

Article

Review Article: The Effect of Plant Extracts on Vegetative Growth and Plant Productivity

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Abstract: Plant extracts have been recognized as natural sources for bioactive substances (phenols, flavonoids, terpenes, and alkaloids), which likely have serious potential to promote the vegetative growth of plants. Several investigations have reported that application of plant extracts can positively influence the increase of vegetative growth, the induction of photosynthetic activity and nutrient uptake, the drought tolerance and the replacement for use of chemical components, and the resistance to environmental stresses. For the purposes of this review, it is the use of plants oils and its implications on the growth of plants.

Keywords: Plant Extracts, Vegetative Growth, Environmental Conditions

1. Introduction

Modern To meet the threats to environment and health that have been posed by the overuse of chemical agriculture inputs like fertilisers and pesticides, the modern agriculture is shifting towards safe and eco-friendly alternative inputs. Plant extracts are acknowledged as one of the most hopeful alternatives, since they are rich in active natural compounds, such as phenols, flavonoids, terpenes, essential oils and organic acids, which can act directly or indirectly on plant growth and productivity (Naguib et al., 2012; Yousif and Abd El-Gawad, 2018; Abou-El-Hassan et al., 2020).

Benefits of plant extracts:

- Promote vegetative growth: Some of the extracts, eg, seaweed extract, have natural growth regulators such as auxins, and cytokinins that increase cell division and cell elongation, and. therefore improved vegetative growth (Khan et al., 2009; Atia, 2005.)



Figure 1. Effect of various plant extracts on the vegetative growth attributes of treated plants.

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- b. Improvement in photosynthesis efficiency: Iron is involved in protecting chlorophyll pigments from oxidation (Sangha et al., 2014), which is promoted by phenolic compounds and flavonoids, and thus enhancing photosynthesis efficiency. Improvement of photosynthetic efficiency: Phenolic compounds and flavonoids play a role in the protection of chlorophyll pigments against oxidation, thus enhancing photosynthetic efficiency (Sangha et al., 2014, Wang et al., 2025).

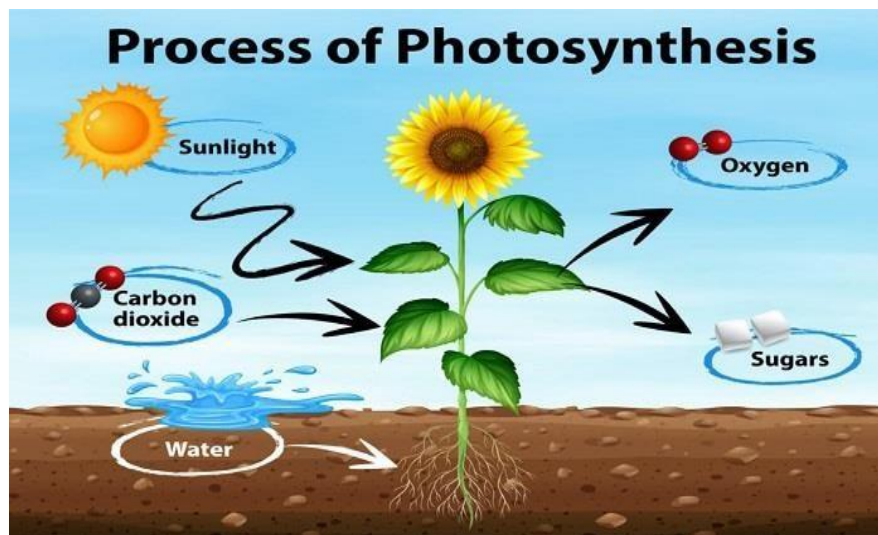


Figure 2. Effect of seaweed extract concentrations on plant height and leaf number.

- c. Stress management: Some plant extracts such as garlic and neem increase plant defense against biotic diseases and improve its tolerance to abiotic stresses, such as salinity and drought through the induction of antioxidants and defense enzymes (Ali et al., 2019). Enhancing the stress resistance: Contents such as, garlic, neem stimulates the biotic resistance against diseases, while improves the tolerance towards the abiotic stresses; such as salinity and drought through the induction of antioxidants and defensive enzymes (Ali et al., 2019, Abd El-Gawad Et al., 2017).

