"Review on foliar application of seaweed extract and micronutrients on plant growth and yield of strawberry (*FragariaxannanassaDuch*) cv. Winter Dawn"

Comment [N1]: Kindly write the scientific name in proper format

Abstract:-

The study investigates the potential benefits of integrating seaweed extracts and micronutrients into the cultivation practices of strawberries to enhance overall plant performance and fruit production. Seaweed extracts are known to contain a myriad of bioactive compounds, including plant growth regulators, amino acids, and minerals, which have been reported to positively influence various physiological processes in plants. Additionally, micronutrients play a crucial role in the plant's metabolic activities, and deficiencies can lead to reduced growth and yield. The synergistic effects of seaweed extract and micronutrients present an intriguing avenue for improving the overall health and productivity of strawberry crops. The review synthesizes findings from recent studies, assessing the impact of foliar application of seaweed extracts and micronutrients on strawberry plants. Emphasis is placed on elucidating the mechanisms underlying the observed improvements in growth parameters, nutrient uptake, and yield. Furthermore, the review considers the potential ecological and economic advantages of adopting these practices in strawberry cultivation.

Keywords: Micronutrients, seaweed extract, optimal growth, stress tolerance.

Comment [N2]: Write the keywords in chronological order

Introduction

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The strawberry, scientifically known as Fragaria × ananassa, is a hybrid species that belongs to the Rosaceae family. It is a cultivated garden strawberry that originated from a cross between the Virginia strawberry (Fragaria virginiana) and the Chilean strawberry (Fragaria chiloensis).The genus Fragaria includes several species that produce strawberries, and they are collectively referred to as strawberries**(Hummer *et al.*, 2010).**

Comment [N4]: Mention the scientific name in Italics

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The cultivation of strawberries, particularly the Winter Dawn variety, is of significant agricultural interest due to the economic importance and widespread consumption of this fruit. The foliar application of seaweed extract and micronutrients has gained attention as a potential

strategy to enhance plant growth, improve nutrient uptake, and ultimately increase crop yield **(Nabti*et al.*, 2017).**

Seaweed extract is known for its rich content of bioactive compounds, such as auxins, cytokines, and other growth-promoting substances **(Ali *et al.*, 2023).**These compounds have been reported to positively influence various physiological processes in plants, including seed germination, root development, and flowering.

Micronutrients, essential elements required by plants in small quantities, play a crucial role in various metabolic processes **(Osvalde*et al.*, 2023).**Their deficiency can significantly impact plant growth and yield. The foliar application of micronutrients aims to address such deficiencies and optimize the overall nutritional status of the plants.

The study reviews existing literature, synthesizes research findings, and critically evaluates the effectiveness of foliar application of seaweed extract and micronutrients on strawberry plants. It explores the physiological mechanisms underlying the observed effects, considering factors such as nutrient absorption, photosynthesis, and stress tolerance **(El-Bialy *et al.*, 2023).**

Effect of seaweed extract on plant growth of strawberry:-

Comment [N6]: Mention some of the species

Comment [N7]: Add more review

Seaweed extracts, derived from various types of seaweed or algae, have been studied for their potential benefits on plant growth and development. While the specific effects can vary depending on the type of seaweed extract, concentration, and application method, here are some general potential benefits of using seaweed extract on strawberry plants:

Nutrient Content: Seaweed extracts are rich in various essential nutrients, including micronutrients; trace elements, and growth-promoting hormones **(Ghatas*et al.*, 2021).**These can contribute to improved plant nutrition, leading to enhanced growth and development.

Comment [N8]: Add nutrient content in table form

Stress Tolerance: Seaweed extracts may help plants cope with environmental stress, such as drought, salinity, or temperature extremes. This stress tolerance can be especially beneficial for plants growing in challenging conditions **(Deolu- Ajayi *et al.*, 2022).**

Root Development: Seaweed extracts have been reported to stimulate root development. Healthy and well-developed roots are essential for nutrient uptake, water absorption, and overall plant health **(Kumar *et al.*, 2022).** Improved root systems can contribute to increased plant vigor.

