2024 SICASH
SLIIT INTERNATIONAL CONFERENCE ON ADVANCEMENTS IN SCIENCES & HUMANITIES

Influence of *Mimosa pigra*-Based Bio Fertilizer on the Sensory Properties of MI-2 Chili Peppers (*Capsicum annum*)

T.M.M.P.S. Bandara*[1], K.G.S. Madhushani[2]

[1]*University of Vavuniya, Sri Lanka*

[2] *University of Peradeniya, Sri Lanka*

Email address of the corresponding author - *tmmpsbandara.6@gmail.com

Abstract

This study investigates the impact of *Mimosa pigra*-based bio fertilizers on the sensory properties of MI-2 chili pods (*Capsicum annum*). Utilizing *Mimosa pigra*-based bio fertilizers, this research examines how organic farming practices influence the sensory quality of MI-2 chili pods. The organic fertilizer was formulated by cutting *Mimosa pigra* into small pieces prior to its flowering stage and allowing them to decompose fully in a pit over a period of six months. The experiment was conducted using a randomized but complete block design, comprising four distinct treatments and nine replicates each. The first treatment consisted of a fertilizer mixture incorporating *Mimosa pigra* (MP). The second treatment combined *Mimosa pigra* with calcium carbonate (MP+C). The third treatment included a combination of *Mimosa pigra* and inorganic fertilizer (MP+IF). Additionally, a negative control (NC) treatment was included for comparative purposes. Each pot mixture was prepared using a combination of garden soil, goat manure, and sand at a 2:2:1 ratio. After comparing sensory ratings across the treatments using ANOVA, post-hoc tests were performed with significance defined at $p < 0.05$. The mean scores with 95% confidence intervals were used to present the results. A group of fifty participants joined in a sensory evaluation that evaluated the taste, color, texture, odor, and overall acceptability of the mixture using a 5-point hedonic scale. When compared to other treatments, chili pods treated with MP biofertilizer were rated as having the best overall acceptance ($p = 0.02$) and taste ($p = 0.03$). Pods from the MP+C, MP+IF and NC fertilizers are among the most preferred in term of colour and texture. More importantly, the overall acceptability of the chili pods grown with the MP fertilizer was found to be the most preferred by the study participants. Also, thefindings aim to enhance our understanding of the role of sustainable agricultural practices in shaping food quality and maintaining the cultural relevance of chili peppers in culinary traditions.

Keywords: Hedonic scale; Mimosa pigra; Organic fertilizer; Questionary survey

Introduction

Organic agriculture is now emerging as an alternative to traditional agriculture using an environment-friendly strategy. Several countries are actively striving to reduce the use of agrochemicals, as chemical fertilizers, pesticides and fungicides are broadly used in agriculture to enhance crop yields (Esteban F.et al.,2020). In this scenario, organic fertilizers are essential for maintaining soil fertility, proffering benefits such as cost effectiveness, increase in soil structure, aeration and texture, enhancing water retention abilities and stimulating healthy root development. Organic agricultural systems prioritize

https://doi.org/10.54389/SCOI1977

the use of organic fertilizers to ensure a sustainable and environment-friendly approach (Assefa et al., 2019). In order to acquire composted material that can respond more expeditiously and safely to soil organic fertility requirements than the raw material, the composting process is generally shown as the most effective pre- treatment (Senesi, 1989).

Invasive plant species that cause a profound impact on native biodiversity are numerous, and they are considered ecologically harmful (Rameshwar et al., 2016). Lately, the management of such invasive plants has garnered a growing interest and concern due to their remarkable adaptability to various environmental conditions, ability to reproduce quickly, and capability to spread rapidly, all of which pose serious threats to the delicate balance of the ecosystem (Feng et al., 2021). The use of organic fertilizers derived from invasive species plant has been explored as a sustainable alternative to synthetic fertilizers (Rapatsa and Terapongtanakorn, 2010). *Mimosa pigra* commonly referred to as a sensitive giant tree which is a leguminous shrub that has originated from tropical America (Lonsdale et al., 1998). *Mimosa pigra* is a significant invasive species that causes ecological disturbances in areas that it colonizes. The production of fertilizer from *Mimosa pigra* is an efficient way of controlling that species as well as helps formulate one of the biological control methods against invasive species.

Chili peppers are an important crop worldwide, valued for their unique flavour, colour and health benefits (Rapatsa and Terapongtanakorn, 2010). The aims of this study were: (1) to evaluate the efficacy of *Mimosa pigra*-based organic fertilizer; (2) to determine the colour, texture, odour and taste of MI-2 chili plant pods grown using *Mimosa pigra*-based fertilizer treatments in order to identify the characteristics that most significantly impact consumer preference; (3) to assess the overall acceptability of MI-2 chili pods grown the *Mimosa pigra*-based fertilizers through consumer survey; and (4) to provide recommendations for the control of that species in environment-friendly manner.

