**Effects of Basfoliar and Biovita Foliar Spray on Growth and Quality Attributes of Summer Squash (*Cucurbita pepo* L*.*)**

**ABSTRACT**

The study aimed to analyse the effects of Basfoliar and Biovita on the growth and quality attributes of Summer Squash (*Cucurbita pepo* L.). cv. Punjab Chappan Kaddu- 1. Basfoliar (extract from *Ecklonia maxima*)and Biovita (freshly harvested extract of Norwegian seaweed viz., *Ascophyllum nodosum*) is one such product containing naturally occurring major and minor nutrients produced helpful for obtaining maximum yield and better-quality crop. The study involved ten treatments consist of Basfoliar and Biovita at 5, 10, 25 and 20% along with the Recommended dose of fertilizer (100-50-50 kg/ha). The RDF + Basfoliar @ 20% had a beneficial effect on plant height, number of leaves, days to first male flower appearance, days to first female flower appearance, male-to-female sex ratio, days to first fruit set, days to first fruit harvest, harvest duration, number of fruits per plant per picking, number of pickings, average fruit weight, yield per plot, TSS and ascorbic acid. It is concluded that applying a Recommended dose of fertilizer + Basfoliar @ 20% is beneficial as this enhances the growth, yield and quality attributes of summer squash due to their unique bioactive components and beneficial effects. These products exhibit phytostimulatory properties that promote plant growth and enhance yield in several important crops. Furthermore, their phytoelicitor activity triggers defence responses in plants, improving resistance to pests, diseases, and abiotic stresses like drought, salinity, and cold.

**KEY-WORDS:** Basfoliar, Biovita, fertilizer, Yield.

**INTRODUCTION**

Summer squash (*Cucurbita pepo* L.) is a short-duration crop grown in summer and is adapted to temperate and sub-tropical climates (Paris, 2008; Goyal & Thind, 2016). The increasing global population and climate change are driving the need for higher crop productivity and food security (Martinez et al., 2024). However, meeting these demands presents challenges for agriculture in terms of reliability, sustainability, and maximizing productivity while minimizing negative impacts on human health and the environment (Afonso, 2022; Asadi et al., 2022; Sani et al., 2021). An innovative approach to addressing these challenges is the foliar application of plant biostimulants (PBs), which can improve or alter physiological processes to optimize plant growth, productivity, and tolerance to environmental stress (Martinez et al., 2024; Sani et al., 2021; Shahid & Liu, 2022). Despite widespread use of PBs by producers and enterprises, further research is needed to better understand their effects on plants and the environment, which can contribute to improving treatment efficacy and food security (Yao et al., 2020; Yakhin et al., 2017).

 Bio stimulants made from seaweeds have properties that improve plant growth, yield and quality as well as improve nutrient use (Arioli et al., 2015; Shulka et al., 2019). Seaweed extract comprises various substances such as polysaccharides, plant growth promoting hormones, fatty acids and minerals. Seaweed extract made from *Ascophyllum nodosum* is enriched in phytohormones i.e. auxin, gibberellin, cytokinin and abscisic acid (Strik et al., 2014). These growth regulators improve the growth of plant and enrich the overall quality attributes of crops (Roughphael et al., 2017; Kaur et al., 2025). Due to its organic and biodegradable properties, it is important in sustainable agriculture and holds a strong potential to reduce the dependence on chemical fertilizers. Summer squash is an economically significant vegetable crop, valued for its nutritional content and market demand. The objective of this study is to assess the effects of seaweed extract on key growth and yield parameters of summer squash. The aim is to enhance plant growth, improve yield components, and optimize overall productivity through the application of seaweed-based biostimulants.

**MATERIAL AND METHODS**

The study was conducted at the research farm of DAV University, Jalandhar, Punjab, during the 2023 on 15th of March. The experimental site is located at 31°33' North latitude and 75°56' East longitude with an elevation of 238 meters above sea level. The experiment was conducted in randomised block design followed by three replications and ten treatments. Seaweed extracts were sprayed at 30 days and 45 days after the transplanting. Also, the foliar treatments were carried out on non-windy days. The study aimed to provide comprehensive data on the impact of Basfoliar and Biovita on summer squash. The experiment was carried out in a randomized block design (RBD) and data analysis was performed using SPSS.

