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The Use of Neem Plant (Azadirachta indica) and Victoria regia Lily (*Victoria amazonica*) Leaves Extract as Organic Fertilizers for Tomato Plant, *Solanum lycopersicum*

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ABSTRACT

Tomatoes (Solanum lycopersicum) are considered as an essential food source internationally and in Guyana. There is a need to use alternative natural organic fertiliser compared to synthetic one, in light of the effect of synthetic fertilizer on the environment. Tomato seedlings (Solanum lycopersicum) were subject to three treatments: synthetic fertiliser, potential natural fertilisers of aqueous extract of Victoria Regia and Neem (Azadirachta indica) and control experiments. Experimental design revolves around a Completely Randomised Block approach. Experiments were conducted over a period of eight weeks. Parameters investigated were plant height, nodal distance, internodal distance, leaf width and leaf length. It was found that the aqueous extract of Victoria Regia was the most effective for plant nodal distance and internodal distance. The synthetic fertiliser was the most effective for seedling height, leaf width and leaf height. However, for parameters where synthetic treatments were more effective, there wasn't much significance difference compared to the effects induced by the natural fertiliser. For example, in promoting leaf height, synthetic fertiliser induced a growth of 20.15cm, whereas the Victoria Regia and Azadirachta indica induced height of 18.74 and 15.68cm. Thus, the Victoria Regia and Azadirachta indica extracts can be used as an alternative fertiliser for tomatoes.

Keywords

Tomatoes (*Solanum lycopersium*), Natural fertiliser, Synthetic fertiliser, *Victoria Regia.*

Introduction

Natural fertilizers are compounds that are essential, original, organic and are derived either by biotic organisms or the environment [1]. Hence, they are usually obtained from a plant or an animal. Plant extracts are isolated components from plants in their raw state [2]. Sustainable farming is an agricultural practice that utilizes strategies such as crop rotation, organic manure, composting, natural fertilisers and repellents [3]. Accordingly, because of these health benefits, it is critical to utilize organic materials instead of synthetic fertilizers in this vegetable production.

Climate change effects have brought food insecurity around the globe. To offset this, smart agriculture practises have evolved [4-6]. One of these involves the use of natural fertilisers in plant based format. There has been increasing dependence on natural fertilisers. However, synthetic fertilisers poses a treat or challenge to farmers in contributing to soil degradation and pollution. Synthetic fertilisers can leach into groundwater and cause pollution. They can also disturb soil microorganism balance. Synthetic fertilisers can cause a rapid spike in nutrient levels followed by a sharp decline. Synthetic fertilizers containing nitrous oxide (N-nitroso) have the ability to potentially cause thyroid disease, several types of cancer in humans, neurodevelopmental abnormalities, and hyperglycemia (diabetes). Nevertheless, depending on the levels of vitamin C and antioxidant-rich supplements may avoid possible cancerous activities in humans and other negative consequences of

N-nitroso substances in a person's health [7].

Thus, there is a need to use alternative remedy in natural fertiliser which can boost crop production and productivity in a sustainable manner, while at the same time is eco-friendly. In addition, natural fertilisers are biodegradable and don't leave harmful residues in the soil and water. Natural fertilisers improve soil health in multiple ways. They incorporate organic matter to the soil, improving soil structure, water holding capacity and aeration. There is also a slow release of nutrients from plant extracts over a period of time and this provides a continous source of nourishments for plants. Plants also respond well to natural fertilisers. The nutrients in plant extracts are in a form that is more easily absorbed by plants, compared to synthetic fertilisers. Natural fertilisers can also help plants to develop stronger root systems, which makes them more resistant to diseases and environmental stress. Guyana has a diverse flora whose aqueous extracts can be explored in this regards. Plant based extracts have been used as antifungal, antimicrobial, antiparasitic, antiprotozoal, antioxidant, medicinal, aromatic and anti-inflammatory agents. It's the natural products or phytochemical constituents that are responsible for these effects [8,9]. Natural fertilisers can improve the texture of the soil, and aeration, boosting the soil's ability to retain water and fostering healthy root growth [10].

