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The Fertilization Potential of *Prosopis juliflora* Leaf and Seed Extracts on the Growth of *Mentha piperita*

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ABSTRACT

This study investigates the potential of *Prosopis juliflora* (mesquite) leaf and seed extracts as organic fertilizers for *Mentha piperita* (peppermint) cultivation in the Asir region, Saudi Arabia. *P. juliflora* is an invasive species that has raised ecological concerns, but its biomass holds promise as a sustainable agricultural resource. The research evaluates the impact of leaf and seed extracts on plant growth parameters (height, biomass, leaf area) and soil nutrient content (nitrogen, phosphorus, potassium). Results indicate that both leaf and seed extracts enhanced plant growth and soil fertility, with the leaf extract showing the most significant improvements in nitrogen and phosphorus levels, while the seed extract was more effective in increasing potassium. These findings demonstrate the potential of *P. juliflora* biomass as an eco-friendly alternative to synthetic fertilizers, contributing to sustainable agriculture, especially in arid regions. However, due to its invasiveness, the species must be carefully managed to avoid further ecological disruption. The study emphasizes the dual benefits of using *P. juliflora* for soil nutrient enhancement and mitigating its environmental impact, suggesting its inclusion in integrated pest management and organic farming systems. Further studies are recommended to assess the long-term implications of this practice on crop yield, biodiversity, and ecosystem health.

Keywords: Seeds and leaves, Prosopis juliflora, fertilization, Mentha Piperita, Asir region.

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1. Introduction:

Prosopis juliflora, commonly known as mesquite, is a leguminous tree native to South America, particularly Mexico, and has spread globally, including to Saudi Arabia, where it is considered an invasive species. Its rapid proliferation, driven by extensive seed production and deep-rooted systems, enables it to outcompete native vegetation for water and nutrients, disrupting ecosystems through mechanisms like allelopathy, where it secretes allelochemicals to inhibit neighboring plant growth (Shiferaw et al., 2023). This invasiveness threatens biodiversity, exacerbates soil degradation, and contributes to ecological imbalances, potentially impacting human health and increasing disease vectors like mosquitoes due to its year-round flowering.

Despite its ecological challenges, P. juliflora holds potential for sustainable utilization. Its leaves and seeds are rich in nutrients, proteins, and bioactive compounds, suggesting applications in organic fertilization and agriculture (Solano et al., 2022). Organic fertilization using plant extracts has shown promise in enhancing soil fertility, improving crop growth, and promoting sustainable agriculture, as seen in studies on crops like lavender and basil (Peçanha et al., 2021; Ono-free et al., 2018). However, the fertilization potential of P. juliflora extracts remains underexplored, presenting a research gap.

This study investigates the efficacy of P. juliflora leaf and seed extracts as organic fertilizers to enhance the growth of Mentha piperita (peppermint), a valuable medicinal and aromatic plant. We hypothesize that these extracts, due to their nutrient-rich composition, will improve M. piperita growth parameters compared to conventional fertilizers. The objectives are: (1) to evaluate the impact of P. juliflora extracts on M. piperita growth metrics (e.g., height, biomass, leaf yield), (2) to assess their influence on soil nutrient profiles, and (3) to propose a sustainable strategy for managing P. juliflora invasiveness by repurposing it as a biofertilizer. This approach aims to mitigate its ecological harm while contributing to sustainable agricultural practices.

2. Material and Methods

1. Study Area

This study was conducted in the Asir region in southwestern Saudi Arabia, located between latitudes 17.25°–19.50°N and longitudes 41.50°–50.00°E. The region lies at an elevation of approximately 2000 meters above sea level and is characterized by moderate summer temperatures (not exceeding 24°C) and an annual average rainfall of around 500 mm.

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2. Experimental Design

A completely randomized design (CRD) was used to evaluate the effect of Prosopis juliflora leaf and seed extracts on the vegetative growth of Mentha piperita. The experiment included three treatments:

Control (CN): No fertilization, irrigated with natural water only.
Leaf Extract (B): Fertilization using dried leaf solution of P. juliflora.
Seed Extract (S): Fertilization using ground seed solution of P. juliflora.

Each treatment was applied to three pots, with two Mentha piperita plants per pot, totaling six plants per treatment and 18 plants overall.

3. Preparation of Fertilizer Solutions

Leaf extract: Collected P. juliflora leaves were dried at ambient temperature (25–30°C) for one week, ground into powder, and soaked in distilled water at a 1:10 w/v ratio for 48 hours, then filtered and used immediately.
Seed extract: Seeds were dried, ground, and extracted using the same protocol as for leaves.

