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Effect of Humic Acid and Yeast Extract Application on the Growth and Flowering of Petunia.

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Abstract :

The experiment was carried out at the College of Agriculture's Department of Horticulture and Landscape Engineering's wooden shade house, Tikrit University, during the 2025–2026 growing season, using Petunia hybrida. The purpose of the study was to examine the effects of foliar application of active yeast extract at three time intervals (no application, after 24 hours, and after 72 hours), coded as L0, L1, and L2, and humic acid application at three concentrations (0, 1 g L^{-1}, and 2 g L^{-1}), coded as H0, H1, and H2, respectively. Based on a Randomized Complete Block Design (RCBD) with two variables, the experiment was set up as a factorial. There were nine experimental treatments in the research, each with three replicates of three seedlings per experimental unit, for a total of eighty-one seedlings. The findings demonstrated that foliar spraying with yeast extract and adding humic acid greatly enhanced vegetative development and blooming traits. Plant height (cm), number of branches (branch $plant^{-1}$), number of leaves (leaf $plant^{-1}$), flower diameter (mm), and chlorophyll content (SPAD) were all significantly better in treatment H2L2, with values of 20.16 cm, 11.63 branch $plant^{-1}$, 58.96 leaf $plant^{-1}$, 11.06 mm, and 29.13 SPAD units, respectively.

Keywords: Petunia, organic fertilizers, humic acid, yeast extract, biofertilizers.

Introduction

Large multicolored flowers that can be grown in hanging baskets and gardens make petunia grandiflora a major annual ornamental plant. Nutrient content and soil fertility play a crucial role in the development and flowering of petunias. In search of sustainable ways to improve ornamental growth and reduce reliance on inorganic fertilizers, studies have been conducted to find ways to boost growth and flowering in soils with low organic matter, which can lead to stunted plant growth and low flowering (Martins et al., 2024).

In this sense, organic fertilizers are a vital element in improving the chemical, biological and physical properties of the soil. Humic acid, one of the most important components of humic substances in the soil, stands out from these. It plays a crucial role in regulating soil pH, enhancing the availability of macro and micronutrients to plants, improving soil structure and increasing the water and nutrient-holding capacity of the soil (Shah et al., 2018). Humic acid also promotes root growth, enhances the efficiency of nutrient absorption, and boosts several physiological processes, such as photosynthesis and enzyme activity, which in turn influence positively plant growth and flowering, particularly in ornamental plants. Use of humic acid has been shown to significantly enhance the growth and flowering of petunia by increasing biological processes and nutrient use efficiency (Martins et al., 2024).

Biofertilizers, together with organic fertilizers, are a modern trend in agriculture because they increase soil fertility and promote plant biological processes. The yeast Saccharomyces cerevisiae is considered a candidate microbe due to its rich content of different bioactive compounds that act as natural plant growth promoters, such as vitamins, amino acids, enzymes and plant hormones. Furthermore, yeast enhances the availability of food and the activity of microbes in the rhizosphere, leading to better vegetative growth and better photosynthetic activity (Silva et al., 2026). Several studies have shown that application of yeast extracts improves the morphological and production traits of plants by increasing chlorophyll content and metabolism (Vargas et al., 2024).

Various research demonstrates the positive effect of the combined use of biofertilizer and organic fertilizers on plant growth. Humic acid helps improve the soil's physical properties and improves the nutrients' availability, while the yeast activates various biochemical processes in the plant and soil. This combination leads to improved plant growth and flowering in ornamental plants (Fardous et al., 2020). So, the use of humic acid and yeast extract is a sustainable approach for promoting petunia growth and yield in environmentally safe and sustainable farming systems.

The objective of this study is to investigate the impact on the vegetative and flowering characteristics of petunia plants of the foliar use of active baker's yeast extract, produced at different times of activation, and soil use of humic acid at different concentrations. It also seeks to identify the best activation period of yeast for its ability to produce secondary

metabolites and its impact on the quality and quantity of flowers.