This paper outlines the use of plant based extracts from Neem **(*Azadirachta indica*)** and *Victoria Regia* (***Victoria amazonica***) as natural fertilisers on tomatoes plants. The objectives of this study were to (1) determine whether chemical fertilizer or organic fertilizer made from the Neem (*Azadirachhta indica*) and *Victoria Regia* Lily leaf extract will be more effective at enhancing the growth and productivity of tomato plants. (2) To analyze the effects of the neem *Azadirachta indica* and *Victoria regia* lily extracts as organic fertilizer on tomato plant growth and development and (3) To compare the difference in growth and development of tomato plants treated with *Azadirachhta indica, Victoria regia* Lily fertilizer, and synthetic fertilizer.

The tomato *Solanum lycopersicum*, is a plant whose fruit is an edible berry that is eaten as a vegetable. It originated from the Andes Mountains of South America, and may have been domesticated there or in Mexico (Central America). It was introduced to the Old World by the Spanish in the 16th century [11]. Tomato plants are vines, largely annual and vulnerable to frost, though sometimes living longer in greenhouses. The flowers are able to self-fertilise. Tomatoes are attacked by many insect pests and nematodes, and are subject to diseases caused by viruses and by mildew and blight fungi. Today, tomatoes are consumed and grown worldwide, including in Guyana. Tomatoes can be used for a variety of cooked, steamed and uncooked food products, including sauces, sandwiches, tomato puree, paste, sun-dried, and beverage [12]. This fruit is highly equipped with a rich supply of lycopene, a primary component present in them that contains antioxidant effects, assists in preventing neurodegeneration, and is essential to its red appearance [12]. Tomato flavonols are high in antioxidant compounds and enable the human bodies as well as organs to combat against poisons. Flavonoides, which are specifically linked with daily nutrition substances, serve a critical role in sickness protection and provide several beneficial medical effects [12]. Tomatoes are an essential antioxidant-rich food source (lycopene, phenolics, and vitamin C) for human nutrition which minimize the risk of developing a heart or cancerous ailment [3]. In Guyana, tomatoes are consumed raw by themselves or as part of salads, cooked in sauces and stews and have many beneficial nutrients [13].

Neem (*Azadirachta indica*) is a fast-growing tree in the mahogany family, valued for its medicinal properties and as a source of organic pesticides. It has been used in Ayurvedic and folk medicine for its antimicrobial, antiviral, and immunomodulatory effects. Neem is native to the Indian subcontinent and is known for its potential health benefits, including skin care and dental health. However, it is important to be aware of possible side effects and interactions when using neem products [14-17].

Victoria regia, also known as *Victoria amazonica*, is a giant water lily native to the Amazon Basin, renowned for its enormous leaves and stunning flowers [18-21]. Figure 1 shows a morphological display of *Azadirachta indica* and Victoria Regia.

(a) Neem (b) Victoria Regia

Figure 1: Morphological display of *A. indica* & *V. regia.*

There are several reports of *Azadirachta indica* aqueous extracts as natural fertilizer. However, there is no report of *Victoria regia* as a natural fertilizer. The natural fertilizer potential of *Azadirachta indica* Leaves aqueous extract for irrigation practices have been evaluated by analyzing some physicochemical parameters using standard methods. The pH level were, 8.4, 7.2, 7.1, and 7.3 respectively, indicating a moderate alkalinity status suitable for irrigation. The electrical conductivity values were as 2.4, 2.2, and 1.8 mg/L for Neem aqueous extract while turbidity values were 334, 323, and 296 NTU respectively. These values are within FAO guidelines [22].

The effects of *Azadirachta indica* Extract on Growth Performance and Post-harvest Quality of Chili has been reported in the literature [23]. The application of 25% neem extract resulted in better performance for pre-harvest parameters of chili, compared to the chemical pesticide and other concentration of neem extract while for post-harvest; only two out of six parameters indicated a significant difference [23].

Azadirachta indica products and formulations have been used widely for improving the growth, yield, and management of insect pests attacking field crops. The direct and indirect actions of neem extract on growth, yield, and insect pests have been evaluated. The results showed that modified neem leaf extract resulted in higher plant height, stem girth, leaf area, and number of branches of tomato plants compared to the poultry manure, neem leaf, and wood ash extract [24]. The petiole has been studied for its nutritional properties. However, the nutritional analysis and antioxidant activity of *Victoria amazonica* seeds have been evaluated [25]. There is no report in Guyana, where *Azadirachta* and *Victoria regia* aqueous extracts have been used as natural fertilisers.

