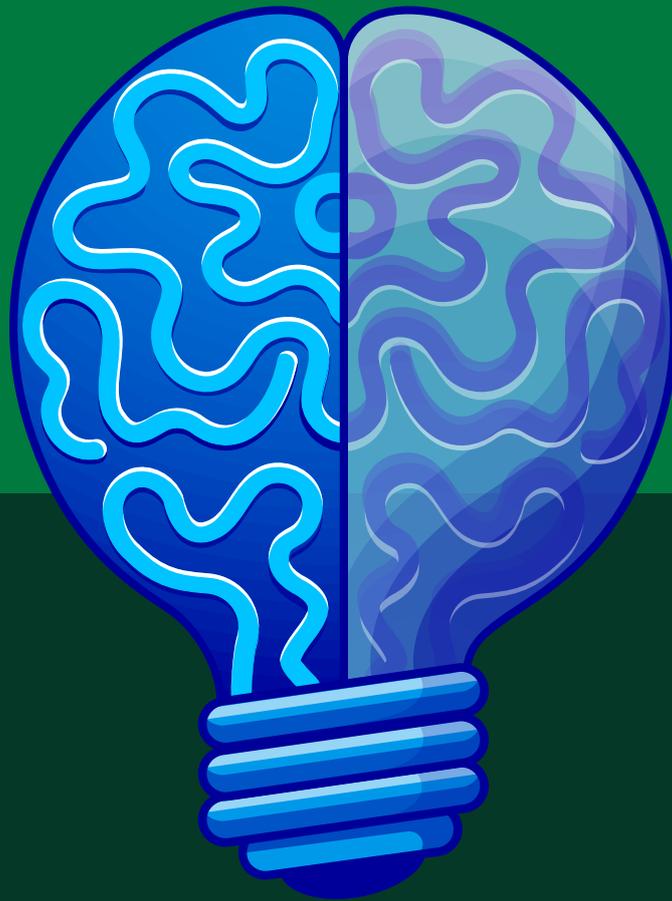


FACULTY OF
APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA
PERAK BRANCH

SCIENTIFIC PROJECT COLLOQUIUM 2025



BIOLOGY ~ CHEMISTRY ~ PHYSICS

Final Year Project Colloquium 2025
Faculty of Applied Sciences,
Universiti Teknologi MARA,
Perak Branch Tapah Campus,
35400 Tapah Road, Perak, Malaysia.

Colloquium date 12th July 2025
Publication date 31st October 2025

Proceedings of Extended Abstracts

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e-1.S.B.N: 978-629-97630-6-2

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Preface

The Scientific Project Colloquium offers a platform for publishing Diploma Science final year projects (FYP). The objective is to effectively distribute research findings throughout all scientific disciplines. The primary objective of including final year projects into the course curriculum is to encourage students to put their theoretical knowledge into practical applications.

We would like to express our gratitude to our primary establishment, the Faculty of Applied Sciences and Universiti Teknologi MARA, Perak Branch, for their invaluable assistance.

Lastly, we would like to express our gratitude to all of the authors for the tremendous help in preparing the articles, without which this undertaking would not have been completed.

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October 2025

HONEY SOLUTION AS A NATURAL BIOSTIMULANT FOR THE GROWTH OF *Capsicum annuum* L.

