Enhanced growth and yield of eggplant (*Solanum melongena* L.) applied with seaweed extract

K.M. Jamili[1], K.M.L. Catubis[1,*], P.R.L. Pascual[2] and R.A. Cabillo[1]

[1] Horticulture Department, College of Agriculture, Cebu Technological University Tuburan Campus, Cebu 6043, The Philippines

[2] Crop Science Department, College of Agriculture, Cebu Technological University Barili Campus, Cebu 6036, The Philippines

* Corresponding author: kentcatubis@gmail.com

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ABSTRACT

Eggplant is one of the high-value vegetable crops in the country that has been studied for growth and yield improvement due to its nutritional and medicinal benefits to the consumer. Thus, a study was conducted utilizing the *Sargassum polycystum* seaweed extract as foliar fertilizer for eggplants to assess its growth and yield responses. The study was arranged in a randomized complete block design. Treatments were control (no foliar application of seaweed extract), recommended commercial fertilizer (10 g of 14-14-14), 0.5% v/v, 1.0% v/v, and 1.5% v/v seaweed extract in water. Results show improvement in eggplant growth and yield parameters applied with seaweed extract ($P < 0.05$). Application of 1.0% v/v seaweed extract resulted in the highest plant height (44.00 ± 7.28 cm) and root length (21.61 ± 4.83 cm) for eggplant, comparable to all plants applied with commercial fertilizer (39.06 ± 10.32 cm, 20.28 ± 3.64 cm), 0.5% v/v (42.33 ± 11.11 cm, 20.78 ± 3.84 cm) and 1.5% v/v (42.06 ± 10.56 cm, 20.11 ± 4.50 cm) of seaweed extract, respectively. A similar result was observed for leaf number and leaf width. Moreover, 1.0% v/v of seaweed extract application got the highest number of fruits per plant (3.00 ± 0.49), fruit length (16.00 ± 0.77 cm), fruit circumference (10.92 ± 0.67 cm), and fruit weight (97.22 ± 37.27 g). Hence, the foliar application of 1.0% v/v seaweed extract is recommended for more profitable and sustainable eggplant production.

Keywords: Seaweed extract, *Solanum melongena* L., growth, yield

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INTRODUCTION

Due to its medicinal characteristics, the consumption of eggplant (*Solanum melongena*) has increased significantly (Raigón *et al.,* 2008). Eggplants contain phenolic compounds, which are antioxidants. A serving of eggplant contains at least 5% of a person's daily fiber, copper, manganese, B-6, and thiamine requirements, as well as other vitamins and minerals (Ware, 2019). To meet the increasing demand for eggplant fruits, investment in research is crucial to improve yield and postharvest fruit quality. Fertilizer management is one of the main factors responsible for eggplant quality and yield. Fertilization of eggplant is usually done using mineral fertilizer, where doses and applications depend on expected yield and plant phenology. However, as with other vegetable crops grown using conventional cultural practices, excessive fertilization of eggplant culture can lead to several problems, including soluble solids accumulation in the soil and nutrient leaching (Cardoso *et al*., 2008). Thus, there is a growing need to develop environmentally-friendly strategies for the sustainable culturing of horticultural crops with high yields and minor environmental damage.

Microalgae, often known as seaweed, are aquatic plants that belong to the plant kingdom (Dhargalkar *et al*., 2001; Kerswell, 2006). *Sargassum polycystum* is a brown marine macroalga with a wide range of applications. Seaweed extracts (SE) possess great potential as biostimulants for improving agricultural yield. It also reduces the use of chemicals that harm the environment. The beneficial effect of seaweed extract application is a result of many components that may work synergistically at different concentrations (Fornes *et al*., 2002). It has many bioactive compounds beneficial to plant development, giving them great potential as an agricultural fertilizer. This research aimed to determine the effect of varying concentrations of seaweed biofertilizer derived from *S. polycystum* on the growth and yield of eggplant applied through foliar spraying.

MATERIALS AND METHODS

Location of the Study

The study was conducted in the open area of Sitio Mohon at Barangay Liki, Balamban, Cebu, Philippines.

Planting Material

Calixto F1 cultivar of eggplant seeds was used. Two seeds were sown in each hole of a seedling tray with a ratio of 1:1 goat manure and garden soil as a medium.

Preparation of Growth Medium

A total of 90 bags measuring 60 cm in height and 20 cm in width were used in this study. Only one seedling was planted per prepared planting medium filled with a mixture of 20 kg of soil and 50 g of goat manure.

