Application of biostimulants derived from agricultural by-products for the enhancement of plant growth and tolerance to abiotic stress

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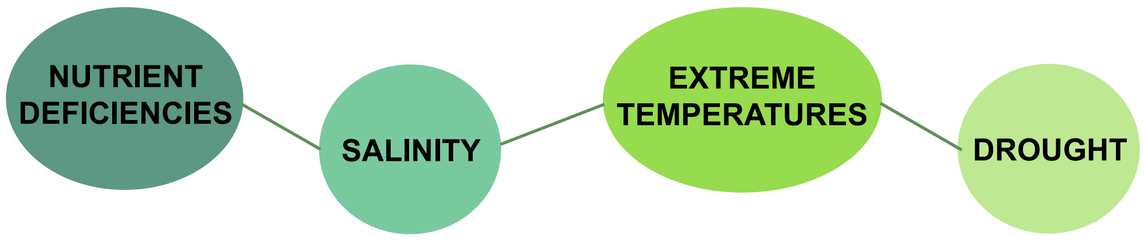
INTRODUCTION & AIM

Global **climate change** has significantly threatened **food production and quality**.



Consequently, there is an **urgent need to develop formulations** that can **enhance crop growth and resistance to abiotic stresses.**

BIOSTIMULANTS

Compounds applied to **plants** or **soil** to **stimulate natural processes** improving **nutrient uptake** and **tolerance to abiotic stress**.

BIOSTIMULANTS FROM BY-PRODUCTS

The formulation of **biostimulants** using **by-products** generated along the **agri-food chain** has been proposed, thereby contributing to the **circular economy**.

RESULTS & DISCUSSION

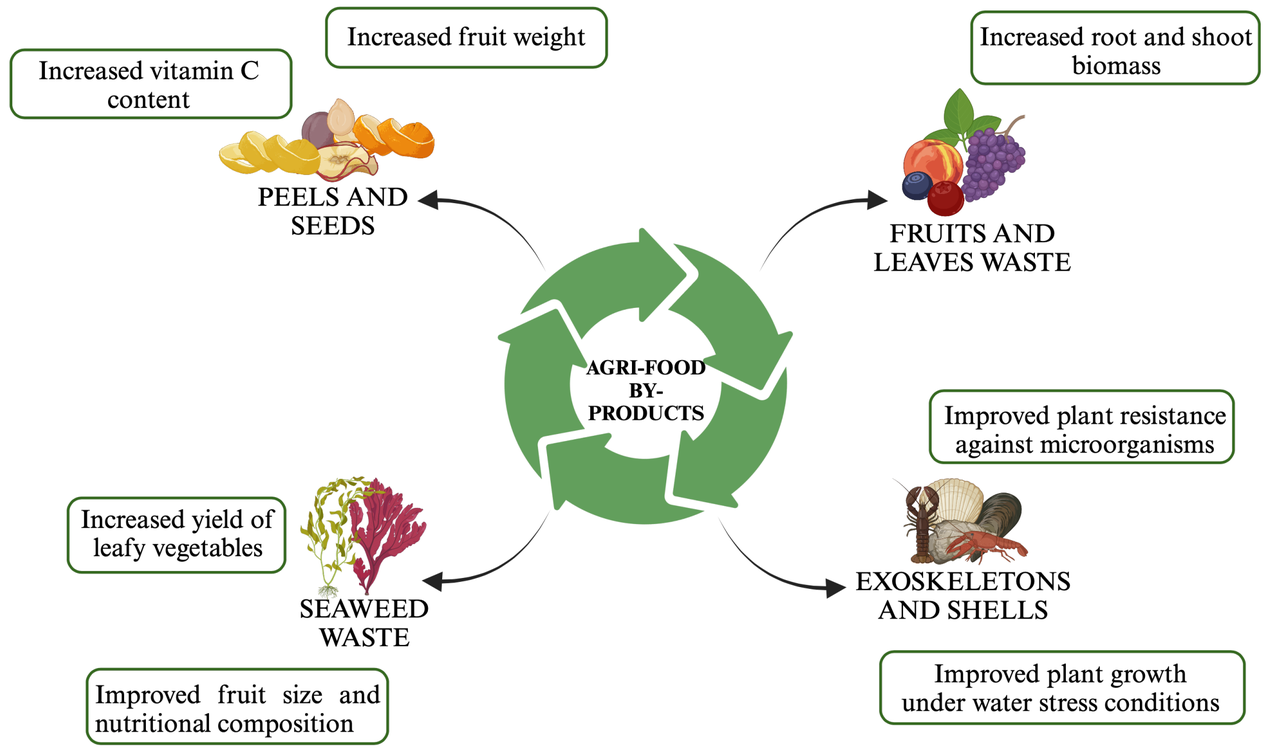


Figure 1. Benefits achieved by formulating biostimulants with agri-food by-products.

The criteria for **selecting by-products** for recovery as a biostimulant are absence of pesticide residues, low cost of collection and storage, sufficient supply and synergy with other recovery routes.

The **importance of the extraction technique** used lies in the **amount of compound** of interest extracted, the **cost** to obtain it, and the use of **environmentally friendly solvents**.

Table 1. Extraction techniques applied in agri-food by-products for biostimulant production.

Extraction method	Matrix	Compound extracted	Achievements
Solvent extraction	Seeds, peels and fruits	Phenolic compounds and essential oils	Increased fruit size of the crops
Water extraction	Leaves, fruits, and peels	Phenolic compounds	Improved root size of tuber crops Improved nutritional composition
UAE	Seeds and fruits	Essential oils and phenolic compounds	Improved resistance to plagues Increased fruit size of the crops
MAE	Fruits and leaves	Phenolic compounds	Improved resistance to plagues
SFE	Seeds, shells and fruits	Essential oils and chitin	Improved plant growth under stress conditions
EAE	Peels, seeds and leaves	Polysaccharides and phenolic compounds	Improved plant growth under stress conditions

Abbreviations. UAE: ultrasound assisted extraction; MAE: microwave assisted extraction, SFE: supercritical fluid extraction; EAE: enzyme assisted extraction.

CONCLUSIONS

The use of biostimulants incorporating compounds extracted from food by-products has been shown to:

- **Promote the growth** of crops under environmental stress conditions.
- **Improve the quality** of the fruits produced in these crops.

In addition, for **the extraction of stimulant compounds** from food by-products, the extraction techniques used influence the **effectiveness of the formulations**.

- Each extraction technique shows advantages for extracting certain compounds, depending on their **chemical nature**.
- The extraction techniques applied influence the **cost-effectiveness** of biostimulant production costs.

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