**Treatment details**

The experimental treatments utilized in this study are as follows (T1- Absolute control, T2- NPK, T3- NPK+ Basfoliar @ 5%, T4- NPK+ Basfoliar @ 10%, T5- NPK+ Basfoliar @ 15%, T6- NPK+ Basfoliar @ 20%, T7- NPK+ Biovita @ 5%, T8- NPK+ Biovita @ 10%, T9- NPK+ Biovita @ 15%, T10- NPK+ Biovita @ 20%): T1 represents the absolute control, consisting of no additives. T2 involves the application of NPK fertilizer alone. Treatments T3 through T6 consist of NPK combined with Basfoliar at concentrations of 5%, 10%, 15%, and 20%, respectively. Similarly, treatments T7 through T10 involve NPK combined with Biovita at concentrations of 5%, 10%, 15%, and 20%, respectively. These treatments were implemented to evaluate the effects of varying concentrations of Basfoliar and Biovita, in combination with NPK, on the parameters being studied.

**Preparation of Percentage Solutions**

To prepare a percentage solution, the required amount of solute is calculated based on the desired concentration and the total volume of solution to be prepared. To prepare a 5% solution of Basfoliar in 1 litre (1000 mL) of water, 50 mL of Basfoliar is required, and the remaining 950 mL of the solution is filled with water. Similarly, for a 10% solution, 100 mL of Basfoliar would be required per litre of solution. This process is repeated for each required concentration, ensuring proper mixing to achieve a homogeneous solution.

**RESULTS AND DISCUSSION**

**Growth parameters:**

The growth parameters of summer squash showed significant variations between the treatments as the nutrients present in marine extracts play an important role in plant nutrition, as they are essential for plant growth and development. The maximum plant height was noted in T6 (98.67cm) and minimum was observed in control i.e. T1 (77.67 cm). This might be due to the gibberline present in marine extracts which works on elongation and results in increased plant height and similar results were noticed by Hussein et al. (2019) in sweet pepper.

Maximum number of leaves was observed in T6 (17.34) and minimum was noted in T1 i.e. control (11.33). The presence of cytokinin as it plays an important role in organ metabolites and nutrient partitioning and mobilization. Similar results were observed by Kocira et al. (2017) in common bean and Singh et al. (2017) in cucumber.

Minimum days to first male flower appearance and minimum days to first female flower appearance was noted in T6 (30.00 days and 38.00 days, respectively), whereas the maximum days for both the first male and female flower was noted in T1 (36.67 days and 42.43 days, respectively). Days to flowering are affected by cytokinin which activates the physiological processing plant and affects the flowering (Haberer & Keiber, 2002). The highest sex ratio i.e. 1.05 was noted in T6. However lowest was observed in T1 (0.73). Reason behind this might be due to the seaweed extract interferes with the formation of nucleotides, vitamins and growth hormones and enter the synthesis of enzymes necessary for flower formation (Hussain et al., 2021). The similar results were observed Alhadede & Abdula (2020) in summer squash, Pohl et al. (2019) in eggplant and Mzibra et al. (2021) in tomato.