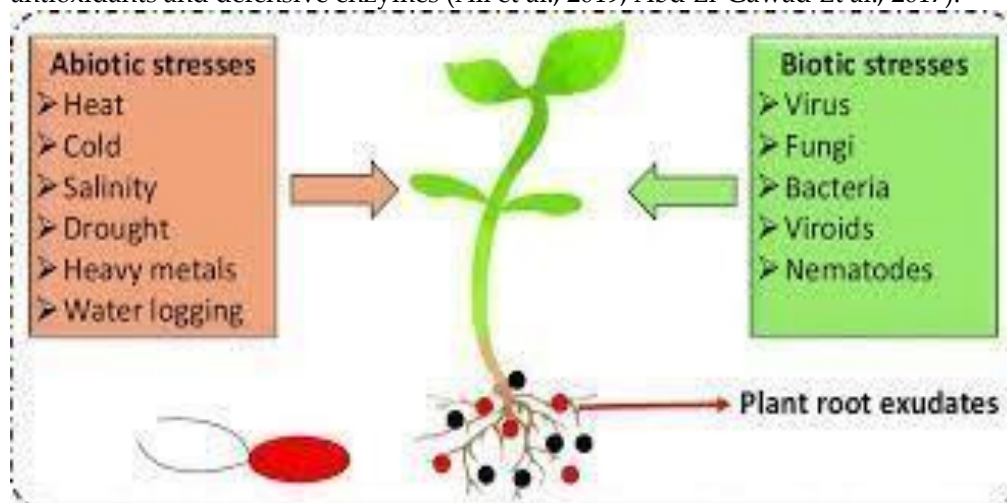


Figure 3. Increase of chlorophyll content on application of different herbal extracts.

- d. Physiological process activation: Free forms of amino acids and organic acids in the extracts increase the uptake of mineral elements and harmonize hormonal activity in the plant (Calvo et al., 2014; Gaobo et al., 2025).



Figure 4. Effect of neem and garlic extracts on plant stress resistance under drought conditions.

The impact on productivity

Improving crop components: It has been shown that spraying seaweed extracts or fenugreek seeds increases the number of flowers, the rate of fruit set, and the size of fruits or grains (Abou-El-Hassan et al., 2020) N go et al., 2011.

Improving product quality: The application of plant extracts such as herbal extracts has led to an increase in the content of medicinal plants in volatile oils and flavonoids, thereby enhancing their economic value (Naguib et al., 2012, Zhuyuan et al., 2025).



Figure 5. Comparative analysis of photosynthetic efficiency influenced by flavonoid-rich extracts.



Figure 6. Improvement of fruit set and grain size after foliar application of fenugreek extracts.

Reducing reliance on chemical inputs: The regular use of extracts contributes to lowering the rates of fertilization and chemical pesticides, while maintaining high productivity and appropriate quality (Ali et al., 2019, Xiaoyu et al., 2025).



Figure 7. Changes in total phenolic content of plants after treatment with medicinal plant extracts.

Practical applications: Some agricultural experiments use extracts to spray on the plant's foliage to enhance growth and productivity, provide resistance against diseases and agricultural pests, and increase the plant's resistance mechanism to fungal diseases. Among these extracts are Seaweed extracts: effective in grains and vegetables to increase growth and productivity (Khan et al., 2009). Garlic and neem extracts: They have dual effects in combating fungal diseases and stimulating systemic resistance (Ali et al., 2019). Fenugreek and ginger extracts: They enhance germination and early growth of plants (Abou-El-Hassan et al., 2020). Medicinal plant extracts: increase the accumulation of active compounds in medicinal plants such as mint and chamomile (Naguib et al., 2012).

2. Conclusion

Plant extracts have proven their ability to improve plant growth and productivity, enhance resistance to biotic and abiotic stresses, in addition to their role in improving the quality of agricultural products. Nevertheless, there is still a need for more field studies to determine the best extraction methods, optimal concentrations, and application mechanisms, ensuring their effective integration into sustainable agricultural systems.

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