Transplanting of Seedlings

The seedlings were transplanted 3 to 4 weeks after the seedlings were fully developed. The seedling was removed from the seedling tray for transplanting.

Collection and Preparations of Seaweed Extract

Sargassum polycystum, a brown algae species in the genus *Sargassum*, was used in this study. It was collected in the coastal area of Asturias, Cebu. Collected seaweeds were washed with tap water to remove sand and excess salts. Washed seaweeds were air-dried until complete dryness from the water was obtained. Dry seaweeds were cut into smaller pieces. One kilogram of fresh seaweed was boiled separately with a liter of distilled water for an hour. It was filtered to remove solids using a double-layered cloth (Sivasankari *et al*., 2006). The filtrate was taken as 100% concentrate of the seaweed extract. It was diluted to tap water when applied.

Experimental Design and Treatments

The experiment was laid out in a randomized complete block design (RCBD). There were 5 treatments, including the control treatment. Each treatment consists of 3 replications (which served as blocks) with 6 samples. The treatments were T0 – control (no foliar application of seaweed extract), T1 – commercial fertilizer (10 g of 14-14-14), T2 – 0.5% v/v of seaweed extract, T3 – 1.0% v/v of seaweed extract, and T4 – 1.5% v/v of seaweed extract.

Treatment Application

After transplanting, seedlings were irrigated twice a day for 7 days. Seaweed extract treatments were applied twice a week using the foliar application, while 10 g of complete fertilizer (14-14-14) was applied twice a month by the side-dress method. Application of such treatment was made until the termination of the study.

Data Collection

The experimental period of this study is 3 months from transplanting the eggplant seedlings to its growing pots to the first harvest (March to April 2022). Different growth parameters, i.e., plant height, number of leaves per plant, and leaf width, were measured weekly. The yield parameters, i.e., fruit circumference, number of fruits per plant, weight per fruit, fruit length, and root length, were measured after 60 days. Measurement of each data was as follows:

Growth parameters

Plant height (cm) was measured from the base of the eggplant plant to the tip. It was taken through the use of a tape measure. Leaf width (cm) was taken from the 5th leaf from the base of a 6-week-old plant using a tape measure. Such a leaf was marked for weekly data gathering. Number of leaves per plant was gathered by counting all the fully opened leaves. Root length (cm) was measured per plant sample in each treatment using a tape measure.

Yield parameters

Number of fruits per plant was done by counting all the fruits produced per plant. Fruit length was done by measuring the fruits from the base of the fruits to the tip using a tape measure. Weight per fruit was done by weighing every fruit produced using a weighing scale. Fruit circumference was done by measuring the girth of the fruits using a tape measure.

Statistical Analysis

One-way analysis of variance (ANOVA) was used to determine the significant differences among treatments in a randomized complete block design. A post hoc test was done using Tukey significant test to determine which treatment would significantly differ from the other treatment means ($P < 0.05$).

RESULTS AND DISCUSSION

Plant Height

Significant differences among treatments on the plant height of eggplant were observed on week 8–12 ($P < 0.05$). Table 1 shows that foliar spraying of seaweed extracts promotes the plant height of eggplant at week 12 similar to plants fertilized with commercial fertilizer (39.06 ± 10.32 cm), where in 1.0% v/v of seaweed extracts got the highest height of 44.00 ± 7.28 cm. Eggplants grown without fertilizer had the shortest plant height (33.17 ± 13.24 cm). It is because no fertilizer was applied, which explains the importance of fertilization for plant growth and development.

More importantly, eggplants applied with *S. polycystum* seaweed extract can be compared to commercially fertilized eggplants since seaweed fertilizers have the broadest range of benefits to plants beyond plant nutrition. Similarly, *S. melongena* plants obtained significant differences in their vegetative growth and yield when sprayed with *Stoechospermum marginatum* seaweed extract at a 5.0% concentration (Ramya *et al*., 2015). Also, the tomato's plant height significantly increased by up to 16% compared to the control plants ($P < 0.05$) after the application of a lower concentration (20%) of seaweed liquid extract (Sutharsan *et al*., 2014). Such positive results can be credited to several plant growth-stimulating compounds in seaweeds when applied to soil or leaves (Wally *et al*., 2013).