**Table 1: Effect of Basfoliar an Biovita on growth parameters of Summer Squash**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Treatment** | **Plant height****(cm)** | **Number of leaves** | **Days to first male flower appearance** | **Days to first female flower appearance** | **The male-to-female sex ratio** |
| **T1** | 77.67 | 11.33 | 36.67 | 42.34 | 0.73 |
| **T2** | 78.67 | 12.00 | 35.00 | 41.34 | 0.76 |
| **T3** | 95.34 | 15.34 | 34.34 | 40.67 | 0.91 |
| **T4** | 82.34 | 13.00 | 35.34 | 40.00 | 0.98 |
| **T5** | 86.34 | 16.67 | 33.00 | 39.33 | 1.00 |
| **T6** | 98.67 | 17.34 | 32.00 | 38.00 | 1.05 |
| **T7** | 92.34 | 14.00 | 33.00 | 41.00 | 0.90 |
| **T8** | 89.67 | 15.00 | 32.34 | 40.34 | 0.92 |
| **T9** | 98.00 | 16.67 | 32.66 | 39.00 | 0.96 |
| **T10** | 97.67 | 15.02 | 31.34 | 39.34 | 1.00 |
| **CD0.05** | 4.65 | 1.77 | 2.28 | 2.28 | 0.16 |

*(T1- Absolute control, T2- NPK, T3- NPK+ Basfoliar @ 5%, T4- NPK+ Basfoliar @ 10%, T5- NPK+ Basfoliar @ 15%, T6- NPK+ Basfoliar @ 20%, T7- NPK+ Biovita @ 5%, T8- NPK+ Biovita @ 10%, T9- NPK+ Biovita @ 15%, T10- NPK+ Biovita @ 20%)*

**Yield parameters:**

The evaluation study of yield parameters recorded significant variation among treatments. Minimum days to first fruit set, minimum days to first fruit harvest and maximum harvest duration was observed in T6 (42.00 days, 50.00 days and 52.00, respectively).

This might be due to the enhanced production of growth promoting substances like gibberellic acid which induces the earliness of fruit setting (Kameswari et al., 2010) was observed in T6 (NPK + Basfoliar @ 20%). Therefore, the reason for the increase in the characteristics of vegetative growth is to contain marine extracts on Auxins and cytokinin’s, which promote physiological events and increase total chlorophyll, which effects the vegetative structure and thus shows its effect on the characteristics of vegetative growth and the marine extracts contain the gibberellins, which work on elongation of the parasites as a result of which the increase in the vegetative parameters were observed with the application of seaweed extract. The maximum harvest duration is attributed to improved nutrient uptake and utilization efficiency which is critical for sustaining plant growth over the extended period and this is an essential for evaluating the success of cultivation practices (Ahmed et al 2021).

Number of pickings and number of fruits per plant per pickings was recorded maximum in T6 (23.34 and 8.26 respectively), whereas minimum (12.67 and 5.53, respectively) for both the parameters was noted in T1 i.e. control. This might be due to the seaweed which act as biostimulant. This aligns with the existing literature of Singh et al. (2018) and Thongney et al. (2020) in cucumber and Al-Bayati et al. (2020) in brinjal.

Highest average fruit weight and highest yield per plot was observed in T6 (2.47 g and 20.67 kg). However, lowest was observed in T1 (1.25 and 9.63, respectively). The findings are in line with the results of earlier researchers Hindangmagun & Sharma (2017) in onion, Jung &Choi (2020) in cucumber, Rasheed & Shareef (2019) in Brinjal and Alkharpotly et al. (2024) in summer squash. Increase in the growth characteristics due to the presence of auxin and cytokines in seaweed extracts along with the micro and macro nutrients which are reflected positively in the number of fruits, average fruit weight and fruit yield was observed in T6 (NPK + Basfoliar @ 20%). The similar results align with the existing literature of Hindangmagun & Sharma (2017) in Onion, Sahu et al. (2020) in red radish, Valencia et al. (2018) in cucumber and Hassan et al (2021) in cucumber.