Materials and Methodology

Study Design and Study Location

The study design was the Randomized Block Design which is typically used in research of this nature in order to minimize risk of error. The study location was Turkeyen, Georgetown which has acidic, loamy soil and extended sunshine that a tomato plant requires. Tomato plants are day-neutral plants [26]. Optimum temperature for tomato plant growth is between twenty-one (21°C) degrees Celsius and 29.4°C, and this is regularly the temperature range of this area [27].

Soil Preparation

The soil was tested before the experiment began to determine its pH and the quantities of Nitrogen, Phosphorus, and Potassium as well as other nutrient substances therein. This assisted the researcher to have a fair idea of the expected effects of each added fertilizer treatment. The soil on its own contained inadequate nutrient quantities for normal plant growth, so SOWMIX was added to the soil. The results of the soil test at National Agriculture Research Institution, NAREI indicated that the soil pH was 5.98, while that of the SOWMIX was 6.42. The optimum pH for tomato plant growth is between 6.2 and 6.8 [27].

Seed Preparation

Seeds were acquired from NAREI, and seedling trays bought. The seedling trays were disinfected with water and bleach and then filled ⅞ way with its respective soil and soil treatment. Tapping gently to remove any air pockets, the seeds were planted 0.5 cm deep and watered liberally. In three weeks, the seedlings were transplanted. A total of 12 seedlings were sown in a multicellular tray and split into 4 groups [28].

Group 1: P_1 (Control, No Fertilizer Application)
Group 2: P_2 (Chemical Fertilizer)
Group 3: P_3 (Neem Fertilizer Application)
Group 4: P_4 (Water Lily Fertilizer Application)

Fertilizer Preparation

Neem extract fertilizer

Azadirachta indica branches were collected from the study area. The branches were then air dried, and when dried were sterilized with NaOCl, 1% sodium hypochlorite. When sterilized, they were grounded in a blender. The ground content was placed into a blender, and distilled water added. When complete, the contents of the blender were filtered with a strainer. The filtrate was stored in a fridge below 4 degrees until ready for use. After preparation, the mixture lasted for two weeks and there were multiple preparations of the fertilizer [29].

Victoria regia Lily Fertilizer

Fresh leaves were collected from a trench in Pattensen, Georgetown, Guyana. 200g were weighed and the plant extract was prepared by taking the leaves and blending them in a 1:3 ratio. This was done to increase surface area and agitate metabolites. The biomass was filtered with a sterile cloth. The filtrate was then stored in a labeled bottle in a refrigerator until needed.

Chemical Fertilizer

The chemical fertilizer was diluted with tap water to the recommended dosages on labels, which was 1tbs to a gallon of water and stored in a labeled container.

Application of Treatments

The aqueous plant extract and chemical fertilizer were applied to their respective treatment groups at the volume of 35 ml per plant using a 10 ml syringe. The *Solanum lycopersicum* seedlings were grown for 2 weeks then transplanted. The aqueous plant extract and chemical fertilizer were applied after 2 weeks of transplantation of the *Solanum lycopersicum* (tomato) seedlings. The treatments will be applied twice weekly for up to 8 weeks.

The treatments were applied at the roots and leaves of the plants; 15ml to the leaves and 20ml to the roots. The controls were not treated. However, they were watered daily along with the other tomato plants.

Transplanting

The soil used in the experiment was from the study area. The soil was mixed; the sand in it allowed for adequate drainage and the clay portion was conducive to the anchoring of the roots of the young seedlings. The plants were grown in plant pots to reduce error and losses. All plants were planted in the up-right method, since they were planted within a plant pot instead of a bed. Therefore, leaves were set at 2-4 inches above the potting soil within each pot. Plant pots for each experiment carried the same size, and in all cases were watered once daily, every morning. The plant pots were not fully exposed to sunlight to avoid killing the developing tomato plants. The seedlings were transplanted with the soil surrounding them intact to decrease seedling transplanting shock. SOWMIX was applied to the potting soil before the seeds were transplanted. The plant pots were covered with palm branches for 2 weeks afterward, watered once a day for the first week to encourage hardening and the anchoring of the young plants' roots [30]. Two coconut branches were placed over the plant pots horizontally, upheld by two wooden, forked sticks pressed into the soil.

The parameters of interest in this experiment were: plant height, node distance, internodal distance, leaf width and leaf length. Every

Results

Table 1: The effect of various treatments on plant height over the 8-week period.