Table 1 Average weekly plant height of eggplant (cm) as influenced by the different treatments used in the study

Treatment	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
T0	13.17 ± 5.68	15.11 ± 6.13^{ab}	17.06 ± 7.17^{c}	22.61 ± 7.06^{b}	27.28 ± 11.84^{b}	33.17 ± 13.24^{b}
T1	12.83 ± 5.73	14.78 ± 6.38^{b}	18.61 ± 6.09^{bc}	24.56 ± 10.53^{b}	31.06 ± 7.74^{ab}	39.06 ± 10.32^{ab}
T2	15.78 ± 6.53	17.44 ± 7.00^{ab}	23.56 ± 8.56^{abc}	30.33 ± 8.84^{ab}	39.17 ± 12.78^{a}	42.33 ± 11.11^{ab}
T3	14.67 ± 3.25	15.89 ± 4.06^{ab}	25.06 ± 6.90^{ab}	32.89 ± 8.01^{a}	40.56 ± 9.26^{a}	44.00 ± 7.28^{a}
T4	17.56 ± 4.79	20.50 ± 5.99^{a}	27.56 ± 9.22^{a}	34.56 ± 9.34^{a}	40.94 ± 12.03^{a}	42.06 ± 10.56^{ab}

Note: Means within the same column not sharing letters in common differ significantly at 5% significance based on the Tukey's range test. T0 = control (no fertilizer), T1 = commercial fertilizer, T2 = 0.5% v/v of seaweed extract, T3 = 1.0% v/v of seaweed extract, T4 = 1.5% v/v of seaweed extract

Leaf Width

Generally, there was no significant difference among treatments used on the width of the eggplant leaves (Table 2). A significant difference among treatments were observed from week 7 to week 11, where SE-treated plants had wider leaf compared to control and commercially-fertilized plants. At week 11, plants sprayed with 1.5% v/v SE got the widest leaf (17.67 ± 2.45 cm) comparable to plants sprayed with 1.0% v/v SE (16.83 ± 2.28 cm), and 0.5% v/v SE (16.39 ± 3.60 cm). Controlled plants without SE application got the narrowest leaf (12.33 ± 3.14 cm), comparable to those fertilized with 14-14-14 (12.78 ± 2.84 cm).

Table 2 Average weekly leaf width of eggplant (cm) as influenced by the different treatments used in the study

Treatment	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
T0	7.70 ± 2.28^{ab}	7.92 ± 2.67^{b}	9.00 ± 3.05^{b}	11.83 ± 2.46^{b}	12.33 ± 3.14^{b}	14.94 ± 3.42
T1	7.13 ± 2.23^{b}	7.67 ± 2.20^{b}	8.89 ± 3.50^{b}	11.61 ± 3.18^{b}	12.78 ± 2.84^{b}	15.33 ± 2.33
T2	8.00 ± 2.45^{ab}	9.81 ± 3.18^{ab}	11.83 ± 3.42^{ab}	15.06 ± 2.98^{a}	16.39 ± 3.60^{a}	17.89 ± 5.07
T3	8.44 ± 1.46^{ab}	9.22 ± 1.80^{ab}	13.28 ± 2.76^{a}	15.89 ± 2.45^{a}	16.83 ± 2.28^{a}	17.44 ± 1.69
T4	9.33 ± 2.52^{a}	11.39 ± 3.35^{a}	14.17 ± 3.28^{a}	16.28 ± 3.63^{a}	17.67 ± 2.45^{a}	17.67 ± 2.40

Note: Means within the same column not sharing letters in common differ significantly at 5% significance based on the Tukey's range test. T0 = control (no fertilizer), T1 = commercial fertilizer, T2 = 0.5% v/v of seaweed extract, T3 = 1.0% v/v of seaweed extract, T4 = 1.5% v/v of seaweed extract

Such a result implies the positive effects of seaweed extract to plant growth. As verified by Abbas *et al*. (2020), the application of seaweed extracts significantly improved the leaf width of different onion cultivars ($P < 0.05$). Application of 0.5% and 1% seaweed extracts showed a maximum increase in leaf width of all onion cultivars, particularly 38.6% for 'Nasar puri', 35.2% for 'Nasar puri', 15.2% for 'Phulkara', and 11.9% for 'Lambada' compared to the control plants. In addition, a 39.63% increase in the polar head diameter of cabbage has been observed under combined effective microorganism (EM) and seaweed extract (Kelpak®) application compared to control plants (Satekge *et al*., 2016).