4. Irrigation and Environmental Conditions

All pots were irrigated with equal volumes of natural water twice a week. The experiment was conducted outdoors under natural sunlight in the period from January to March, and temperature and humidity were monitored daily using a standard weather station.

5. Morphological Measurements

Morphological parameters were recorded for each plant monthly:

Stem height (cm) – measured using a measuring tape.
Number of leaves – counted manually.
Number of branches – counted manually.
Leaf area (cm^2) – estimated using the formula:
Leaf area = Length × Width × 0.75 (approximation method; Li et al., 2020).

6. Soil Chemical Analysis

Soil samples from each pot were collected at the end of the experiment. Samples were air-dried, sieved (2 mm), and analyzed for available nitrogen (N) using the Kjeldahl method, available phosphorus (P) using the Olsen method, and available potassium (K) using flame photometry. Results were expressed in parts per million (ppm).

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7. Statistical Analysis

Data were analyzed using R software version 4.3.0. One-way ANOVA was applied to assess differences among treatments. Mean values were compared using Tukey's HSD test at a significance level of $p < 0.05$. Results were presented as mean ± standard deviation (SD).

3. Results

3.1. Morphological Measurements of Mint Plants Fertilized with Prosopis juliflora Leaf and Seed Extracts

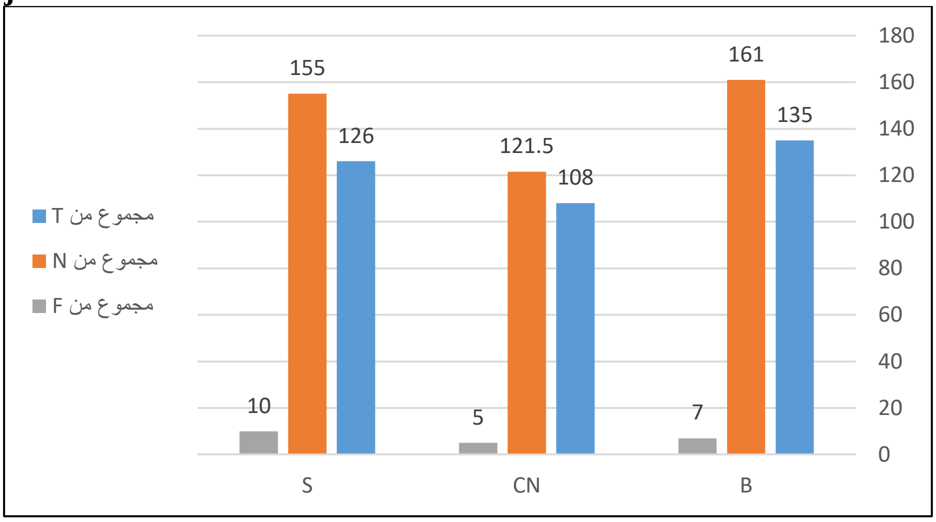

Figure 1. The measurement of the average length (T), the number of leaves (N), and the branches (F) of the plant that has been fertilized with *Prosopis juliflora*

The results showed through measurement for the mint plant that was fertilized with mesquite that the best average length (T) and the best average number of leaves (N) in terms of number, size and large leaf area for the growing top was for the mint plant that was fertilized with a *Prosopis juliflora* leaf solution, which was symbolized by the symbol (B), and it turned out that the best branching (F) was for the mint plant that was fertilized with a solution of *Prosopis juliflora* seeds that were ground and symbolized by the symbol (S) compared to the group Control, which is denoted by CN.
To assess the effectiveness of Prosopis juliflora as a biofertilizer, a one-way ANOVA test was conducted to compare the effect of three treatments—leaf extract (B), seed extract (S), and control (CN)—on the average plant height (T), number of leaves (N), and number of branches (F).
The results showed that plants treated with the leaf extract (B) achieved the highest average height (T = 135 cm) and leaf count (N = 161). On the other hand, plants treated with the seed extract (S) exhibited the greatest number of branches (F = 10).

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The control group (CN) consistently recorded the lowest values across all measured parameters (T = 108 cm, N = 121.5, F = 5).

The ANOVA analysis revealed statistically significant differences between the treatments in at least one of the parameters measured ($p < 0.05$), indicating that the observed differences were unlikely due to random chance. Post-hoc comparisons (e.g., Tukey's HSD) are recommended for further identifying which specific groups differ significantly.