Materials and Methods

This variety of organic fertilizer was formulated by cutting *Mimosa pigra* into small pieces before its flowering stage and then allowing them in a pit for a period of 6 months. One sample was treated with 1:1 ratio of $CaCO_3$, while the other was left to decompose without adding any $CaCO_3$. (Bandara and Madhushani, 2024).

The manure produced from the decomposed *Mimosa pigra* (MP) was extracted from the pit and used to create several distinct piles, each with a unique composition. One pile was formulated using a 2:2:2:1 ratio of MP, Garden soil (GS), Goat manure (GM) and Sand (S), resulting in an organic fertilizer based on MP. Another pile was prepared by combining MP with $CaCO_3$, GS, GM, and S to create the MPC fertilizer. A third pile was composed of MP, GS, GM, S and inorganic fertilizer (IF) at a 2:2:2:1 ratio, resulting in the MPIF mixture. A negative control pile was established by combining GS, GM and S at a 2:2:1 ratio (Bandara and Madhushani, 2024) without MP. Baurs special chilli fertilizer was used as an organic fertilizer which contained Nitrogen (12%), Phosphorous pentoxide (9%) and Potassium oxide (4%). After that, all the piles were kept for an additional week, with daily sprinkling of water to maintain appropriate moisture levels without saturating the materials. The experiment design was carried out in a randomized complete block design (RCBD) with four treatments and nine replicates in each and the data was analysed by Excel 2021 and sensory evaluations across treatments were statistically analysed using ANOVA, followed by post-hoc tests to identify significant differences, with the level of significance set at $p < 0.05$. The results were presented as mean values accompanied by 95% confidence intervals.

MI-2 chilli plants were grown using each fertilizer and the harvested pods were evaluated by a survey of 50 participants. The survey was conducted to evaluate the colour, texture, Odor, taste and overall acceptability of the harvested pods. The participants were asked to rate selected characteristics on a scale

of 1 to 5 with options, such as, as “Like very much” (5), “Like slightly” (4), “Neither like NOR dislike” (3), “Dislike slightly” (2) and “Dislike very much” (1).

Results and Discussion

A sensory evaluation involving fifty participants assessed the taste, color, texture, odor, and overall acceptability of the mixture using a 5-point hedonic scale. Chili pods treated with MP biofertilizer received the highest ratings for overall acceptability ($p = 0.02$) and taste ($p = 0.03$) compared to other treatments.

The sensory evaluation results of the MI-2 chili pods treated with four different fertilizer types were: *Mimosa pigra* (MP), *Mimosa pigra* with calcium carbonate (MP+C), *Mimosa pigra* with inorganic fertilizer (MP+IF), and a negative control (NC). The sensory attributes assessed include color, texture, odor, taste, and overall acceptability, rated on a hedonic scale from 1 to 5.

All treatments, including the control, scored relatively high (around 4) in color, indicating that the fertilization type had a minimal impact on the visual appeal of the chili pods. The MP treatment shows a slight advantage, but the difference is marginal.

The texture ratings are also closely grouped around 4 for all treatments, with MP and MP+IF slightly outperforming MP+C and NC. This suggests that the addition of *Mimosa pigra*, especially when combined with inorganic fertilizer, may enhance the textural quality of the chili pods.

The odour ratings show more variation, with MP and MP+IF scoring higher than MP+C and NC. This indicates that *Mimosa pigra*, particularly in combination with inorganic fertilizer, may improve the aromatic properties of the pods.

Taste ratings highlight a significant preference for the MP treatment, followed closely by MP+IF. The MP+C and NC treatments scored lower, suggesting that *Mimosa pigra* alone or with inorganic fertilizer enhances the flavour profile of the chili pods more effectively than that when combined with calcium carbonate or used without *Mimosa pigra*.

Overall acceptability ratings mirror the trends observed in individual attributes, with MP and MP+IF leading, followed by MP+C and NC. This indicates that the combination *of Mimosa pigra* with inorganic fertilizer or its use alone results in a more favourable overall sensory experience for the consumers.

The combination of *Mimosa pigra* with inorganic fertilizer (MP+IF) often parallels the performance of MP alone, suggesting potential synergistic effects that could be explored further.

Figure 1. Web diagram for sensory evaluation

The addition of calcium carbonate (MP+C) appears to have a less pronounced impact on improving sensory qualities compared to MP and MP+IF, indicating that it might not contribute significantly to the sensory enhancement of the chili pods. The high ratings across various attributes for MP and MP+IF treatments emphasize the importance of organic and combined fertilization methods in meeting consumer preferences for sensory quality in chili pods.

