			
	45 DAP	55 DAP	65 DAP	75 DAP
A – Levels of IMO 7				
Control (N;P;K;, 120:90:60)	3.66	6.04	6.23	10.58^{a}
7.5 t ha^{-1}	3.38	4.92	5.26	9.35^{b}
15 t ha^{-1}	3.54	4.87	5.59	9.84^{ab}
22.5 t ha^{-1}	3.07	5.03	5.91	10.37^{a}
B – ONS				
Control	3.45	5.38	5.38	10.10
FAA	3.18	5.25	5.69	9.80
FPJ	3.49	4.83	5.72	9.95
FS	3.53	5.40	6.20	11.00
F- test:				
A	ns	ns	ns	*
B	ns	ns	ns	ns
A x B	ns	ns	ns	ns
C.V. (%)	21.64	25.51	17.38	11.10

ns - non-significant; * - significant at 5% level of Tukey's test

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Economic Analysis

ROI. The ROI of sweet corn applied with varying levels of IMO 7 and ONS is presented in Table 6. As projected, 120-90-60 had the highest ROI of 392.07, while 22.5 t ha^{-1} obtained the least ROI at 144.59. Statistical analysis revealed a significant result suggesting that 120-90-60 was the cheapest among the rests of treatments. This is due to the lesser inputs incurred during the production. A level of 7.5 t ha^{-1} had an ROI of 286.96 ranked next to the synthetic fertilizer and significantly the cheapest compared to 15 tons IMO 7 (187.98), and 22.5 tons IMO 7 (144.60). Economically, an ROI of 286.96 obtained by the level of 7.5 t ha^{-1} would gave more advantage in the farmers side which is comparable to the ROI of corn in the study of Elmundo *et al.* (2010) which reported that a variety of NM08A4 gave the highest ROI of 276 as influenced by inorganic fertilizers.

For the effects of ONS, FS gave the highest ROI at 269.8. The result suggested that the use of FS is more profitable since it gave the highest ROI compared to the FAA. The result is supported by the study of Pal *et al*. (2015) in which seaweed extracts improved the yield of sweet corn and gave a maximum ROI of about 203%. The interaction effects of rates of IMO 7 and ONS did not reveal any significant result on the ROI.

Table 6. ROI of 1-hectare sweet corn production as influenced by levels of IMO 7 and ONS.

Treatments	Return on Investment (ROI)
A – Levels of IMO 7	
Control (N;P;K;, 120:90:60)	392.1[a]
7.5 t ha^{-1}	287.0[b]
15 t ha^{-1}	187.98[c]
22.5 t ha^{-1}	144.59[d]
B – ONS	
Control	259.2[ab]
FAA	230.2[b]
FPJ	252.4[ab]
FS	269.8[a]
F- test:	
A	**
B	*
A x B	ns
C.V. (%)	40.75

ns - non significant; * = significant at 5% level of Tukey's test; * = significant at 1% level of Tukey's test

Conclusion and Recommendations

Based on the results of the study, the rates of IMO 7 influenced ear height while ONS affected the weight per ear, number of kernels per ear, and ear yield. They also improved the NAR (55-65 DAP), and DMY at 75 DAP while ONS impacted the LAI (65 DAP), and NAR (45-55, and 55-65 DAP). The interaction effects of rates of IMO 7 and ONS did not reveal any significant difference in the different agronomic, physiological, and economic parameters. Furthermore, synthetic fertilizers (120-90-60) gave the highest ROI of about 392.1%, followed by 7.5 t ha^{-1} at 287%. Lastly, for the ONS, FS gave the highest ROI of 269 %.

This study provides more information on the production of sweet corn using organic inputs. IMO 7 and FS were proven effective in improving the sweet corn yield. Besides, they also improve soil fertility. Economically, synthetic fertilizers are still considered the cheapest when compared to IMO 7. Despite economic status results, IMO 7 and FS are

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always the best due to their positive contributions to the environment and the consumers as well. Organically grown products are safe for consumption. If further study is conducted, it is recommended to include the post-harvest quality parameters like total soluble solids, protein content, and shelf life.

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