3.2. Leaf Area Measurements

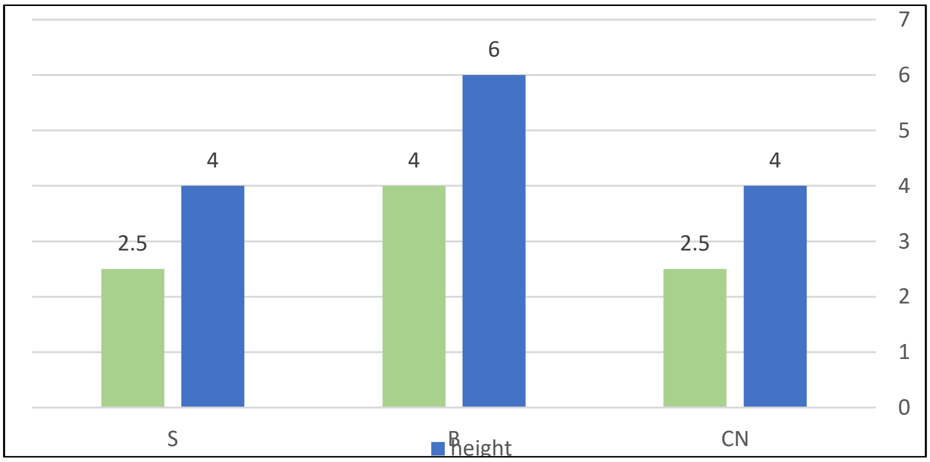

Figure 2: The measurement of the average length (T), number of leaves (N), and branches (F) of a plant fertilized with *Prosopis juliflora*.

The results by measuring the leaf area of the mint plant that was fertilized with *Prosopis juliflora* showed that the best length and width of the leaf was for the mint plant that was fertilized with a solution of dried *Prosopis juliflora* paper, which was symbolized by the symbol B, where the length was 6 cm, while the leaf width of the plant that was fertilized with a *Prosopis juliflora* paper solution was 4 cm.

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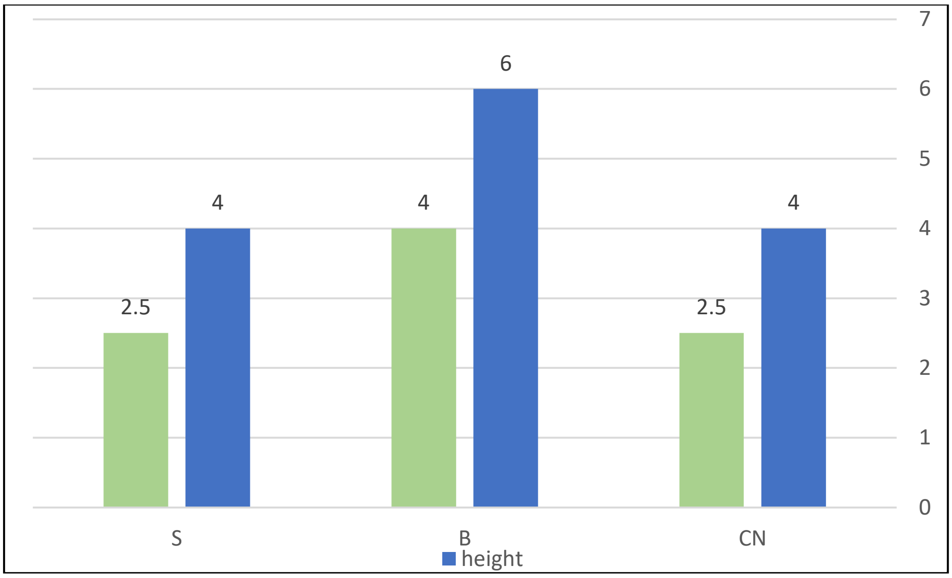

Figure 3: The measurement of the average length (T), number of leaves (N), and branches (F) of a plant fertilized with *Prosopis juliflora*.

The results by measuring the leaf area of the mint plant that was fertilized with *Prosopis juliflora* showed that the best length and width of the leaf was for the mint plant that was fertilized with a solution of dried *Prosopis juliflora* paper, which was symbolized by the symbol B, where the length was 6 cm, while the leaf width of the plant that was fertilized with a *Prosopis juliflora* paper solution was 4 cm.
Further analysis of the mint leaf dimensions showed that plants fertilized with the leaf extract (B) had the largest leaf area, with an average length of 6 cm and width of 4 cm. This confirms the visible morphological improvement attributed to the leaf-based biofertilizer.

