

Improving Aesthetic Leaf Quality of *Sansevieria* through Natural Plant Growth Regulators in Soilless Art Glass Cultivation

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ABSTRACT

This study aimed to determine the effect of natural plant growth regulators (PGRs) derived from seaweed extract on soilless growing media in enhancing the visual quality of *Sansevieria* ornamental plant leaves using the art glassplanting technique. The main problems in this technique include limited nutrients, low light intensity, and the absence of growth regulators in the medium, which lead to reduced aesthetics and leaf color quality. The research was conducted using an experimental method with a Completely Randomized Design (CRD), consisting of six concentrations of seaweed extract (0%, 50%, 55%, 60%, 65%, and 70%) with four replications. Observed parameters included leaf aesthetics (shape, thickness, symmetry, texture, and integrity) and leaf color quality (L^* , a^* , and b^* values). ANOVA results showed that the application of seaweed extract had a significant effect on all aesthetic parameters ($p < 0.05$), with the 70% concentration yielding the highest values. Leaf color observation indicated that the 70% concentration produced a darker green color, as shown by the decrease in L^* , a^* , and b^* values. This confirms an increase in chlorophyll content and visual quality of the leaves. Therefore, seaweed extract is proven to be an effective natural PGR for improving the aesthetic and physiological appearance of *Sansevieria* leaves in soilless art glassplanting systems.

Seaweed, Art Glassplanting, Leaf Visual Quality,
Keywords: *Sansevieria*, Natural PGRs

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INTRODUCTION

According to Lewu et al. (2023), *Sansevieria* is a popular ornamental plant due to its unique leaf shape, tolerance to extreme environmental conditions, and air-purifying properties. *Sansevieria* belongs to the Agavaceae family and is known for its upright, thick leaves with distinctive color patterns, making it a widely used decorative plant (Pramono, 2008). Additionally, this plant is recognized for its ability to absorb air pollutants, making it popular in modern interior design. One of the emerging innovations in plant cultivation is the art glassplanting technique, which involves growing ornamental plants in transparent glass containers. According to Mardhiah et al. (2023), this technique highlights the plant's overall visual appeal but presents challenges such as low light intensity, high humidity, and limited air circulation. These conditions can cause plant stress, reduce leaf color quality, and affect leaf texture and integrity. The enclosed microenvironment may also inhibit pigment formation, resulting in dull leaf appearance (Wally et al., 2013). Furthermore, Salisbury and Ross (1992) stated that excessive humidity can reduce leaf turgor and tissue health.

The main issues in the art glassplanting technique are limited nutrients, low light intensity, and a lack of natural plant growth regulators (PGRs) in the growing media. These factors lead to pigment degradation, reduced leaf brightness, and weakened visual structure of the plant. Holland et al. (2020) noted that inadequate light intensity can hinder photosynthesis and chlorophyll production, thereby diminishing the plant's aesthetic value. Jones (2014) added that the balance of air and temperature is crucial for maintaining the leaf's visual structure, especially in enclosed spaces. This technique commonly uses soilless growing media to support minimalist design and space efficiency. However, such media tend to lack essential nutrients and natural PGRs, resulting in limited plant growth and reduced visual quality. These conditions contribute to pigment degradation and decreased leaf brightness.

An environmentally friendly alternative to address these issues is the application of seaweed extract. According to Craigie (2011), seaweeds such as *Sargassum* sp. contain bioactive compounds, including cytokinins, alginic acid, mannitol, and antioxidants, which play important roles in enhancing the physiological quality of plants. Shukla et al. (2019) explained that mannitol and alginic acid in seaweed act as

anti-stress agents, helping plants adapt to extreme environmental conditions. Sharma et al. (2014) reported that cytokinins also stimulate chlorophyll biosynthesis and maintain chloroplast stability, significantly improving leaf greenness.