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Abstract: Honey is a natural product rich in sugars, amino acids, vitamins, and bioactive compounds, with potential applications as a sustainable plant biostimulant. This study evaluated the effects of different concentrations of honey solution on the growth of *Capsicum annuum* by measuring plant height over a five-week period. Five treatments were prepared: fertilizer only (control), and honey solutions at concentrations of 5%, 10%, 15%, and 20% (v/v) without fertilizer. Each treatment was replicated four times, and solutions were applied fortnightly at weeks 1, 3, and 5. Plant height was recorded weekly, and mean values were compared across treatments. The results showed that the 20% honey solution produced the greatest increase in average plant height (11.33 ± 1.15 cm), whereas the 5% solution resulted in the lowest growth (1.63 ± 0.48 cm). The control achieved 6.75 ± 0.96 cm, which was slightly higher than the 10% (6.00 ± 0.82 cm) and 15% (6.50 ± 1.29 cm) treatments. These findings indicate that honey supplementation influenced growth in a concentration-dependent manner, with only the higher concentration producing substantial improvement compared to fertilizer alone. The stimulatory effects of honey are likely linked to its nutrient content and bioactive compounds, which may enhance microbial activity, nutrient uptake, and plant metabolic processes. In conclusion, honey solution particularly at 20% concentration demonstrated potential as an eco-friendly biostimulant for enhancing the growth of *C. annuum*. Future research should investigate additional growth parameters, such as leaf development, biomass accumulation, and fruit yield, and extend testing to other crops and environmental conditions. These findings support the potential of honey as a sustainable alternative to synthetic fertilizers in horticultural production.

Keywords: *Capsicum annuum*, Honey solution, Plant growth, Natural biostimulant, Sustainable agriculture

INTRODUCTION

Capsicum annuum is one of the most widely cultivated vegetable crops, valued both for its nutritional content and economic importance (Bosland & Votava, 2012; Taiz et al., 2018). Growth and productivity of *C. annuum* are significantly influenced by soil fertility and nutrient availability. Traditionally, chemical fertilizers are applied to enhance crop growth, however, excessive use of such fertilizers has led to environmental concerns and soil degradation (Savci, 2012). This has increased the demand for eco-friendly and sustainable alternatives, such as plant biostimulants, organic amendments, and natural growth enhancers (Du Jardin, 2015; Feitosa de Vasconcelos & Garófalo Chaves, 2019; Peña-Calzada et al., 2025).

Honey, a natural product rich in sugars, amino acids, vitamins, enzymes, and bioactive compounds, has been recognized not only for its nutritional value but also for its potential use in agriculture (Bogdanov et al., 2008; Ahmed et al., 2007). Studies have shown that honey application can enhance plant growth, yield, and biochemical properties by improving phytohormone balance, antioxidant activity, and nutrient uptake (Belal et al., 2023; Moussa et al., 2024; Sadou et al., 2025). In particular, honey has been reported to alleviate stress conditions and stimulate physiological functions similar to other biostimulants (Cattivello, 2019; Henderson et al., 2025).

Therefore, the present study aims to evaluate the effects of honey solution at different concentrations (5, 10, 15, and 20% v/v) on the growth of *C. annuum*. By comparing honey treatments with fertilizer controls, this research explores the potential of honey as an eco-friendly biostimulant for sustainable agriculture.

METHODOLOGY

Plant material

The research was conducted using *C. annuum* plants (20–50 cm in height), cultivated in polythene bags filled with nursery soil. The experiment was carried out at Universiti Teknologi MARA (UiTM) Perak Branch, Tapah Campus, Perak, Malaysia.

Experimental design

The study was arranged in a completely randomized design with five treatments and four replications each. The treatments consisted of:

- **Treatment A (Control):** Fertilizer solution
- **Treatment B:** 5% (v/v) honey solution
- **Treatment C:** 10% (v/v) honey solution
- **Treatment D:** 15% (v/v) honey solution
- **Treatment E:** 20% (v/v) honey solution

Preparation of solutions

Fertilizer solution: 10 g of fertilizer was weighed and dissolved in distilled water in a 100 mL beaker. The solution was transferred into a 100 mL volumetric flask and diluted to the mark with distilled water. The flask was inverted several times to ensure homogeneity.

Honey solutions: Different concentrations of honey solutions were prepared separately in 100 mL volumetric flasks. For each solution, the required volume of honey (5 mL, 10 mL, 15 mL, and 20 mL for 5%, 10%, 15%, and 20% v/v solutions, respectively) was measured and transferred into the flask. Distilled water was added to make up to 100 mL final volume, and the flask was gently swirled until the honey was completely dissolved.