**Table 2: Effect of Basfoliar and Biovita on yield parameters of Summer Squash**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Treatment** | **Days to first fruit set**  | **Days to first fruit harvest** | **Harvest duration** | **Number of fruits per plant per picking**  | **Number of pickings**  | **Average fruit weight****(g)** | **Yield****per plot****(kg)** |
| **T1** | 46.67 | 56.34 | 49.00 | 12.67 | 5.53 | 1.25 | 9.63 |
| **T2** | 46.34 | 54.34 | 49.34 | 17.34 | 6.20 | 1.30 | 10.30 |
| **T3** | 44.67 | 53.67 | 50.67 | 20.67 | 7.46 | 1.46 | 14.79 |
| **T4** | 43.34 | 52.67 | 51.00 | 21.00 | 7.46 | 1.43 | 15.89 |
| **T5** | 43.00 | 51.34 | 51.89 | 22.67 | 8.00 | 1.93 | 18.68 |
| **T6** | 42.00 | 50.00 | 52.00 | 23.34 | 8.26 | 2.47 | 20.67 |
| **T7** | 45.00 | 53.00 | 50.00 | 18.67 | 6.67 | 1.57 | 15.74 |
| **T8** | 44.33 | 52.34 | 51.34 | 19.00 | 7.00 | 2.09 | 16.84 |
| **T9** | 43.00 | 51.33 | 51.45 | 21.60 | 7.90 | 1.89 | 18.00 |
| **T10** | 43.34 | 51.34 | 51.89 | 22.67 | 8.20 | 2.40 | 19.74 |
| **CD0.05** | 2.28  | 2.29 | 1.86 | 2.88 | 0.76 | 0.02 | 0.19 |

*(Treatment detail: See Table 1)*

**Quality parameters:**

Significant influence was observed with the foliar application of Basfoliar and Biovita in increasing the ascorbic acid content of summer squash fruits. The quality parameters showed that the maximum total soluble solids (3.19 oB) and maximum ascorbic acid (15.20 mg/100g) was noted in T6 (NPK + Basfoliar @ 20%). This is because seaweed extract contains glycine betaine which could have led to enhanced phenolic compound synthesis (Karjalainen et al., 2002) that has been positively correlated to TSS, Sweetness and Ascorbic acid content of fruit (Abdel Mawgourd et al., 2010). Foliar application exhibited the maximum increase in ascorbic acid content. This increase in ascorbic acid content also might be due to the synthesis of some metabolic intermediary substances that promoted greater synthesis of the precursor of ascorbic acid. The results align with earlier researcher’s findings Zodape et al. (2011) in okra and Sarhan et al. (2011) in potato.

**Table 3: Effect of Basfoliar and Biovita on quality attributes of Summer Squash**

|  |  |  |
| --- | --- | --- |
| **Treatment** | **TSS (OB)** | **Ascorbic acid****(mg/100g)** |
| **T1** | 3.11 | 11.97 |
| **T2** | 3.13 | 12.42 |
| **T3** | 3.15 | 12.50 |
| **T4** | 3.16 | 12.86 |
| **T5** | 3.17 | 13.92 |
| **T6** | 3.19 | 15.20 |
| **T7** | 3.15 | 12.68 |
| **T8** | 3.16 | 12.77 |
| **T9** | 3.16 | 13.21 |
| **T10** | 3.18 | 14.94 |
| **CD0.05** | 0.03 | 2.09 |

*(Treatment detail: See Table 1)*

**CONCLUSION**

The results of this study demonstrate that the foliar application of Basfoliar and Biovita significantly enhances the growth, yield, and quality attributes of Summer Squash (Cucurbita pepo L.). Among the treatments, the combination of NPK + Basfoliar @ 20% (T6) showed the most pronounced positive effects, improving plant height, number of leaves, early flowering, fruit set, and fruit yield. Furthermore, the treatment increased total soluble solids (TSS) and ascorbic acid content in the fruits, indicating an improvement in quality. The biostimulatory properties of seaweed extracts, including the presence of growth hormones like gibberellins, cytokinins, and auxins, likely contributed to these beneficial outcomes. This suggests that the use of Basfoliar and Biovita as foliar sprays can be an effective strategy for enhancing the productivity and nutritional quality of summer squash, with potential benefits for sustainable agricultural practices.

**Disclaimer (Artificial intelligence)**

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

**References**

Abdel-Mawgoud, A. M. R., Tantaway, A. S., Hafez, M. M., & Habib H. A. (2010). Seaweed extract improves growth, yield and quality of different watermelon hybrids. *Research Journal of Agriculture and Biological Sciences,* 6 (2), 161-168.