However, as of week 12, no significant differences among treatments used on the leaf width of eggplants. Such a result could be attributed to the reached potential of the definite leaf growth of those

SE-treated plants and the continuous leaf growth of those treated only with goat manure (control) and 14-14-14 (commercial fertilizer). Goat manure has a considerable amount of mineral nutrients for plant growth. In support, the leaf width of the beetroot plant has increased by up to 18.59% when applied with combined goat manure (10 t/ha), sugarcane molasses (3 t/ha), and 50% tripe super phosphate compared to pure inorganic fertilizers (Nadeeka and Seran, 2020). Moreover, *P. purpureum*'s leaf width has also increased by up to 27.27% as applied with 20% goat manure in 80% acid soil compared to no manure in 100% acid soil (Sari *et al*., 2021).

Leaf Number

As presented in Table 3, there was a significant difference in the leaf number of eggplants among treatments used in the study from week 10 to week 12 ($P < 0.05$). Eggplants applied with commercial inorganic fertilizer produced the highest number of leaves (15.22 ± 5.16) compared to plants sprayed with SE at different concentrations and no SE application (week 12). Eggplants without SE had the fewest leaves, with only 11.22 ± 3.84 leaves on average. A consistent trend of results was observed from week 10 until the termination of the study at week 12.Such a result indicates that seaweed extracts did not significantly affect the leaf number of plants, which contradicts the claim of some studies. Yusuf *et al.* (2021) claimed that eggplants applied with *K. alvarezii* seaweed extract produced the highest number of leaves (36.38), which is comparable to plants applied with *Caulerpa* sp., *Sargassum* sp., *Ulva* sp., and NPK fertilizer (commercial) at week 12 after planting. Furthermore, the Barshelona cultivar of eggplant got the highest total number of leaves per plant (44.51) as sprayed with one mL/L of seaweed extract (Khazaal and Rashed, 2018). Such a positive effect of seaweed extract on plants is probably due to the beneficial minerals and hormones that can be found in it that stimulate plant growth (Karthik *et al*., 2020).

However, the leaf number response of a plant to seaweed extract could be influenced by the seaweed species being used. A study conducted by Yusuf *et al*. (2020), in particular, supported the result of this study, wherein the leaf number of *Allium wakegi* treated with *Ulva* sp. of seaweed extracts is significantly higher at $P < 0.05$ (16.75) compared to plants treated with *Sargassum* sp. of seaweed extracts (14.71). The leaf number of shallot treated with *Sargassum* sp. of seaweed extracts is comparable to the leaf number of control plants (no seaweed extract), with an average of 12.54 at 56 days after planting.

Table 3 Average weekly leaf number of eggplants as influenced by the different treatments used in the study

Treatment	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
T0	5.78 ± 0.73	5.78 ± 0.73	6.56 ± 2.04	7.94 ± 2.07^{b}	8.61 ± 3.43^{b}	11.22 ± 3.84^{b}
T1	6.17 ± 1.72	7.00 ± 2.70	8.50 ± 3.87	11.39 ± 4.08^{a}	12.61 ± 4.51^{a}	15.22 ± 5.16^{a}
T2	6.89 ± 2.14	7.22 ± 2.21	7.83 ± 2.57	8.94 ± 2.71^{ab}	10.89 ± 4.90^{ab}	12.78 ± 4.54^{ab}
T3	6.72 ± 0.83	6.72 ± 0.83	7.06 ± 0.94	8.56 ± 1.42^{b}	13.00 ± 3.73^{a}	14.67 ± 2.68^{ab}
T4	6.61 ± 0.70	7.00 ± 1.03	8.17 ± 1.50	10.28 ± 2.42^{ab}	11.56 ± 2.81^{ab}	12.83 ± 2.57^{ab}

Note: Means within the same column not sharing letters in common differ significantly at 5% significance based on the Tukey's range test. T0 = control (no fertilizer), T1 = commercial fertilizer, T2 = 0.5% v/v of seaweed extract, T3 = 1.0% v/v of seaweed extract, T4 = 1.5% v/v of seaweed extract

Root Length

Significant differences (P < 0.05) among treatments used on the root length of eggplant were presented in Table 4. Among all treatments, 1.0% v/v concentration of SE produced the longest root length of eggplant, averaging 21.61 ± 4.83 cm, comparable to those plants grown under 0.5% v/v SE (20.78 ± 3.84 cm), commercial fertilizer (20.28 ± 3.64 cm), and 1.5% v/v SE (20.11 ± 4.50 cm). The shortest root length was those eggplants without SE (18.22 ± 2.90 cm), indicating the importance of consistent fertilizer application for the plant's proper growth and development, including root development.