Yield and Fruit Quality: Some studies suggest that the application of seaweed extracts can positively impact fruit yield and quality on strawberry.. This may include factors such as fruit size, color, and taste **(Soltaniband*et al.*, 2022).**

Disease Resistance: Seaweed extracts have been investigated for their potential to enhance a plant's resistance to certain diseases **(Jayaraman *et al.*, 2021).** While not a replacement for proper disease management practices, seaweed extracts may contribute to a plant's overall health and resilience.

Comment [N9]: Add some of the disease which was controlled by Seaweed

Bio-stimulant Effects: Seaweed extracts are considered bio-stimulants, meaning they can enhance various physiological processes in strawberry plants **(Kapur *et al.*, 2018).**This can include increased photosynthesis, nutrient absorption, and hormonal regulation.

Environmental Sustainability: Seaweed extracts are often promoted for their environmentally friendly nature. They are derived from renewable marine resources and are generally considered to have a low environmental impact **(Nedumaran *et al.*, 2015).**

Effect of micronutrients on plant growth and yield of strawberry:-

Comment [N10]: Add more review

Micronutrients play a crucial role in the growth and development of plants, including strawberries (Fragaria x ananassa Duch). While macronutrients such as nitrogen, phosphorus, and potassium are required in larger quantities, micronutrients are essential in smaller amounts for various physiological functions. Here are some effects of micronutrients on the growth and yield of strawberries:

Comment [N11]: Italics

Iron (Fe): Chlorophyll Formation: Iron is a key component of chlorophyll, the green pigment responsible for photosynthesis. A sufficient supply of iron promotes healthy leaf development and overall plant vigor.

Flower and Fruit Development in strawberry, Iron is also involved in the formation of flowers and fruits, contributing to reproductive success and yield of strawberry.**(Chakraborty et al., 2016).**

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Manganese (Mn): Enzyme Activation: Manganese activates several enzymes involved in photosynthesis, respiration, and nitrogen metabolism. This positively impacts energy production and nutrient assimilation of strawberry **(Trejo-Téllez *et al.*, 2014).**

Disease Resistance: Manganese plays a role in plant defense mechanisms, helping the plant resist certain diseases.

Zinc (Zn): Enzyme Activation: Zinc is a cofactor for many enzymes involved in various metabolic processes, including auxin synthesis. Adequate zinc levels contribute to proper hormone balance and overall plant growth of strawberry **(Ahanger*et al.*, 2016).**

Fruit Formation: Zinc is essential for fruit development and maturation.

Copper (Cu): Enzyme Activation: Copper is involved in the activation of enzymes related to photosynthesis and lignin formation. Lignin strengthens cell walls, providing structural support to the plant **(Printz *et al.*,2016).**

Reproductive Processes: Copper is crucial for pollen formation and fertilization, influencing fruit set and yield of strawberry.

Boron (B): Cell Wall Formation: Boron is essential for cell wall formation and stability. It influences the transport of sugars and the development of meristematic tissues.

Flower and Fruit Development: Boron is particularly important during flowering and fruiting stages, impacting seed and fruit set of strawberry **(El-Hefnawi*et al.*, 2021).**

Molybdenum (Mo): Nitrogen Metabolism: Molybdenum is essential for nitrogen metabolism, particularly in the conversion of nitrate to ammonia. This process is crucial for protein synthesis and overall plant growth of strawberry **(Liu *et al.*,2017).**

Chlorine (Cl): Osmotic Regulation: While chlorine is not considered an essential micronutrient for strawberry plants **(Tabatabaei *et al.*, 2017).**It plays a role in osmotic regulation and stomata function.

Conclusion

In conclusion, the reviewed literature suggests that foliar application of seaweed extract and micronutrients can be a valuable strategy for enhancing the growth and yield of Winter Dawn strawberry cultivars. However, further research and field trials are needed to fine-tune application methods and better understand the underlying mechanisms for optimal results in different growing conditions.

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Comment [N13]: Need toad atleast 30 references for review article and change it in a journal format

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