Height	Mean +/- SEM			
Week	Control	Victoria Regia	Neem	Synthetic
1	13.53 +/- 0.09	13.87 +/- 0.09	14.10 +/- 0.0	15.07 +/- 0.07
2	14. 13 +/- 0.1	13.83 +/- 0.18	14.27 +/- 0.67	15.63 +/- 0.09
3	14.37 +/- 0.15	14.23 +/- 0.15	14.50 +/- 0.06	15.23 +/- 0.09
4	14.53 +/- 0.18	16.30 +/- 0.18	14.77 +/- 0.09	15.87 +/- 0.03
5	15.23 +/- 0.09	17.10 +/- 0.42	15.33 +/- 0.09	16.00 +/- 0.00
6	20.10 +/- 0.10	20.27 +/- 0.15	16.70 +/- 0.12	24.93 +/- 0.77
7	25.30 +/- 0.17	26.17 +/- 0.12	17.57 +/- 0.18	27.80 +/- 0.10
8	27.30 +/- 0.17	28.17 +/- 0.12	18. 23 +/- 0.09	30.67 +/- 0.33
Average Increase	18.06	18.74	13.68	20.15

Table 2: The effect of various treatments on plant node over the 8-week period.

Node Distance	Mean +/- SEM			
Week	Control	Victoria Regia	Neem	Synthetic
1	3.70 +/- 0.00	3.97 +/- 0.03	4.10 +/- 0.00	4.10 +/- 0.58
2	3.83 +/- 0.03	4.23 +/- 0.03	4.10 +/- 0.00	4.10 +/ 0.03
3	3.93 +/- 0.33	4.23 +/- 0.03	4.10 +/- 0.00	4.13 +/- 0.03
4	4.10 +/- 0.06	4.43 +/- 0.03	4.10 +/- 0.00	4.13 +/- 0.03
5	4.47 +/- 0.03	4.53 +/- 0.03	4.20 +/- 0.00	4.50 +/- 0.00
6	4.53 +/- 0.07	6.53 +/- 0.09	4.53 +/- 0.07	5.37 +/- 0.13
7	5.87 +/- 0.03	8.10 +/- 0.06	4.70 +/- 0.10	6.30 +/- 0.12
8	6.17 +/- 0.03	10.1 +/- 0.06	4.80 +/- 0.10	6.53 +/- 0.09
Average Increase	4.58	5.27	4.33	4.89

Table 3: The effect of various treatments on plant internode distance during an 8-week period.

Internode Dist.	Mean +/- SEM			
Week	Control	Victoria Regia	Neem	Synthetic
1	0.1 +/- 0.00	0.1 +/- 0.00	0.1 +/- 0.00	0.1 +/- 0.00
2	0.1 +/- 0.00	0.2 +/- 0.00	0.2 +/- 0.00	0.2 +/- 0.00
3	0.2 +/- 0.00	0.3 +/- 0.00	0.2 +/- 0.00	0.3 +/- 0.00
4	0.2 +/- 0.00	0.3 +/- 0.00	0.2 +/- 0.00	0.3 +/- 0.00
5	0.2 +/- 0.00	0.3+/- 0.00	0.2 +/- 0.00	0.3 +/- 0.00
6	0.3 +/- 0.00	0.5 +/- 0.00	0.27 +/- 0.03	0.5 +/- 0.00
7	0.33 +/- 0.03	1.0 +/- 0.00	0.30 +/- 0.00	0.63 +/- 0.09
8	0.43 +/- 0.03	1.07 +/- 0.03	0.48 +/- 0.03	0.8 +/- 0.09
Average Increase	0.23	0.47	0.24	0.39

Table 4: The effect of various treatments on leaf width during an 8-week period.

Leaf Width	Mean +/- SEM			
Week	Control	Victoria Regia	Neem	Synthetic
1	0.60 +/- 0.00	0.43 +/- 0.03	0.30 +/- 0.00	0.80 +/- 0.00
2	0.80 +/- 0.06	0.53 +/- 0.03	0.43 +/- 0.03	0.80 +/- 0.00
3	0.80 +/- 0.06	0.70 +/- 0.06	0.50 +/- 0.00	0.80 +/- 0.00
4	0.80 +/- 0.06	0.83 +/- 0.07	0.50 +/- 0.00	0.80 +/- 0.00
5	1.23 +/- 0.03	1.27 +/- 0.03	0.60 +/- 0.00	1.30 +/- 0.00
6	1.30 +/- 0.00	1.43 +/- 0.03	0.73 +/- 0.03	1.63 +/- 0.07
7	1.43 +/- 0.03	1.57 +/- 0.03	0.83 +/- 0.03	2.23 +/- 0.03
8	1.58 +/- 0.67	1.73 +/- 0.07	0.93 +/- 0.03	2.43 +/- 0.03
Average Increase	1.068	1.061	0.63	1.35

plant in this experiment was labeled with paper tape, measured, and tabular data recorded. These are shown in Table 1 to Table 5.