The result has manifested improved root growth when seaweed extracts are supplemented to plants through soil or foliar application. In validation, Ertani *et al*. (2018) reported that the root length of corn has been positively influenced by the addition of *Laminaria* and *A. nodosum* seaweed extracts (plus 81%). Moreover, pakchoi's root growth was increased by 8.37 cm compared with the control when 10% kelp waste extracts (KWE) were applied (Zheng *et al*., 2016). Such effect on root length can be ascribed to alginate oligosaccharides induced expression of an auxin-related gene leading to higher auxin concentration, thus promoting root elongation (Abbas *et al*., 2020).

Table 4 Average root length and yield components of eggplant as influenced by the different treatments used in the study

Treatment	Root length (cm)	Number of fruits	Fruit length (cm)	Fruit weight (g)	Fruit circumference (cm)
T0	18.22 ± 2.90^{b}	1.67 ± 0.49^{b}	14.67 ± 0.84^{c}	55.32 ± 22.73^{b}	10.03 ± 0.76^{b}
T1	20.28 ± 3.64^{ab}	1.67 ± 0.49^{b}	15.83 ± 1.10^{ab}	59.72 ± 23.70^{b}	10.22 ± 0.52^{b}
T2	20.78 ± 3.84^{ab}	2.00 ± 0.34^{b}	15.00 ± 0.91^{bc}	73.61 ± 24.96^{ab}	10.64 ± 0.97^{ab}
T3	21.61 ± 4.83^{a}	3.00 ± 0.49^{a}	16.00 ± 0.77^{a}	97.22 ± 37.27^{a}	10.92 ± 0.67^{a}
T4	20.11 ± 4.50^{ab}	1.72 ± 0.46^{b}	14.89 ± 1.32^{c}	75.00 ± 29.70^{ab}	10.17 ± 0.64^{b}

Note: Means within the same column not sharing letters in common differ significantly at 5% significance based on the Tukey's range test. T0 = control (no fertilizer), T1 = commercial fertilizer, T2 = 0.5% v/v of seaweed extract, T3 = 1.0% v/v of seaweed extract, T4 = 1.5% v/v of seaweed extract

Fruit Number

One percent concentrate (v/v) of SE significantly influenced the fruit number of eggplants among all treatments used in the study (P < 0.05). Compared with commercial fertilizer, a 44.33% increase in fruit number was recorded on plants sprayed with 1.0% v/v SE. Result suggests that a 1.0% v/v concentration of SE for a foliar spray on eggplant is optimal. A lower or higher concentration than 1.0% v/v of SE is critical and comparable to those applied with commercial fertilizer and no SE.

However, the study's result conflicted and somehow supported a particular study wherein 0.25%, 0.5%, and 1.0% concentrations of True-Algae-Max (TAM®) significantly improved the total yield of hot pepper. A 0.5% TAM concentration got the highest rate of increase (23.20%) compared to the control but comparable to 0.25% and 1.0% TAM (Ashour *et al*., 2021). Moreover, seaweed extract application increases the yield of tomato plants compared to those of control plants. Such an increase was due to the essential macro and micronutrient contents of seaweed *U. reticulata* absorbed by plants, which cause cells and tissues to grow and develop plant organs, resulting in increased fruits and yield. Phytohormone gibberellin (GA) and particular essential elements such as potassium and magnesium, which are majorly present in most seaweed extracts, influenced the fruit numbers of most plants. The GA's function in plants significantly increases the flowering time and fruit set during the developmental transition of ovaries into fruits (Shinozaki *et al*., 2020; Novita, 2022). Aside from the growth benefits of potassium to plants, it also increases fruit production per plant as it regulates the carbon assimilation and translocation of protein and sugars within the plants (Cruz *et al*., 2017). Similarly, the supplementation of magnesium also increases fruit yield (Le *et al*., 2020). But then, increasing the concentration of extract by more than 20% significantly inhibited the yield of tomatoes (Abu *et al*., 2022)

Fruit Length

Eggplant sprayed with 1.0% v/v SE got the longest length of fruit (16.00 ± 0.77 cm) among varied concentrations of SE significantly ($P < 0.05$). Such fruit length of eggplant applied with 1.0% v/v SE is comparable to the plants fertilized with commercial fertilizer (15.83 ± 1.10 cm). The shortest fruit length is from those plants with no and higher concentrations of SE (1.5% v/v).