3.3. Soil Nutrient Analysis (NPK)

Result of soil sample analysis			
1445/03/27 12/10/2023	Date	Thursday	today
Agricultural Research Unit 1	Laboratory Number	Maximum allowable	Properties
Chemical tests of soil sample with paper coefficient B			
Analysis	Total		Quantitative Limit
Nitrogen	1324. 09 ppm		100. 00
Phosphorus	15. 55 ppm		0. 50
Potassium	377. 60 ppm		0. 4

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Chemical tests of soil sample with seed laboratories		
Analysis	Total	Quantitative Limit
Nitrogen	994. 99 ppm	100. 00
Phosphorus	11. 96 ppm	0. 50
Potassium	421. 61 ppm	0. 4
Chemical tests of soil sample with control		
Analysis	Total	Quantitative Limit
Nitrogen	708. 82 ppm	100. 00
Phosphorus	9. 67 ppm	0. 50
Potassium	215. 60 ppm	0. 4

Table (1): The result of soil samples analysis for the three coefficients paper (B), seed (S) and control (CN)

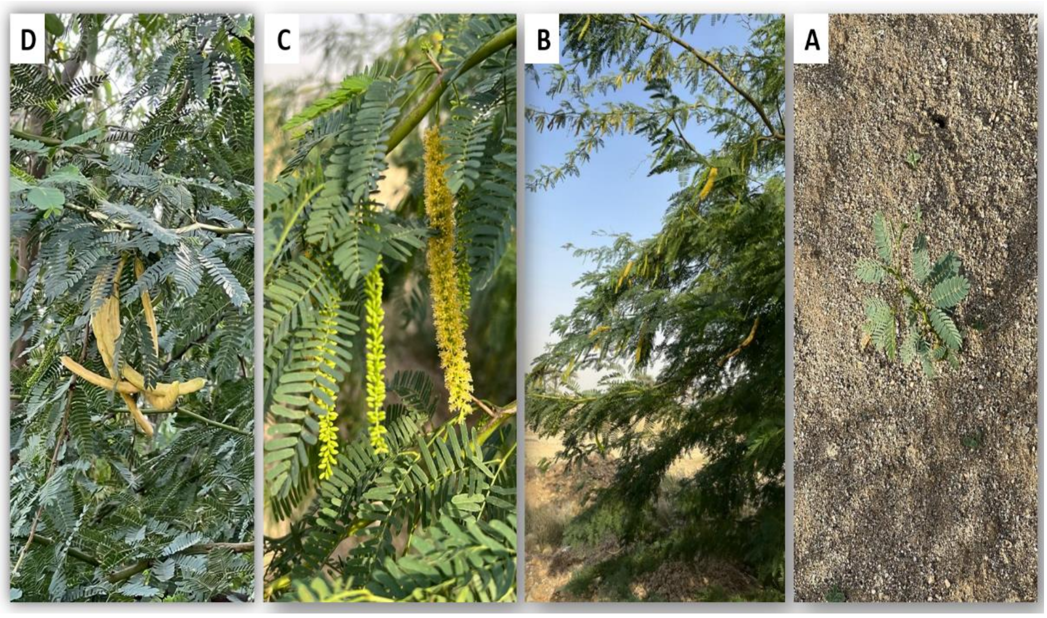

Figure 4. *Prosopis juliflora*

A: The plant when it is young. B: The plant when it grows up: C: Flowers and inflorescences. D: The fruits or pods that carry the seeds

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Figure 5. The difference between the leaves of the *Prosopis juliflora* plant during the day (A) and night (B)

Figure 6. A mint plant before fertilizing with *Prosopis juliflora*.
CN: Control sample B: Fertilization with a solution of *Prosopis juliflora* leaves: S: Fertilization with a solution of ground *Prosopis juliflora* seeds