Furthermore, Wally et al. (2013) revealed that antioxidants in seaweed extract can prevent pigment degradation caused by oxidative stress. This effect makes seaweed a solution that not only enhances leaf color but also improves overall aesthetic appearance. According to Tejasree et al. (2024), seaweed extract has been proven to improve morphological and physiological growth parameters in plants. However, its application in the art glassplanting technique, particularly for *Sansevieria*, remains underexplored. Therefore, this study aims to examine the effect of natural PGRs derived from seaweed extract in soilless growing media on the visual quality of *Sansevieria* leaves, as well as to determine the most effective concentration for enhancing leaf aesthetics and color quality in the art glassplanting technique.

METHOD

This study was conducted in the Greenhouse of Universitas Pasundan, Bandung, West Java, for 30 days. The research used an experimental method with a quantitative approach to examine the effect of natural PGRs from seaweed extract on the visual quality of *Sansevieria* leaves in the art glassplanting technique. A Completely Randomized Design (CRD) with one factor was applied, consisting of six treatments with seaweed extract concentrations of 0%, 50%, 55%, 60%, 65%, and 70%. Each treatment was replicated four times, resulting in 24 samples. Materials used in this research included *Sansevieria* plants selected using purposive sampling (2–3 leaves per plant), *Sargassum* sp. seaweed extract, distilled water as a diluent, methanol as an organic solvent, and a soilless growing medium composed of burnt husks and PUKCAPEDIA.

Transparent glass pots were used as planting containers (art glassplanting). The seaweed extract was sprayed onto the growing medium (not directly on the leaves) at a volume of 50 mL per treatment, seven days after planting. Watering was performed regularly every 7 days at 4:00 PM WIB with the same volume for all treatments. The research steps included: selecting homogeneous *Sansevieria* plants with 2–3 leaves, preparing the growing media by mixing burnt husks and

PUKCAPEDIA, placing it into glass pots, and allowing the plants to adapt for seven days. Then, the seaweed extract was applied according to the specified concentrations. Observations were conducted every 7 days for 30 days.

The main observed parameters were the visual responses of the leaves, including aesthetics and color quality. Leaf aesthetics were assessed subjectively using a scoring rubric that evaluated shape, thickness, symmetry, texture, and integrity. Leaf color quality was measured objectively using a colorimeter based on L^* , a^* , and b^* values. Supporting data such as light intensity (lux meter), room temperature (thermometer), air humidity (hygrometer), and media pH, humidity, and temperature (soil tester) were recorded regularly. Data were analyzed using IBM SPSS Statistics software. Statistical tests included normality and homogeneity tests as prerequisites, followed by one-way ANOVA to examine treatment effects on each parameter, and Tukey's HSD post hoc test to identify significant differences between treatment groups

RESULTS AND DISCUSSION

Utilization of Natural PGRs from Seaweed Extract on Sansevieria Leaf Aesthetics

The application of seaweed extract showed a significant effect on the aesthetics of Sansevieria leaves. Based on ANOVA results using IBM SPSS Statistics 25, all five aesthetic aspects, shape, thickness, symmetry, texture, and integrity, showed a significance value of <0.05 , indicating a significant difference among the treatment concentrations

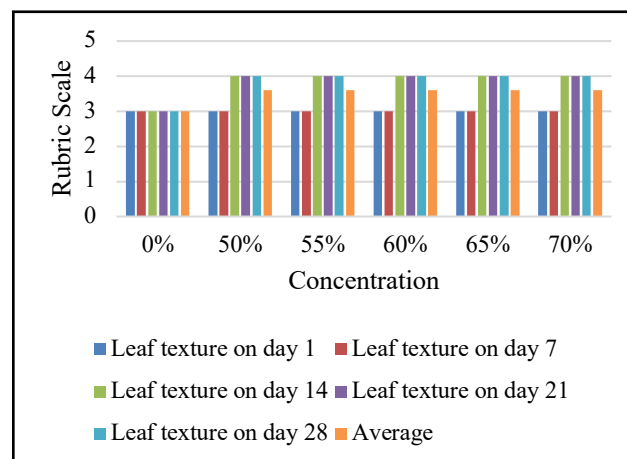


Diagram 1. Leaf Texture

The highest average scores were observed at the 70% concentration, while the lowest were at 0%. The strongest significance in the one-way ANOVA was in leaf thickness ($p = 0.000$), followed by leaf integrity ($p = 0.002$), leaf texture ($p = 0.029$), leaf shape ($p = 0.026$), and leaf symmetry ($p = 0.041$). Tukey HSD test supported these findings, showing that the 65% and 70% concentrations consistently belonged to the highest value subset for all aspects, while 0% to 55% concentrations were in the lower to moderate value subset. This confirms that higher seaweed extract concentrations have a greater positive influence on visual leaf appearance.