Increased fruit length could be credited to the nutrients and hormones in the seaweed extract, which improved the photosynthesis process. The manufactured carbohydrates and other photosynthates will be translocated to their fruits to meet growth requirements and development. Auxin and cytokinin hormones, in particular, influence the plants' fruit size development. Auxin's role is critical during fruit development as it activates cell division and expansion processes (Godoy *et al*., 2021). Likewise, cytokinin induces fruit enlargement through cell expansion or division and sustains the growth of fruit (Devoghalaere *et al*., 2012). As reported, the maximum fruit length of eggplant at 14.24 cm can be achieved through foliar spraying one mL/L seaweed extract (Khazaal and Rashed, 2018). Similarly, *C. annuum*'s fruit length is significantly increased by applying True-Algae-Max (TAM®) at up to 1.0% concentration.

As plants receiving no SE produced shorter fruit length due to inadequate nutrients for growth, a higher concentration of seaweed extract also inhibits fruit growth. The *Arabidopsis* study can support such inhibitory effects, wherein a higher concentration of *Ulva* extract inhibits seed germination (Ghaderiardakani *et al*., 2019). In addition, the germination rate of *S. lycopersicum* and *Abelmoschus esculentus* were inhibited beyond 60% of seaweed extract application, which indicates that a higher concentration of SE is toxic to plant growth and development (Arun *et al*., 2014).

Fruit Weight

As to the fruit weight of eggplant, 1.0% v/v SE got the heaviest weight of fruit (97.22 ± 37.27 g), comparable to the 1.5% v/v SE (75.00 ± 29.70 g) and 0.5% v/v SE (73.61 ± 24.96 g). The lightest weight of eggplant fruits was recorded under commercial fertilizer-applied plants (59.72 ± 23.70 g) and no SE (55.32 ± 22.73 g). Such a result indicates significant effects of seaweed extracts on fruit weight even at varying concentrations up to 1.0% v/v. The study's result agrees with the increased fruit weight of eggplant by 17.24% sprayed with one mL/L of seaweed extract compared to control plants (Khazaal and Rashed, 2018). Same with tomatoes, the total yield feature significantly increased with rates of 23.20% by 0.5% TAM® (commercial seaweed extract) application, which is significantly similar to the TAM® concentrations of 0.25% and 1.0% (Ashour *et al*., 2021). The increase in fruit weight can also be attributed to the increase in fruit size of those plants sprayed with SE. As mentioned, SE contains essential elements (potassium and magnesium) and hormones that enhance fruit setting and its development. Aside from increasing fruit size, potassium's role also improves the quality of fruits, including their weight. Potassium regulates essential functions in a plant, like maintaining turgor pressure in cells and carbon assimilation, which enhances and keeps the weight of fruit intact (Kumar *et al*., 2006). In addition, cytokinin and auxin's cell expansion function enlarges fruit sizes that may contribute to the weight of the fruit (Aremu *et al*., 2020).

Fruit Circumference

Like other fruit parameters, eggplant sprayed with 1.0% v/v SE had the highest fruit circumference (10.92 ± 0.67 cm), which was similar to 0.5% v/v SE-applied plants (10.64 ± 0.97 cm). The smallest fruit circumference was observed in control plants (10.03 ± 0.76 cm), comparable to plants applied with commercial fertilizer and with 1.5% v/v SE. A similar result has supported the study's result, wherein different TAM® concentrations have improved tomatoes' fruit diameter by 14.41% (0.5% TAM) compared to plants fertilized with

NPK (Ashour *et al*., 2021). Moreover, Khazaal and Rashed (2018) reported a 12.46% increase in the *S. melongena* fruit applied with one mL/L of SE compared to control plants. This signifies the positive effect of seaweed extracts as biostimulants for Solanaceous crops. Phytohormones in SE, such as auxin and cytokinin, enhance the eggplant's fruit size and circumference due to its cell division and expansion function (Aremu *et al*., 2020; Godoy *et al*., 2021). Moreover, the supplementation of potassium from SE boosts fruit size (Cruz *et al*., 2017).

CONCLUSIONS

Among all treatments, the application of 1.0% seaweed extract as biofertilizer could enhance different vegetative and yield characteristics like plant height, root length, number of fruits, fruit length, fruit weight, and fruit circumference of eggplant, indicating enhanced nutrient uptake by the plants. Thus, the foliar application of 1.0% seaweed extract can be a good biofertilizer for eggplants.

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