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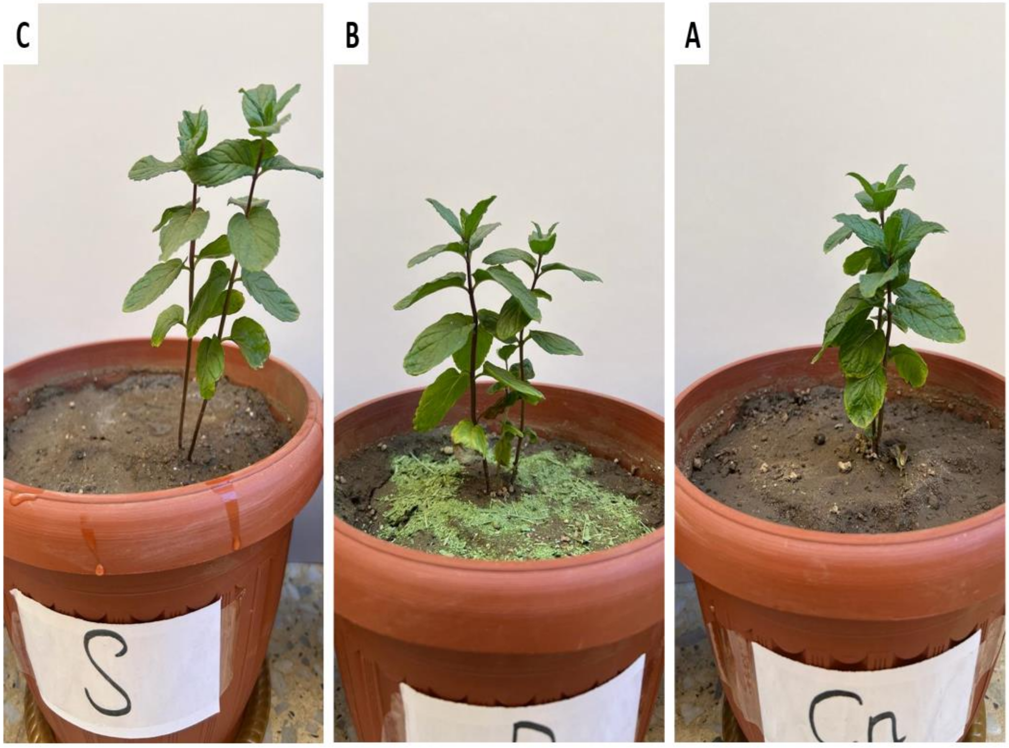

Figure 7. A mint plant and the beginning of fertilization with *Prosopis juliflora.*
CN: Control sample B: Fertilization with a solution of *Prosopis juliflora* leaves: S: Fertilization with a solution of ground *Prosopis juliflora* seeds

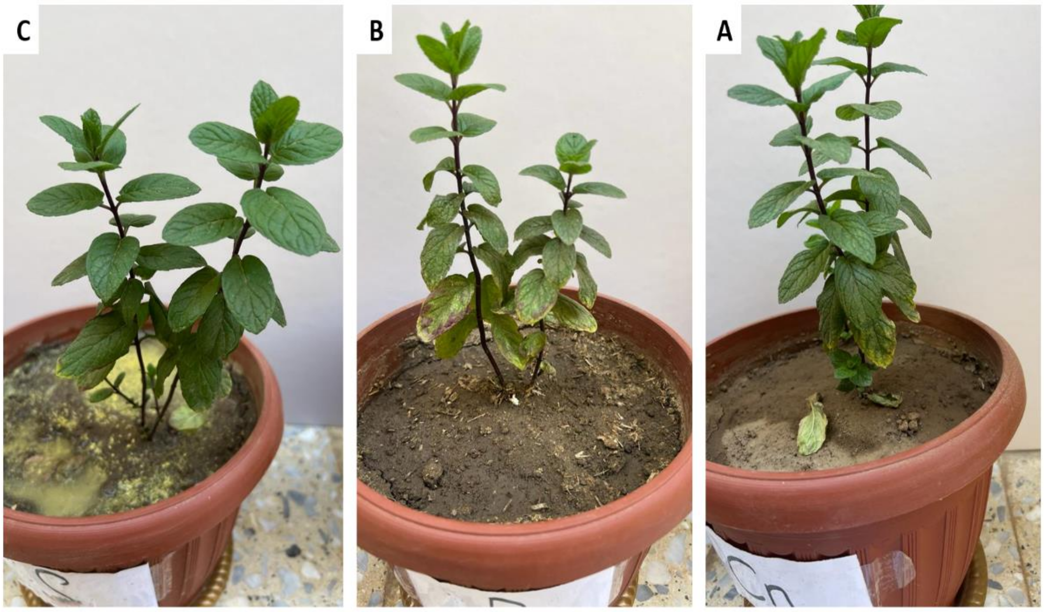

Figure 8. The mint plant and its changes after a period of fertilization with *Prosopis juliflora.*

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CN: Control sample B: Fertilization with a solution of *Prosopis juliflora* leaves: S: Fertilization with a solution of ground *Prosopis juliflora* seeds

Table 2: The difference in changes in mint plants after a period of fertilization with *Prosopis juliflora*.