Table 5: The effect of various treatments on leaf length over an 8-week period.

Leaf Length	Mean +/- SEM			
Week	Control	Victoria Regia	Neem	Synthetic
1	1.07 +/- 0.03	1.0+/- 0.09	0.93 +/- 0.03	1.17 +/- 0.07
2	1.23 +/- 0.03	1.2 +/- 0.00	1.20 +/- 0.06	1.17 +/- 0.07
3	1.23 +/- 0.03	1.2 +/- 0.03	1.20 +/- 0.06	1.17 +/- 0.07
4	1.23 +/- 0.33	1.3 +/- 0.03	1.40 +/- 0.06	1.17 +/- 0.07
5	1.67 +/- 0.07	1.6 +/- 0.07	1.60 +/- 0.06	1.30 +/- 0.09
6	2.6 +/- 0.12	2.3 +/- 0.17	1.87 +/- 0.09	2.80 +/- 0.10
7	3.8 +/- 0.70	3.1 +/- 0.06	2.23 +/- 0.18	4.60 +/- 0.15
8	4.2 +/- 0.10	3.3 +/- 0.09	2.61 +/- 0.15	4.80 +/- 0.15
Average Increase	2.13	1.88	1.63	2.27

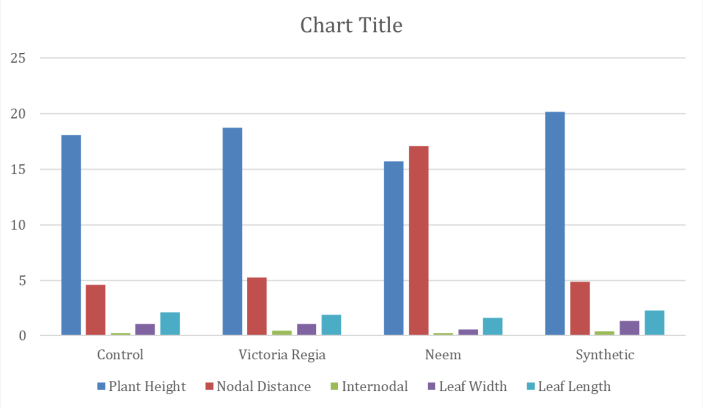

Figure 2: A plot of tomato plant growth parameters induced by the various treatments.

Discussion

The SSOWMIX (Seedling Soil Organic Waste Mixture), a product of the National Agricultural Research Extension Institute, NAREI, contained P, Cu, Mn, Fe and Zn. Fertilizer produced from neem leaves had P, K, Ca, Mg, Na, C and N, whereas, the leaves of the *Victoria regia* lily, were found to contain C, N, Mg, Ca, Si, Al, S, Si, Fe, Li, Mn and Ce. These are all important in plant growth. Plants require the major nutrients Nitrogen, Phosphorus and Potassium for growth and development.

They all play an important role in seed germination, the growth and development of plants and can be found in everyday fertilizers. Nitrogen, when it is lacking, results in leaf yellowing, slower or no plant growth, and reduced productivity. Excess nitrogen in a plant can be seen by the extremely dark green leaves that will be thin and scanty fruit and flowers. Potassium is the next important nutrient. It is necessary for enzyme activity, fruit development, as well as protein building. When this nutrient is deficient there is slow crop growth, the plants will shed their leaves and the produced fruits will be little and of poor quality. A Phosphorus deficiency results in slow growth as well, and when it is too much the plant will have a hard time absorbing the other nutrients that it needs. These nutrients should be pre applied to the soil prior to the tomato seedlings. With this information, it was expected that the developing tomato plants treated with the neem and *Victoria regia* lily fertilizers would benefit from the nutrients contained therein.

The use of *Azadirachta indica* and *Victoria Regia* aqueous extract as natural fertilisers on Tomato seedlings (*Solanum lycosparium*) were investigated using the Completely Randomised Block Design, CRBD. The block consists of Control, Experimental and Reference. Parameters of interests that were investigated in the experiment were plant height, node distance, internodal distance, leaf width and leaf length. All plants in this experiment were labelled with paper tape, measured and data recorded and tabulated in Tables 1-5.