Afonso, S., Oliveira, I., Meyer, A. S. & Goncalves, B. (2022). Biostimulants to improve tree physiology and fruit quality: A review with special focus on sweet cherry. *Agronomy,* 12, 659.

Ahmed, D. A. E. A., Gheda, S. F. & Ismail, G. A. (2021). Efficacy of two seaweeds dry mass in bioremediation of heavy metal polluted soil and growth of radish (*Raphanus sativus* L.) plant. *Environmental Science and Pollution Research,* 28, 12831-12846.

Al-Bayati, A. S., Jaafar, H. S. & Alhasnawi, N. J. R. (2020). Evaluation of eggplant via different drip irrigation intervals and foliar sprays with seaweed extract biostimulant. *International Journal of Agricultural and Statistical Sciences,* 16(2), 633-639.

Alhadede, F. & Abdula, K. (2020). Effect of seaweed extract (Acadian) on some flowering characteristics for two cultivars of summer squash (*Cucurbita pepo* L.). *Mesopotamia Journal of Agriculture* 48(2), 15-23.

Alkharpotly, A. A., Abdelrasheed, K. G. & Shehata, M. N. (2024). Evaluating seaweed extract foliar spray as a substitute for synthetic cytokinin to improve the performance of squash plant. *Journal of Plant Production,* 15(2), 29-36.

Arioli, T., Mattner, S. W. & Winberg, P. C. (2015). Applications of seaweed extracts in Australian agriculture: past, present and future. *Journal of Applied Phycology,* 27, 2007-2015.

Arthur, G. D., Stirk, W. A., Van Staden, J. & Scott, P. (2003). Effect of a seaweed concentrate on the growth and yield of three varieties of *Capsicum annuum*. *South African Journal of Botany,* 69(2), 207-211.

Asadi, M., Rasouli, F., Amini, T., Hassanpouraghdam, M. B., Souri, S., Skrovankova, S., Mlcek, J. & Ercisli, S. (2022). Improvement of photosynthetic pigment characteristics, mineral content, and antioxidant activity of lettuce (*Lactuca sativa* L.) by arbuscular mycorrhizal fungus and seaweed extract foliar application. *Agronomy,* 12, 19-43.

Du Jardin, P. (2015). Plant biostimulants: Definition, concept, main categories and regulation. *Scientia Horticulturae,* 196, 3–14.

Esho, K. B. & Saeed, S. H. (2016). Correlation and genetic parameters in summer squash (*Cucurbita pepo* L.). *Journal of Dynamics in Agricultural Research,* 3(3), 41-45.

Gallon, J. R. & Wright, J. T. (2006). Limited grazing pressure by native herbivores on the invasive seaweed Caulerpa taxifolia in a temperate Australian estuary. *Marine and Freshwater Research,* 57, 685-694.

Goyal, P. & Thind, S. K. (2016). Effect of seaweed extract on morpho-physiological parameters of rice. *Indian Journal of Ecology,* 46, 335-337.

Haberer, G. & Kieber, J. J. (2002). Cytokinins: New insights into a classic phytohormone. *Plant Physiology,* 128(2), 354-362.

Hassan, A. H. & Abd Al, M. (2001). Cucurbitaceae, watermelon, cantaloupe, cucumber, summer squash. First Edition. Arabic Publishing House, The Egyptian Arabic Republic.

Hassan, S. M., Ashour, M., Sakai, N., Zhang, L., Hassanien, H. A., Gaber, A. & Ammar, G. (2021). Impact of seaweed liquid extract biostimulant on growth, yield, and chemical composition of cucumber (*Cucumis sativus*). *Agriculture,* 11(4), 3-20.

Hidangmayum, A. & Sharma, R. (2017). Effect of different concentrations of commercial seaweed liquid extract of Ascophyllum nodosum as a plant biostimulant on growth, yield and biochemical constituents of onion (*Allium cepa* L.). *Journal of Pharmacognosy and Phytochemistry,* 6(4), 658-663.