Treatment	Nitrogen (ppm)	Phosphorus (ppm)	Potassium (ppm)
Leaf (B)	1324.09	15.55	377.60
Seed (S)	994.99	11.96	421.61
Control (CN)	708.82	9.67	215.60

The data indicate a substantial improvement in soil nutrient content, particularly nitrogen and potassium, after application of P. juliflora-based fertilizers. This highlights the dual

The data from Table 2 show significant improvements in soil nutrient levels following the application of P. juliflora-based fertilizers. Here's a concise analysis of the soil nutrient content (NPK) across the treatments:

- Nitrogen (N): The Leaf (B) treatment resulted in the highest nitrogen content at 1324.09 ppm, followed by Seed (S) at 994.99 ppm, and the Control (CN) at 708.82 ppm. The Leaf treatment increased nitrogen by approximately 86.7% compared to the control, indicating strong nitrogen enrichment.
- Phosphorus (P): Phosphorus levels were highest in the Leaf (B) treatment at 15.55 ppm, followed by Seed (S) at 11.96 ppm, and Control (CN) at 9.67 ppm. The Leaf treatment improved phosphorus by about 60.7% over the control, suggesting moderate enhancement.
- Potassium (K): Potassium content was highest in the Seed (S) treatment at 421.61 ppm, followed by Leaf (B) at 377.60 ppm, and Control (CN) at 215.60 ppm. The Seed treatment boosted potassium by approximately 95.5% compared to the control, showing significant potassium enrichment.

Key Observations

- Nitrogen and Potassium: Both Leaf (B) and Seed (S) treatments significantly enhanced nitrogen and potassium levels compared to the control, with Leaf (B) excelling in nitrogen and Seed (S) in potassium.
- Phosphorus: Phosphorus improvements were less pronounced but still notable, particularly with the Leaf (B) treatment.
- Dual Benefits: The use of P. juliflora-based fertilizers not only improves soil fertility by boosting NPK levels but likely also contributes to sustainable soil management by utilizing a potentially invasive species, addressing both agricultural and environmental challenges.

4. Environmental Considerations

While Prosopis juliflora offers significant agricultural advantages as an organic fertilizer, it is imperative to address its classification as an invasive species and the associated ecological risks. One of the main concerns is the unintentional spread of its seeds, which may occur through wind dispersal, water flow, or livestock, potentially

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leading to uncontrolled colonization of natural habitats. This spread can result in biodiversity loss by outcompeting native plant species and altering soil chemistry, hydrology, and microbial communities. Additionally, P. juliflora's dense thickets can disrupt ecosystem services such as grazing land availability and habitat quality for native fauna.

To mitigate these potential threats while harnessing the plant's benefits, the researcher recommends adopting controlled usage protocols. This includes exclusively using processed plant parts (such as dried and milled leaves or composted biomass), which significantly reduces the likelihood of seed germination. It is also advised to establish strict harvesting and containment measures when collecting biomass, ensuring that no viable seeds are introduced into new environments. Moreover, ongoing monitoring and ecological risk assessments should accompany any field application of P. juliflora-based fertilizers, especially in or near vulnerable ecosystems.

Integrating these precautionary strategies into sustainable agricultural practices allows for a balanced utilization of P. juliflora — maximizing its contribution to soil fertility and water-use efficiency while minimizing the risks to native biodiversity and ecological stability.

5. Discussion

The present study aimed to evaluate the effect of different biofertilizers derived from the *Persopsis* plant—specifically leaf-based (symbolized as B) and seed-based (symbolized as S) formulations—on soil nutrient concentrations, particularly nitrogen (N), phosphorus (P), and potassium (K). The results revealed significant differences among treatments. The leaf-based fertilizer (B) recorded the highest nitrogen (1324.09 ppm) and phosphorus (15.55 ppm) concentrations, while the seed-based fertilizer (S) exhibited the highest potassium level (421.61 ppm). The control group (CN) consistently recorded the lowest nutrient values.

These findings align with the growing body of literature emphasizing the efficacy of plant-based biofertilizers in enhancing soil fertility and crop productivity. For instance, Ajeng et al. (2024) confirmed that biofertilizers significantly modify the metabolite profile of tropical soils, promoting better nutrient availability and plant uptake. Similarly, Rafiq et al. (2024) demonstrated that applying biomass from the Asteraceae family along with biofertilizers improved plant health and suppressed soilborne diseases, indicating an improvement in overall soil nutrient dynamics.

From an allelopathic perspective, the elevated nutrient levels, particularly in the B treatment, may be partially attributed to allelochemicals in *Persopsis* leaves. Recent studies have indicated that certain plant secondary metabolites not only affect plant–plant interactions but also influence soil microbial communities and enzymatic activities that mediate nutrient cycling (Song et al., 2024). Bakacsy et al. (2024) and Cao et al. (2025) further demonstrated that allelopathic interactions can either enhance

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or inhibit nutrient assimilation depending on compound concentration and environmental context. The current study's results suggest a potentially beneficial allelopathic effect of *Persopsis* leaves at the tested concentrations.