Table 1 shows the effect of various treatments on plant height over the eight (8) weeks period. The synthetic fertiliser induced the highest growth in plant height (20.15cm) followed by *Victoria Regia* (18.74cm). Thus, the order of induced growth followed the sequence:

Table 6: Overall Anova analysis on all plant parameters

ANOVA.						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	610.7387	4	152.6847	76.95405	2.017E-06	3.837853
Columns	8.223144	2	4.111572	2.072258	0.18829509	4.45897
Error	15.87282	8	1.984102			
Total	634.8347	14				

Table 7: Anova analysis between synthetic fertiliser and *Victoria regia* on two plant parameters: plant height and plant node.

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	206.3532	1	206.3532	257.6115	0.039613	161.4476
Columns	0.265225	1	0.265225	0.331107	0.66759	161.4476
Error	0.801025	1	0.801025			
Total	207.4195	3				

Synthetic > Victoria Regia > Control > *Azadirachta indica*

Table 2 shows the effect of various treatments on plant node distance, over the eight week period. It seems that *Victoria Regia* extract induced the highest average node distance of 5.27cm. This was followed by that induced by the synthetic fertiliser (4.89). Thus, the order of induced node distance followed the sequence: *Victoria regia* extract > Synthetic fertiliser> Control > *Azadirachta indica*

Table 3 shows the effect of various treatments on plant internodal distance. The largest internodal distance of 0.47cm was induced by *Victoria regia* aqueous extract. This was followed by that induced by synthetic fertiliser (0.39cm). Thus, the order of induced growth follows the sequence:

Victoria Regia > Synthetic fertilisers > *Azadirachta indica* > Control

Table 4 shows the effect of the three treatments on leaf width of tomato seedlings. Synthetic fertiliser induced the highest leaf width growth of 1.35cm, followed by the Control (1.07cm). Thus, the order of induced growth follows the sequence:

Synthetic fertliser > Control > *Victoria Regia* > *Azadirachta indica*

Table 5 shows the effect of three (3) treatments on the leaf length of tomato seedlings over the eight (8) weeks period. The synthetic fertiliser induced the largest leaf length of 2.27cm, followed by the control. The order of induced growth followed the sequence: Synthetic fertiliser > Control > *Victoria Regia* > *Azadirachta indica*

These results are reflected in graphs displayed in Figure 2.

Anova, two factor without replication was applied to the data in Tables 1-5 and it was found that the p-value was less (2.01×10^{-6}) than 0.05, indicating that there is a significant difference of the plant parameters assessed using the plant extracts and synthetic fertiliser. This is shown in Table 6. When the analysis was done on the two highest promoting treatments: synthetic and *Victoria regia*, it was found that there was also a significant difference, as the p- value is less (0.039) than 0.05, Table 7. Thus, the plant extracts were effective in promoting the growth of various plant parameters: plant height, plant node, plant internode, leaf width and leaf length.

Conclusion

The application of natural fertiliser using neem Plant (*Azadirachta indica*) and *Victoria regia* Lily (*Victoria amazonica*) leaves on Tomato plant (*Solanum lycopersicum*) showed selective activity on various parameters: plant height, plant node, plant internode, leaf width and leaf length. The *Victoria regia* aqueous extract was effective in promoting the growth of nodal and internodal distance, whereas the synthetic fertiliser was the most effective for seedling height, leaf width and leaf height. In all cases, the *Azadirachta indica* aqueous extract wasn't superior to either *Victoria regia* nor the synthetic fertiliser. Anova analyses indicate that there was significant difference in three treatments: two plant extracts and the synthetic fertiliser.