These results align with Craigie (2011), who stated that active compounds in seaweed such as cytokinins, mannitol, and alginic acid can stimulate cell division and improve plant tissue structure. Additionally, Shukla et al. (2019) mentioned that antioxidants and anti-stress agents in seaweed aid tissue recovery and enhance leaf physical quality. Wally et al. (2013) also asserted that seaweed helps maintain leaf structure under environmental stress. Lewu et al. (2023) supported the notion that leaf aesthetics can be improved through appropriate environmental and nutritional interventions.

Utilization of Natural PGRs from Seaweed Extract on *Sansevieria* Leaf Color Quality

Sansevieria leaf color quality was measured using a colorimeter based on L^* (lightness), a^* (red-green), and b^* (yellow-blue) values. The 70% concentration resulted in a decrease in L^* from 44.29 to 39.31, indicating an increase in green color intensity. The a^* value also decreased to -0.37, showing a greener hue, and the b^* value declined to 17.73, suggesting that the leaves retained a slight natural yellow tint. Leaf color quality of *Sansevieria* was quantitatively evaluated using a colorimeter based on the CIELAB color space parameters, namely L^* (lightness), a^* (red–green axis), and b^* (yellow–blue axis). The application of natural plant growth regulators (PGRs) derived from seaweed extract demonstrated a measurable effect on leaf pigmentation characteristics. At a concentration of 70%, the treatment resulted in a noticeable reduction in the L^* value from 44.29 to 39.31, indicating a decrease in brightness and a corresponding enhancement in leaf color depth. This shift suggests an increase in chlorophyll concentration or improved pigment stability, leading to a darker and more visually appealing green coloration.

Furthermore, the a^* value decreased to -0.37, reflecting a shift toward the green spectrum. This change confirms that the application of seaweed-based PGRs promotes greener leaf tones, which are often associated with healthier and more vigorous plants in ornamental horticulture. Meanwhile, the b^* value declined to 17.73, indicating a reduction in the yellow component while still maintaining a slight natural yellow tint. This balance suggests that the treatment enhances green intensity without completely eliminating the natural color variation characteristic of *Sansevieria* leaves. Overall, the results indicate that the use of seaweed extract as a natural PGR at an optimal concentration can effectively improve the visual quality of *Sansevieria* leaves by enhancing green intensity and maintaining color balance. This finding highlights the potential of natural PGRs as an eco-friendly alternative to synthetic growth regulators in ornamental plant production systems.

Table 1. Leaf Color Brightness

treatment	Colorimeter (color brightness)					
	L*		a*		b*	
	initial	final	initial	final	initial	final
0%	48,53	44,29	-2,3	-1,65	21,6	20,72
50%	48,53	43,12	-2,3	-1,45	21,6	20,58
55%	48,53	41,96	-2,3	-1,22	21,6	20,05
60%	48,53	41,71	-2,3	-0,96	21,6	19,67
65%	48,53	40,93	-2,3	-0,59	21,6	18,48
70%	48,53	39,31	-2,3	-0,37	21,6	17,73

Note: Numbers followed by different letters in the same column indicate significant differences according to DMRT α 5%

L* = Luminosity component or lightness/brightness

a* = Red – green color component (- for green)

b* = yellow – blue color component

According to Ahmad Fadillah (2024), dark green leaf color indicates high chlorophyll content and optimal photosynthetic activity. Bright colors may indicate low pigment levels and poor leaf quality. Cytokinins in seaweed enhance chlorophyll production, accelerate cell division, and maintain leaf greenness under limited conditions. Sharma et al. (2014) confirmed that this hormone boosts pigment biosynthesis intensity. Wally et al. (2013) emphasized that seaweed antioxidants protect pigments from oxidative degradation, while Khan et al. (2009) supported that seaweed bioactives stimulate chlorophyll production and maintain leaf color stability. Thus, the green intensity seen at 65% and 70% concentrations reflects the best physiological leaf quality.