In addition, the implications of these findings support the broader goals of **sustainable agriculture**. The integration of organic biofertilizers derived from native or medicinal plants aligns with agroecological principles. According to Ray et al. (2025), intercropping and the use of organic inputs like biofertilizers contribute to ecosystem services such as nutrient cycling, carbon sequestration, and soil biodiversity. Sekhar et al. (2024) also emphasized that merging traditional organic inputs with modern agricultural practices is a viable strategy for long-term sustainability, particularly in regions facing soil degradation and resource depletion.

Thus, the current study contributes valuable empirical support for the use of *Persopsis*-based biofertilizers in sustainable soil fertility management. The results are consistent with contemporary research showing that bio-based amendments not only enhance macronutrient availability but may also act through biochemical pathways influenced by allelopathic compounds.

The researcher believes that *Persopsis* leaf fertilizer holds significant promise as a dual-function soil amendment—serving both as a nutrient-rich biofertilizer and as a potential source of beneficial allelochemicals. However, more detailed studies are needed to isolate and characterize the active compounds responsible for the observed effects. Moreover, long-term field trials should be conducted to assess environmental impacts and validate laboratory findings under real-world conditions.

6. Conclusions

This study concludes that *Prosopis juliflora*, particularly its leaf extract, offers substantial promise as a sustainable organic fertilizer. The leaf extract significantly enhanced nitrogen, phosphorus, and potassium content in the soil, demonstrating its potential to improve soil fertility and plant growth in nutrient-poor environments. The seed extract, while also beneficial, proved more effective in boosting potassium levels and improving branching.

The findings suggest that the use of *P. juliflora* biomass can contribute to sustainable agriculture by providing a cost-effective, eco-friendly alternative to conventional chemical fertilizers. This aligns with global efforts towards greener agricultural practices and could help mitigate the negative environmental impact of *P. juliflora* as an invasive species.

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However, due to the invasive nature of the species, its use should be controlled, and further research is needed to explore the long-term environmental and agricultural impacts, as well as the development of management strategies to ensure its safe application. Overall, *P. juliflora* has the potential to play a crucial role in sustainable agricultural systems, especially in arid and semi-arid regions like Saudi Arabia.

References

1. Almanza, S. G., & Moya, E. G. (1986). The uses of mesquite (Prosopis spp.) in the highlands of San Luis Potosi, Mexico. *Forest Ecology and Management, 16*(1), 49–56. https://doi. org/https://doi. org/10. 1016/0378-1127(86)90007-1
2. Ajeng, A. A., Shim, G. S., Abdullah, R., Ling, T. C., & Khoo, K. S. (2024). Metabolites profiling of humid tropic simulated Bungor soil under biofertilizer application. *Journal of Soil Science and Plant Nutrition, 24*(3), 6072–6084.
3. Bakacsy, L., Kardos, L. V., Szepesi, Á., Nagy, K. N., Vasas, A., & Feigl, G. (2024). Investigation of the allelopathic effect of two invasive plant species in rhizotron system. *Life, 14*(4), 475.
4. Cao, C., Tian, H., Jiang, D., Tang, Y., Ni, J., Zhang, L., & Jiang, N. (2025). Investigation of the allelopathic effect of two medicinal plants in agroforestry systems. *Scientific Reports, 15*(1), 12258.
5. Rafiq, M., Shoaib, A., Javaid, A., Parveen, S., Hassan, M. A., Nawaz, H. H., & Cheng, C. (2024). Application of Asteraceae biomass and biofertilizers to improve potato crop health by controlling black scurf disease. *Frontiers in Plant Science, 15*, 1437702.
6. Ray, S. U. M. I. T., Maitra, S. A. G. A. R., Sairam, M. A. S. I. N. A., Sameer, S. H. A. I. K., Sagar, L. A. L. I. C. H. E. T. T. I., Divya, B. S., & Gitari, H. I. (2025). The nexus between intercropping systems, ecosystem services and sustainable agriculture: A review. *Research on Crops, 26*(1), 1–11.
7. Sekhar, M., Rastogi, M., Rajesh, C. M., Saikanth, D. R. K., Rout, S., Kumar, S., & Patel, A. K. (2024). Exploring traditional agricultural techniques integrated with modern farming for a sustainable future: A review. *Journal of Scientific Research and Reports, 30*(3), 185–198.
8. Song, T., Chen, J. X., Shan, L. M., Qian, Y. C., Chen, M. X., Han, J. G., & Zhu, F. Y. (2024). Allelopathy research on the continuous cropping problem of poplar (*Populus*). *Phytochemistry Reviews, 23*(5), 1477–1495.
9. Dămătîrcă, C., Moretti, B., Bertora, C., Ferrarini, A., Lerda, C., Mania, I., Celi, L., Gorra, R., & Zavattaro, L. (2023). Residue incorporation and organic fertilisation improve carbon and nitrogen turnover and stabilisation in maize monocropping. *Agriculture, Ecosystems & Environment, 342*, 108255. https://doi. org/https://doi. org/10. 1016/j. agee. 2022. 108255
10. de Melo Cavalcante, A. M., de Melo, A. M., da Silva, A. V. F., da Silva Neto, G. J., Barbi, R. C. T., Ikeda, M., Silva, G. B., Steel, C. J., & da Silva, O. S. (2022). Mesquite (Prosopis juliflora) grain flour: New ingredient with bioactive, nutritional and physical-chemical properties for food applications. *Future Foods, 5*, 100114. https://doi. org/https://doi. org/10. 1016/j. fufo. 2022. 100114