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References

1. Waheed K, Nawaz H, Hanif MA, et al. Tomato in Medicinal Plants of South Asia. Elsevier. 2020; 631-644.
2. Godlewska K, Ronga D, Michalak I. Plant Extracts-Importance in Sustainable Agriculture. Italian Journal of Agronomy. 2021; 16: 18511.
3. Özer H. Effects of shading and organic fertilizers on tomato yield and quality. Pak J Bot. 2017; 49: 1849-1855.
4. Kabato W, Getnet GT, Sinore T, et al. Towards Climate Smart Agriculture: Strategies for Sustainable Agricultural Production, Food Security and Greenhouse Gas Reduction. Agronomy. 2025; 15: 565-589.
5. Rajasri S. Climate Smart Agriculture: Mitigation Strategies in Agriculture. AgriCos e Newsletter. 2024; 5: 24.
6. Zheng H, Ma W, Quan He. Climate-smart agricultural practices for enhanced farm productivity, income, resilience, and greenhouse gas mitigation: A Comprehensive Review. Mitig Adapt Strateg Glob Change. 2024; 29: 1-38.
7. Ahmed M, Rauf M, Mukhtar Z, et al. Excessive use of nitrogenous fertilizers: an unawareness causing serious threats to environment and human health. Environ Sci Pollut Res Int. 2017; 24: 26983-26987.
8. Godlewska K, Ronga D, Michalak I. Plant extracts: Importance in sustainable agriculture. Italian Journal of Agronomy. 2021; 16: 18511.
9. Gulcin I. Antioxidants: a comprehensive review. Arch Toxicol. 2025; 99: 1893-1997.
10. Chen JH. The combined use of chemical and organic fertilizers and/or biofertilizer for crop growth and soil fertility. Sustainable management of soil rhizosphere system for efficient crop production and fertilizer use. 2006.
11. Britannica T. Editors of Encyclopedia. 2019.
12. Mallick PK. Medicinal values of tomato, Lycopersicon esculentum Mill.-Solanaceae. Int J Appl Sci Biotechnol. 2021; 9: 166-168.
13. Food and Agriculture Organization of the United Nations. Food loss analysis: causes and solutions. Case study on the tomato value chain in Guyana. 2018.
14. Azadirachta indica Germplasm Resources Information Network. Agricultural Research Service, United States Department of Agriculture. 2017.

15. Compact Oxford English Dictionary. Neem page 679, Third Edition 2008 reprinted with corrections 2013. Oxford University Press. 2013.
16. Henry Y, Burnell AC, Hobson-Jobson. Neem page 622, The Anglo-Indian Dictionary Wordsworth Reference.1996.
17. Encarta World English Dictionary. Neem page 1210. St Martin's Press, New York.1999.
18. Knotts Kit. Victoria's History. Victoria Adventure. Archived from the original on 14 April 2009.
19. http://www.worldfloraonline.org/taxon/wfo-1000058049.
20. Genus: Victoria Lindl. Germplasm Resources Information Network. United States Department of Agriculture. Archived from the original on 13 August 2009.
21. Opitz DL. The sceptre of her power: nymphs, nobility, and nomenclature in early Victorian science. The British Journal for the History of Science. 2013; 47: 67-94.
22. Mohammed KA, Balogun OS, Kikelomo R, et al. Evaluation of Natural Fertilizer Potential of Neem Leaves Aqueous Extract for Irrigation Practices. J Appl Sci Environ Manage. 2023; 27: 1713-1717.
23. Soh NC, Yusoff NS, Lob S, et al. Effect of Neem Extract on Growth Performance and Post-harvest Quality of Chili. Asian J Plant Sci. 2021; 20: 80-85.
24. Verma S, Pradhan SS, Singh SK, et al. A Review on Response of Neem Seed and Leaf Extract on Crop Protection and Production. IJPSS. 2021; 33: 22-27.
25. Saravanan R, Datta S, Seal T. Nutritional analysis and antioxidant activity of Victoria amazonica seeds: Evaluating its potential as a future food source. South African Journal of Botany. 2025; 178: 61-72.
26. Gómez C, Mitchell CA. Growth Responses of Tomato Seedlings to Different Spectra of Supplemental Lighting. HortScience horts. 2015; 50: 112-118.
27. Commercial Tomato Production Handbook. Commercial Tomato Production Handbook. University of Georgia Extension. 2010.
28. Ramdwar M, Stoute V, Abraham B. An evaluation of Sargassum seaweed compositions on the performance of hot pepper (Capsicum chinense Jacq.) seedling production. Cogent Food & Agriculture. 2016; 2: 1-12.
29. Agbenin NO, Paul M. In-vitro assay of some plant extracts against Fusarium oxysporum f. sp. Lycopersici causal agent of tomato wilt. Journal of Plant Protection Research. 2006; 46: 117-121.
30. Sinha A, Petersen J. Caribbean Hot Pepper Production and Post Harvest Manual. CARICOM. 2011.