Hussain, H. I., Kasinadhuni, N. & Arioli, T. (2021). The effect of seaweed extract on tomato plant growth, productivity and soil. *Journal of Applied Phycology,* 33(2), 1305-1314.

Hussein, H. A., Jawad, D. H. & Abboud, A. K. (2019). Effect of foliar nutrition by seaweed extract Marmarine and Basfoliar Aktiv in growth and yield of pepper sweet (Along type) Sierra Nevada variety under plastic house conditions. *International Journal of Botany Studies,* 4(4), 112-116.

Jung, J. S. & Choi, H. S. (2020). Eco-physiological properties of open-field cucumbers responded to organic liquid fertilizers. *Sustainability,* 12(23), 98-30.

Kameswari, P. L., Narayanamma, M., Ahmed, S. R. & Chaturvedi, A. (2011). Influence of integrated nutrient management in ridge gourd (*Luffa acutangula* (Roxb.) L.). *Vegetable Science,* 38(2), 209-211.

Karjalainen, R., Lehtinen, A., Hietaniemi, V., Pihlava, J. M., Tiilikkala, K., Keinanen, M. & Jokinen, K. (2002). Benzothiadiazole and glycine betaine treatments enhance phenolic compound production in strawberry. *Acta Horticulturae,* 567, 353-356.

Kaur, J., Kaur, H., Rattan, P., Sharma, S. & Pangtu, S. (2025). Impact of Basfoliar and Biovita Applications on the Growth, Yield and Quality of Brinjal (*Solanum melongena* L.), 28(2), 944-950.

Kocira, S., Kocira, A., Kornas, R., Koszel, M., Szmigielski, M., Krajewska, M., Szparaga, A. & Krzysiak, Z. (2017). Effects of seaweed extract on yield and protein content of two common bean (*Phaseolus vulgaris* L.) cultivars. *Legume Research-An International Journal,* 41(4), 589-593.

Martínez-Lorente, S. E., Marti-Guillen, J. M., Pedreno, M. A., Almagro, L., Sabater-Jara, A. B. (2024). Higher plant-derived biostimulants: Mechanisms of action and their role in mitigating plant abiotic stress. *Antioxidants,* 13, 318.

Masny, A., Basak, A. & Żurawicz, E. (2004). Effects of foliar applications of Kelpak SL and Goëmar BM 86® preparations on yield and fruit quality in two strawberry cultivars. *Journal of Fruit and Ornamental Plant Research,* 12(4), 23-27.

Mzibra, A., Aasfar, A., Khouloud, M., Farrie, Y., Boulif, R., Kadmiri, I. M. & Douira, A. (2021). Improving growth, yield, and quality of tomato plants (*Solanum lycopersicum* L.) by the application of Moroccan seaweed-based biostimulants under greenhouse conditions. *Agronomy,* 11(7), 1373.

Obaid, A., Hammad, H. & Anjal, S. (2011). Effect of spraying with Algean seaweed extract and Ationk on the growth and yield of cucumbers grown in greenhouses. *Tikrit University Journal of Agricultural Sciences,* 11(1), 146-152.

Paris, H. S. (2008). Summer squash. Vegetables I: Asteraceae, Brassicaceae, Chenopodiaceae, and Cucurbitaceae, 12, 351-379.

Pohl, A., Grabowska, A., Kalisz, A. & Sękara, A. (2019). Biostimulant application enhances fruit setting in eggplant—an insight into the biology of flowering. *Agronomy,* 9(9), 482.

Rasheed, S. M. & Shareef, R. S. (2019). Effect of seaweed extract and plant spacing on growth and yield of two eggplant hybrids (*Solanum melongena* L.). *Journal of Duhok University,* 22(2), 101-112.

Rouphael, Y., Colla, G., Giordano, M., El-Nakhel, C., Kyriacou, M. C. & De Pascale, S. (2017). Foliar applications of a legume-derived protein hydrolysate elicit dose-dependent increases of growth, leaf mineral composition, yield and fruit quality in two greenhouse tomato cultivars*. Scientia Horticulturae,* 226, 353-360.