Materials and Methods

During the growing season of 2025–2026, the experiment was carried out in the wooden shade house of the Department of Horticulture and Landscape Engineering, College of Agriculture, Tikrit University. Petunia hybrida seedlings were used. Each of the 10-cm-diameter plastic pots used to nurture the seedlings had six to eight genuine leaves. Every 15 days, pots were treated with a balanced fertilizer (20:20:20) at a rate of 1 g L^{-1} and watered as required.

With two variables and three replicates, the experiment was set up as a factorial study using a Randomized Complete Block Design (RCBD). Three pots made up each experimental unit. SAS software was used to statistically evaluate the data for the qualities under study (SAS, 2012). Duncan's Multiple Range Test (DMRT) was used to compare treatment means at a significance level of 0.05.

Factor A: Humic acid application (foliar spray) at three concentrations:

1. Control (no application)
2. 1 g L^{-1}
3. 2 g L^{-1}

Factor B: Foliar application of active dry yeast extract as follows:

1. Control (no spray)
2. Spraying with yeast extract after 24 hours of activation
3. Spraying with yeast extract after 72 hours of activation

Three grams of dried baker's yeast (Saccharomyces cerevisiae) were dissolved in one liter of distilled water to create the active yeast extract. Twenty grams of sugar and 0.125 grams of citric acid were added to the mixture to correct its pH. To enable aerobic fermentation, the mixture was kept in an open container at 35°C with constant stirring every hour. According to Abbas (2021), the activation procedure was conducted over two periods of time (24 and 72 hours).

One week after planting, the plants were sprayed in the early morning until they were completely moist. Twice, separated by ten days, the spraying was repeated

Results and Discussion

Table (1): Effect of humic acid application and foliar spraying with dry yeast extract on the growth and flowering of petunia.

Treatment	Plant height (cm)	Number of branches (branch plant^{-1})	Number of leaves (leaf plant^{-1})	Flower diameter (mm)	Chlorophyll content (SPAD)
H1L1	13.16 h	4.63 f	32.96 g	7.16 h	17.96 i
H1L2	14.66 g	5.30 e	39.66 f	7.66 g	19.96 h
H1L3	15.33 f	5.30 e	41.10 f	8.23 f	20.80 g
H2L1	15.86 e	6.30 d	42.96 e	8.73 e	21.50 f
H2L2	16.30 d	6.30 d	47.10 d	8.96 d	22.16 e
H2L3	17.20 c	7.30 c	49.83 c	9.13 d	24.83 d
H3L1	17.30 c	8.30 b	50.56 bc	9.63 c	25.73 c
H3L2	17.90 b	8.63 b	52.00 b	9.86 b	26.90 b
H3L3	20.16 a	11.63 a	58.96 a	11.06 a	29.13 a

***Duncan's Multiple Range Test (DMRT) at the 0.05 probability level indicates that means followed by the same letter within each column do not vary substantially.**

Humic acid application and foliar spraying with yeast extract produced notable changes across treatments, as Table (1) illustrates. Plant height (20.16 cm), number of branches (11.63 branch plant^{-1}), number of leaves (58.96 leaf plant^{-1}), flower diameter (11.06 mm), and chlorophyll content (29.13 SPAD) were all highest for the combined treatment H3L3 (humic acid application with yeast extract activated for 72 hours).

Humic acid treatments greatly enhanced the majority of vegetative and blooming traits, according to the findings. This impact may be explained by humic acid's essential function in improving the soil's chemical and physical characteristics. It helps lower the pH of the soil and make nutrients more accessible, which improves the root system's capacity to absorb nutrients. Humic acid also promotes branching and root development, which enhances mineral nutrition and nutrient absorption efficiency. Furthermore, it includes amino acids and organic chemicals that stimulate the plant's metabolism and encourage the production of proteins and enzymes, which eventually results in better blooming characteristics and increased vegetative development (Unius et al., 2025).

Because yeast cells with longer activation periods produce more bioactive chemicals, the outcomes of the treatments with active dry yeast extract (Saccharomyces cerevisiae) were clearly better. Higher levels of proteins, vitamins, amino acids, and carbs are the outcome. These substances are crucial for the production of nucleic acids (DNA and RNA) and for promoting critical plant functions. Additionally, cytokinins—plant growth

regulators that encourage cell division, differentiation, and elongation—are derived from yeast. In addition, the nitrogen content in yeast contributes to increased chlorophyll synthesis, thereby enhancing photosynthetic efficiency and leading to an increase in leaf number and leaf area, which is positively reflected in overall plant growth (Unius et al., 2025).