Optimalitasion Seaweed Extract Concentration for Enhancing *Sansevieria* Appearance

The effectiveness of seaweed extract concentration in improving leaf aesthetics and color quality was clearly reflected in the data. The optimal concentration was 70%, yielding the highest aesthetic scores and the most intense, healthy green leaf color. The 65% concentration was nearly optimal, while 0% had the lowest results. This suggests that natural PGRs in seaweed provide proportional physiological responses depending on dosage. Tejasree et al. (2024) emphasized that adequate concentrations of seaweed bioactives are needed to optimize pigment formation, texture repair, and tissue reinforcement. Lewu et al. (2023) stated that high concentrations can significantly impact the visual quality of ornamental plants. Wally et al. (2013) also highlighted the importance of proper dosage in boosting pigment synthesis and overall leaf quality.

The effectiveness of different seaweed extract concentrations in improving the aesthetic and visual quality of *Sansevieria* leaves was clearly demonstrated in the experimental results. Among the tested treatments, the 70% concentration consistently produced the highest aesthetic scores and the most intense, healthy green leaf coloration. This indicates that the application of natural plant growth regulators (PGRs)

at this level provides optimal physiological stimulation, particularly in enhancing pigment development and overall leaf appearance.

The 65% concentration also showed relatively high performance, with results approaching those of the 70% treatment, suggesting that the optimal range for effective application lies within this concentration interval. In contrast, the control treatment (0%) exhibited the lowest aesthetic quality, characterized by less intense coloration and reduced visual appeal. These findings suggest a dose-dependent response, where increasing concentrations of seaweed extract lead to proportional improvements in plant physiological performance, up to an optimal threshold.

The observed improvements can be attributed to the presence of bioactive compounds in seaweed extracts, including auxins, cytokinins, and micronutrients, which are known to enhance chlorophyll synthesis, improve cellular structure, and promote tissue regeneration. Adequate concentrations of these bioactives are essential for optimizing pigment formation, repairing damaged tissues, and reinforcing leaf structure, thereby contributing to enhanced visual quality (Tejasree et al., 2024).

Furthermore, higher concentrations of seaweed-derived PGRs have been reported to significantly improve the aesthetic characteristics of ornamental plants, particularly in terms of color intensity and leaf texture (Lewu et al., 2023). However, the effectiveness of these compounds depends on appropriate dosage, as excessive or insufficient application may lead to suboptimal results. This aligns with earlier findings that emphasize the importance of proper concentration in stimulating pigment synthesis and improving overall leaf quality (Wally et al., 2013).

Overall, the results highlight that a 70% seaweed extract concentration represents an optimal level for enhancing the appearance of *Sansevieria*, balancing physiological stimulation with visual improvement. This study underscores the potential of natural PGRs as sustainable and effective alternatives in ornamental plant cultivation, particularly in soilless and controlled growing systems.

CONCLUSION

The application of natural plant growth regulators (PGRs) derived from seaweed extract in soilless growing media has been proven to significantly enhance the visual quality of *Sansevieria* ornamental plant

leaves using the art glassplanting technique. The results showed that a 70% concentration was the most optimal treatment in improving leaf aesthetics, including aspects such as shape, thickness, symmetry, texture, and leaf integrity, as well as leaf color quality based on L*, a*, and b* values. The highest aesthetics and color scores were obtained at this concentration, where the leaves appeared greener, more vibrant, and visually fresh. These findings indicate that seaweed extract is effective as a natural PGRs that can overcome nutrient limitations in soilless media and improve the visual appearance of plant leaves.

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