Application of treatments

Plants were treated with the respective solutions once every two weeks (week 1, week 3, and week 5).

Data collection

The growth parameter measured in this study was plant height. Measurements were recorded weekly for all treatments throughout the five-week experimental period.

FINDINGS

Plant growth performance

The effect of different honey concentrations on the growth of *C. annuum* was evaluated by measuring plant height over a five-week period. The results (Table 1) showed that the 20% honey solution (Treatment E) produced the highest average plant height (11.33±1.15 cm), while the 5% treatment (Treatment B) resulted in the lowest growth (1.63±0.48 cm). The control (6.75±0.96 cm) performed slightly better than the 10% (6.00±0.82 cm) and 15% (6.50±1.29 cm) treatments, indicating that honey supplementation influenced plant growth in a concentration-dependent manner.

Table 1. Average height of *Capsicum annuum* under different treatments

Treatment	Description	Average height (cm)
A	Fertilizer only (Control)	6.75±0.96
B	5% honey solution	1.63±0.48
C	10% honey solution	6.00±0.82
D	15% honey solution	6.50±1.29
E	20% honey solution	11.33±1.15

The superior growth observed in the 20% honey treatment suggests that higher concentrations may provide beneficial levels of sugars, amino acids, and micronutrients, thereby stimulating metabolic activity and nutrient uptake (Bogdanov et al., 2008). Honey also enhances microbial activity in the rhizosphere, which could further improve nutrient availability. In contrast, the poor growth at 5% may reflect insufficient nutrient contribution or potential osmotic effects that limited water uptake. This aligns with Du Jardin (2015), who emphasized that the efficacy of biostimulants is strongly dosage-dependent.

These findings are consistent with previous studies reporting that honey can act as a natural growth enhancer across plant species. Positive growth responses were recorded in beans (Belal et al., 2023), sage (*Salvia officinalis*) (Moussa et al., 2024), and basil (*Ocimum basilicum*) (Sadou et al., 2025), suggesting a broad-spectrum effect. The stimulatory impact is likely linked to honey's bioactive compounds, which may influence phytohormone regulation, enzyme activity, and photosynthetic performance (Ahmed et al., 2007; Henderson et al., 2025; Feitosa de Vasconcelos & Garófalo Chaves, 2019).

Importantly, honey supplementation provides an eco-friendly alternative to synthetic fertilizers, which are often associated with soil degradation and environmental pollution (Savci, 2012). The observed growth improvements support the potential role of honey in sustainable agriculture, where natural inputs are prioritized to maintain productivity while reducing ecological impact (Peña-Calzada et al., 2025).

Overall, the results indicate that honey, particularly at higher concentrations, can act as an effective natural biostimulant for *C. annuum*. However, further studies are needed to assess additional growth parameters, including leaf number, biomass accumulation, and fruit yield, as well as long-term impacts on soil fertility and microbial dynamics.

CONCLUSIONS

This study demonstrated that honey solution has potential as a natural biostimulant for the growth of *C. annuum*. Among the treatments tested, the application of 20% honey solution resulted in the greatest increase in plant height (11.33 ± 1.15 cm), outperforming both the control and lower concentrations. In contrast, the 5% honey treatment produced the lowest growth (1.63 ± 0.48 cm), suggesting that concentration plays a critical role in determining the effectiveness of honey as a growth enhancer. The results indicate that honey at higher concentrations may provide essential nutrients and bioactive compounds that stimulate plant growth, while lower concentrations may be less effective. These findings support the potential use of honey as an eco-friendly supplement to chemical fertilizers in sustainable agriculture. For future research, it is recommended to evaluate additional growth parameters, including leaf development, biomass accumulation, and fruit yield, as well as to investigate the effects of honey solution across different plant species and under varying environmental conditions, particularly its long-term impact on soil fertility and microbial activity.

COMPLIANCE OF ETHICAL STANDARDS

Not applicable.