According to the web diagram, the results of the survey indicate that the participants generally found the pods to have good colour, texture, taste and odour. The data indicated that the pods harvested from MP treated fertilizer scored the highest for its taste and colour. In contrast, the diagram showed that the chili pods harvested from plants grown using MP+C, MP+IF and NC fertilizers received the highest rating for colour and texture from participants in this questionary survey.

Conclusion

The results of this study obtained using a web diagram and provide valuable insights into the impact of different fertilizer treatments on the sensory qualities of chili pods. The result of the survey indicate that the participants generally found the pods to have

obtained a desirable level of colour, texture, odour, taste and overall acceptability from an MP-treated fertilizer.

In addition, these findings suggest that *Mimosa pigra*, particularly when used alone or in combination with inorganic fertilizer, can significantly enhance the sensory properties of MI-2 chili pods, thereby potentially increasing their marketability and consumer satisfaction. Further research could delve into the biochemical mechanisms underlying these sensory improvements and explore the long-term effects of such fertilization practices on soil health and crop yield.

And also, *Mimosa pigra*-derived fertilizer may support eco-friendly agriculture and the effective utilization of invasive alien species, in addition to providing better solutions for the current scenario in Sri Lanka as a management practice of controlling invasive alien species efficiency.

References

Assefa, S., & Tadesse, S. (2019). The principal role of organic fertilizer on soil properties and agricultural productivity - a review. Agriculture Research and Technology: Open Access Journal, 22(2).

Bandra, T.M.M.P.S., & Madhushani, K.G.S. (2024). Effect of an organic fertilizer derived from *Mimosa pigra* on the selected growth parameters of MI-2 chilli (*Capsicum annuum*). In Proceedings of the 12th YSF Symposium-2024 (pp. 128-133).

Bandra, T.M.M.P.S., & Madhushani, K.G.S. (2024). Impact of *Mimosa pigra*-derived organic fertilizer on yield parameters of MI-2 chili *(Capsicum annuum*). In Proceedings of the 2nd International Research Symposium on Traditional Medicine (AyurEx Colombo) - 2024 (pp.199).

Durán-Lara, E. F., Valderrama, A., & Marican, A. (2020). Natural organic compounds for application in organic farming. Agriculture, 10(2), 41.

Feng, Q., Wang, B., Chen, M., Wu, P., Lee, X., & Xing, Y. (2021). Invasive plants as potential sustainable feedstocks for biochar production and multiple applications: A review. Resources, Conservation and Recycling, 164, 105204.

Gupta, V. K., Gupta, R. C., & Khare, D. (2019). Organic fertilizers: Types, production, and utilization. In V. K. Gupta, R. C. Gupta, & M. Kubicek (Eds.), Fertilizers for Sustainable Agriculture (pp. 249-269).

Guzmán, I., & Bosland, P. W. (2017). Sensory properties of chile pepper heat–and its importance to food quality and cultural preference. Appetite, 117, 186-190.

Johnson, L. E., O'Hara, M., & Cheng, A. S. (2018). Sustainable use of invasive plant species for compost and mulch. In M. J. A. Weremijewicz & A. M. Liebman (Eds.), Invasive Species: Detection, Impact and Control (pp. 97-112).

Lonsdale, W. M., & Farrell, G. S. (1998). Testing the effects on *Mimosa pigra* of a biological control agent Neurostrota gunniella (Lepidoptera: Gracillaridae), plant competition and fungi under field conditions. Biocontrol Science and Technology, 8(4), 485-500.

Lozada, D. N., Coon, D. L., Guzmán, I., & Bosland, P. W. (2021). Heat profiles of 'superhot' and New Mexican type chile peppers (Capsicum spp.). Scientia Horticulturae, 283, 110088.

Rameshwar, H. Y., & Argaw, A. (2016). Manurial value of khat waste vermicompost from Awday, Harar town, Ethiopia. International Journal of Recycling of Organic Waste in Agriculture, 5, 105-111.

Rapatsa, J., & Terapongtanakorn, S. (2010). Some physiological measurements on growth, pod yields and polyamines in leaves of chili plants (*Capsicum annuum* cv. Hua Reua) in relation to applied organic manures and chemical fertilisers. Pakistan Journal of Biological Sciences: PJBS, 13(6), 263-270.

Senesi, N. (1989). Composted materials as organic fertilizers. Science of the Total Environment, 81, 521-542.

Smith, V., Descheemaeker, K., & Groenewald, J. (2010). Organic matter and the sustainability of agricultural systems: Definitions and measurement. In S. P. Neelam & B. S. Uma (Eds.), Organic Farming for Sustainable Agriculture (pp. 39-64).

Smithson, A. (2015). Invasive plants as feedstock for bioenergy and biofertilizer. In J. G. V. Miranda & M. A. R. Kozlowski (Eds.), Invasive Plant Ecology and Management: Linking Processes to Practice (pp. 311-325).