Sahu, P., Tripathy, P., Sahu, G. S., Dash, S. K., Pattanayak, S. K., Sarkar, S. & Mishra, S. (2020). Effect of integrated nutrient management on growth and fruit yield of cucumber (*Cucumis sativus* L.). *Journal of Crop and Weed,* 16(2), 254-257.

Sani, M. N. H. & Yong, J. W. H. (2021). Harnessing synergistic biostimulatory processes: A plausible approach for enhanced crop growth and resilience in organic farming. *Biology*, 11, 41.

Sarhan, T. Z. (2011). Effect of humic acid and seaweed extracts on growth and yield of potato plant (*Solanum tuberosum* L.). *Mesopotamia Journal of Agriculture,* 39(2), 19-25.

Shahid, M. A. & Liu, G. (2022). Application of biostimulants to improve tomato yield in Florida. *Vegetable Research*, 2, 6.

Shukla, P. S., Mantin, E. G., Adil, M., Bajpai, S., Critchley, A. T. & Prithiviraj, B. (2019). *Ascophyllum nodosum* -based biostimulants: Sustainable applications in agriculture for the stimulation of plant growth, stress tolerance, and disease management. *Frontiers in Plant Science,* 10, 462-648.

Singh, J., Singh, M. K., Kumar, M., Kumar, V., Singh, K. P. & Omid, A. Q. (2018). Effect of integrated nutrient management on growth, flowering and yield attributes of cucumber (*Cucumis sativus* L.). *International Journal of Chemical Studies,* 6(4).

Singh, V., Prasad, V. M., Kasera, S., Singh, B. P. & Mishra, S. (2017). Influence of different organic and inorganic fertilizer combinations on growth, yield and quality of cucumber (*Cucumis sativus* L.) under protected cultivation. *Journal of Pharmacognosy and Phytochemistry,* 6(4), 1079-1082.

Stirk, W. A., Tarkowska, D., Turecova, V., Strnad, M. & Van Staden, J. (2014). Abscisic acid, gibberellins and brassinosteroids in Kelpak, a commercial seaweed extract made from Ecklonia maxima. *Journal of Applied Phycology,* 26, 561-567.

Tamer, C. E., Incedayi, B., Yonel, S. P., Yonak, S. & Copur, O. U. (2010). Evaluation of several quality criteria of low-calorie pumpkin dessert. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca,* 38(1), 76-80.

Thongney, P. L., Khare, N., Rout, S. & Debbarma, R. (2020). Effect of different levels of vermicompost and FYM organic manure on growth and yield of cucumber intercropped with citrus-based agroforestry system. *Advances in Bioresources,* 11(2), 11-20.

Valencia, R., Sanchez, A. L., Hernandez, F. M., Rangel. P. P., Robles, G. M. A., Cruz, A. R. D. C. & Vázquez, V. C. (2018). Effect of seaweed aqueous extracts and compost on vegetative growth, yield, and nutraceutical quality of cucumber (*Cucumis sativus* L.) fruit. *Agronomy,* 8(11), 2-64.

Yakhin, O. I., Lubyanov, A. A., Yakhin, I. A. & Brown, P. H. (2017). Biostimulants in Plant Science: A global perspective. *Frontiers in Plant Science,* 7, 238-366.

Yao, Y., Wang, X., Chen, B., Zhang, M, & Ma, J. (2020). Seaweed extracts improved yields, leaf photosynthesis, ripening time, and net returns of tomato (*Solanum lycopersicum* Mill.). *ACS Omega*, 5, 4242–4249.

Zodape, S. T., Kawarkhe, V. J., Patolia, J. S. & Warade, A. D. (2008). Effect of liquid seaweed fertilizer on yield and quality of okra (*Abelmoschus esculentus* L.). *Journal of Scientific and Industrial Research,* 67, 1115-1117.