The combination of humic acid and yeast extract, particularly the H3L3 treatment, led to the greatest significant values of most of the examined characteristics compared to the individual treatments, which indicates a synergistic effect between the two. This effect may be due to the physiological complementarity of the two components: the yeast provides bioactive compounds and growth regulators that stimulate the metabolism of the plant and humic acid improves the root environment and increases the nutrient uptake. This combination leads to improved photosynthetic efficiency and nutrient uptake, promoting plant growth and flowering. Also, growth regulators and essential macronutrients such as potassium, phosphorus and nitrogen enhance the activation of enzymes and protein synthesis, increasing the number and quality of the flowers. These findings are consistent with those of Rouphael and Colla (2020) and Unius et al. (2025), which demonstrate that the combination of nutritional and physiological effects of biostimulants on plants boosts their growth and yield.

Conclusion: Because of their synergistic impact, the combination between humic acid and yeast extract, especially under treatment H3L3, produced the most notable increase in vegetative and flowering characteristics. Yeast supplied bioactive chemicals and growth regulators that boosted metabolic processes and photosynthesis, while humic acid improved soil characteristics and increased nutrient availability. Plant growth and productivity were both favorably impacted by this combination.

References

1. **Abbas, Khalil Shakoor. (2021).** *Effect of foliar application of baker's yeast, khella extract, and CPPU–GA_3 mixture on the growth and flowering of two gerbera cultivars and some postharvest treatments* (Unpublished doctoral dissertation). Tikrit University, College of Agriculture, Iraq.
2. **Canellas, L.P. and Olivares, F.L., 2014.** Physiological responses to humic substances as plant growth promoter. *Chemical and Biological Technologies in Agriculture*, 1(1), p.3. https://doi.org/10.1186/2196-5641-1-3
3. **Fardous, A., Hasanuzzaman, M. and Rahman, M.M., 2020**. Effect of humic acid and yeast on growth and flowering of ornamental plants. *Applied Ecology and Environmental Research*, 18(4), pp.5789–5802. https://doi.org/10.1556/168.2020.18.4.10
4. **Martins, L., Silva, J. and Barbosa, J., 2024**. Humic and fulvic acids promote growth and flowering in petunia. *HortScience*, 59(2), pp.235–242. https://doi.org/10.21273/HORTSCI16749-23
5. **SAS, (2012).** Statistical Analysis System,Users Guide.Statistical.

Version 9.1th.SAS.Inc.Cary.N.C.USA.

6. **Shah, Z.H., Rehman, H.M., Akhtar, T. 2018.** Humic substances: determining potential bio-stimulants for increasing agricultural productivity. *Frontiers in Plant Science*, 9, p.263. https://doi.org/10.3389/fpls.2018.00263
7. **Silva, E. L. D., (2026)** Effects of brewer's spent yeast concentrations and application methods on *Coffea arabica* seedling development. *Bioscience Journal*, *42*, e42004. https://doi.org/10.14393/BJ-v42n0a2026-72512
8. **Unius Arinaitwe, Dalitso Noble Yabwalo and Abraham Hangamaisho (2025)** 'Unlocking the potential of biostimulants: A review of classification, mode of action, formulations, efficacy, mechanisms, and recommendations for sustainable intensification', *International Journal of Plant Biology*, 16(4), p. 122. doi: 10.3390/ijpb16040122.
9. **Vargas, M. F., Mestre, M. V., Vergara, C., (2024).** Residual brewer's *Saccharomyces cerevisiae* yeasts as biofertilizers in horticultural seedlings. *Frontiers in Industrial Microbiology*.
10. **Youssef Rouphael and Giuseppe Colla (2020)** 'Editorial: Biostimulants in Agriculture', *Frontiers in Plant Science*, 11, p. 40. doi: 10.3389/fpls.2020.00040.