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11. Korus, J., Witczak, M., Korus, A., & Juszczak, L. (2022). Mesquite (Prosopis L.) as a functional ingredient in gluten-free dough and bread. *LWT*, *168*, 113957. https://doi. org/https://doi. org/10. 1016/j. lwt. 2022. 113957

12. Li, K., & Wang, C. (2023). Multiple soil quality assessment methods for evaluating effects of organic fertilization in wheat-maize rotation system. *European Journal of Agronomy*, *150*, 126929. https://doi. org/https://doi. org/10. 1016/j. eja. 2023. 126929

13. Liang, G. (2022). Nitrogen fertilization mitigates global food insecurity by increasing cereal yield and its stability. *Global Food Security*, *34*, 100652. https://doi. org/https://doi. org/10. 1016/j. gfs. 2022. 100652

14. Onofrei, V., Benchennouf, A., Jancheva, M., Loupassaki, S., Ouaret, W., Burducea, M., Lobiuc, A., Teliban, G. -C., & Robu, T. (2018). Ecological foliar fertilization effects on essential oil composition of sweet basil (Ocimum basilicum L.) cultivated in a field system. *Scientia Horticulturae*, *239*, 104–113. https://doi. org/https://doi. org/10. 1016/j. scienta. 2018. 05. 021

15. Page, M. T., Perotto-Baldivieso, H. L., Ortega-S, J. A., Tanner, E. P., Angerer, J. P., Combs, R. C., Camacho, A. M., Ramirez, M., Cavazos, V., Carroll, H., Baca, K., Daniels, D., & Kimmet, T. (2022). Evaluating Mesquite Distribution Using Unpiloted Aerial Vehicles and Satellite Imagery. *Rangeland Ecology & Management*, *83*, 91–101. https://doi. org/https://doi. org/10. 1016/j. rama. 2022. 03. 007

16. Peçanha, D. A., Freitas, M. S. M., Vieira, M. E., Cunha, J. M., & de Jesus, A. C. (2021). Phosphorus fertilization affects growth, essential oil yield and quality of true lavender in Brazil. *Industrial Crops and Products*, *170*, 113803. https://doi. org/https://doi. org/10. 1016/j. indcrop. 2021. 113803

17. Pérez-Serrano, D., Cabirol, N., Martínez-Cervantes, C., & Rojas-Oropeza, M. (2021). Mesquite management in the Mezquital Valley: A sustainability assessment based on the view point of the Hñähñú indigenous community. *Environmental and Sustainability Indicators*, *10*, 100113. https://doi. org/https://doi. org/10. 1016/j. indic. 2021. 100113

18. Shiferaw, H., Alamirew, T., Dzikiti, S., Bewket, W., Zeleke, G., Teketay, D., & Schaffner, U. (2023). Water abstraction of invasive Prosopis juliflora and native Senegalia senegal trees: A comparative study in the Great Rift Valley Area, Ethiopia. *Science of The Total Environment*, *862*, 160833. https://doi. org/https://doi. org/10. 1016/j. scitotenv. 2022. 160833

19. Solano, F., Hernández, E., Juárez-Rojas, L., Rojas-Maya, S., López, G., Romero, C., Casillas, F., Betancourt, M., López, A., Heidari, R., Ommati, M. M., & Retana-Márquez, S. (2022). Reproductive disruption in adult female and male rats prenatally exposed to mesquite pod extract or daidzein. *Reproductive Biology*, *22*(3), 100683. https://doi. org/https://doi. org/10. 1016/j. repbio. 2022. 100683

20. Wilson, T. B., & Thompson, T. L. (2005). Soil nutrient distributions of mesquite-dominated desert grasslands: changes in time and space. *Geoderma*, *126*(3), 301–315. https://doi. org/https://doi. org/10. 1016/j. geoderma. 2004. 10. 002