REFERENCES

- Ahmed, J., Prabhu, S. T., Raghavan, G. S. V., & Ngadi, M. (2007). Physico-chemical, rheological, calorimetric and dielectric behavior of selected Indian honey. *Journal of Food Engineering*, 79(4), 1207–1213. <https://doi.org/10.1016/j.jfoodeng.2006.04.048>
- Belal, H. E. E., Abdelpary, M. A. M., Desoky, E.-S. M., Ali, E. F., Al Kashgry, N. A. T., Rady, M. M., Semida, W. M., Mahmoud, A. E. M., & Sayed, A. A. S. (2023). Effect of eco-friendly application of bee honey solution on yield, physio-chemical, antioxidants, and enzyme gene expressions in excessive nitrogen-stressed common bean (*Phaseolus vulgaris* L.) plants. *Plants*, 12(19), 3435. <https://doi.org/10.3390/plants12193435>
- Bogdanov, S., Jurendic, T., Sieber, R., & Gallmann, P. (2008). Honey for nutrition and health: A review. *Journal of the American College of Nutrition*, 27(6), 677–689. <https://doi.org/10.1080/07315724.2008.10719745>
- Bosland, P. W., & Votava, E. J. (2012). *Peppers: Vegetable and spice capsicums* (2nd ed.). CABI. <https://doi.org/10.1079/9781845938253.0000>
- Cattivello, C. (2019). Evaluation of biostimulants in growing media for vegetable seedlings. *Acta Horticulturae*, 1266, 159–164. <https://doi.org/10.17660/ActaHortic.2019.1266.22>
- Du Jardin, P. (2015). Plant biostimulants: Definition, concept, main categories, and regulation. *Scientia Horticulturae*, 196, 3–14. <https://doi.org/10.1016/j.scienta.2015.09.021>
- Feitosa de Vasconcelos, A. C., & Garófalo Chaves, L. H. (2019). Biostimulants and their role in improving plant growth under abiotic stresses. In *Biostimulants in plant science*. IntechOpen. <https://doi.org/10.5772/intechopen.88829>
- Henderson, B. C. R., Sanderson, J. M., & Fowles, A. A. (2025). A review of the foliar application of individual amino acids as biostimulants in plants. *Discover Agriculture*, 3, 69. <https://doi.org/10.1007/s44279-025-00222-7>
- Moussa, M. M., Mansour, M. M. F., El-Sharnouby, M., & Hassan, F. A. (2024). Foliar application of bee honey or ginger extract enhanced *Salvia officinalis* L. growth and productivity by improving phytohormones, antioxidants, chlorophylls, and nutrients. *Agronomy*, 14(8), 1819. <https://doi.org/10.3390/agronomy14081819>

Peña-Calzada, K., Calero-Hurtado, A., Meléndrez-Rodríguez, J. F., Rodríguez-Fernández, J. C., Gutiérrez-Cádenas, O. G., García-González, M. T., Madrigal-Carmona, L., & Jiménez-Medina, A. (2025). Impacts of the biostimulant VIUSID® Agro on growth, productivity, and tolerance to salt stress in crops: A systematic review. *Horticulturae*, *11*(4), 407. <https://doi.org/10.3390/horticulturae11040407>

Sadou, D., Fedeli, R., Celletti, S., Amessis-Ouchemoukh, N., Ayad, R., Loppi, S., & Ouchemoukh, S. (2025). Impact of honey soil supplementation on growth and antioxidant activity in basil (*Ocimum basilicum* L.) plants. *International Journal of Plant Biology*, *16*(1), 14. <https://doi.org/10.3390/ijpb16010014>

Savci, S. (2012). An agricultural pollutant: Chemical fertilizer. *International Journal of Environmental Science and Development*, *3*(1), 77–80. <https://doi.org/10.7763/IJESD.2012.V3.191>

Taiz, L., Zeiger, E., Møller, I. M., & Murphy, A. (2018). *Plant physiology and development* (6th ed.). Sinauer Associates.

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Tarikh : 20 Januari 2023

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Sekian, terima kasih.

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Setuju.

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