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Popular Article

Defence Modulators for Enhancing Quality and Disease Resistance in Horticulture Crops

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Introduction

The world population is increasing at an alarming rate and is expected to reach about 10 billion by the end of 2050, but the productivity of food is decreasing due to the effect of various biotic and abiotic stresses and post-harvest losses of produce. In order to meet the world's rising food demand, reducing these losses is a major significant concern for all countries. However, in India losses through diseases are 20%, losses from insect pests are 25%, and abiotic stresses can reduce crop yields by up to 50% on average. There are numerous technical options available to combat this problem. Some options include development of resistant cultivars, biological control, crop rotation, tillage and agrochemicals. A complicated interconnection of biotic and abiotic stresses and post-harvest storage losses leads to enormous usage of agrochemicals. While, their use at commercial level is uneconomical, their application is time-consuming, and some have been shown to cause cancer. However, with rising consumer interest in food, attention has shifted more towards quality assurance with particular emphasis on the enhancement of health-promoting phytochemicals that promote health. Therefore, considerable efforts have been accomplished to devise environmental-friendly strategies for the check of plant diseases and thus to save mankind from health hazard. Keeping this back ground, post-harvest defence modulators/elicitor treatments may a viable option to elicit the desired effect and to ensure an efficient and consumer-oriented supply chain.

Why focus on Defence modulators/elicitors?

- **Chemical compounds** – Not only Contaminate soil, but it also contaminates the natural water resource and vegetation.

- In addition to killing insects and pest, it also **toxic to beneficial organisms** like honey bee and other pollinators in turn the biodiversity and sustainability of environment will be affected.
- The Chemical residues when added to the food chain it will cause health hazards and some chemicals are also proven to be carcinogenic nature.

➢ Whereas, **Defence modulators/ Elicitors** – In-turn induce defence responses by altering the physiology of the plant

- Even the low concentration is enough to provide the plants with long term protection to a wide range of pathogens
- Non – toxic and environmentally friendly in nature.

- **What is Defence modulators (Elicitors)?**

Elicitors are the bio-factors from various sources that can trigger physiological and morphological responses and also phytoalexin accumulation in the target living organisms.Originally the term elicitor was used for molecules capable of inducing the production of phytoalexins, but it is now commonly used for compounds stimulating any type of plant defense.This broader definition of elicitors includes both substances of pathogen origin (exogenous elicitors) and compounds released from plants by the action of the pathogen (endogenous elicitors)

CLASSIFICATION OF DEFENCE MODULATORS

✓ **Depending upon their origin,** they are classified as **biotic** and **abiotic** elicitors.

❖ **Biotic elicitors**: The biotic elicitors are such elicitors that are biological nature derived from plants or pathogens. Biotic elicitors are either pathogen (or) host origin that can stimulate defense responses (such as phytoalexin accumulation) in plant tissues.

❖ **Abiotic elicitors:** Abiotic elicitors have non biological nature and can be either physical agents or chemicals. Abiotic elicitors are of non-biological origin.

✓ Elicitor classification **based on their interaction** with the host plant.

❖ **General Elicitors:** They are able to trigger defense both in host and non-host plants. They do not significantly differ in their effect on different cultivars within a plant species and are involved in primary innate immunity.

❖ **Specific Elicitors (gene-gene):** They induce defense responses leading to disease resistance only in specific host cultivars. They are formed by specialized pathogens and function only in plant cultivars carrying the corresponding disease resistance gene. Effectors typically lead to the secondary innate immunity after an intracellular receptor mediated perception.

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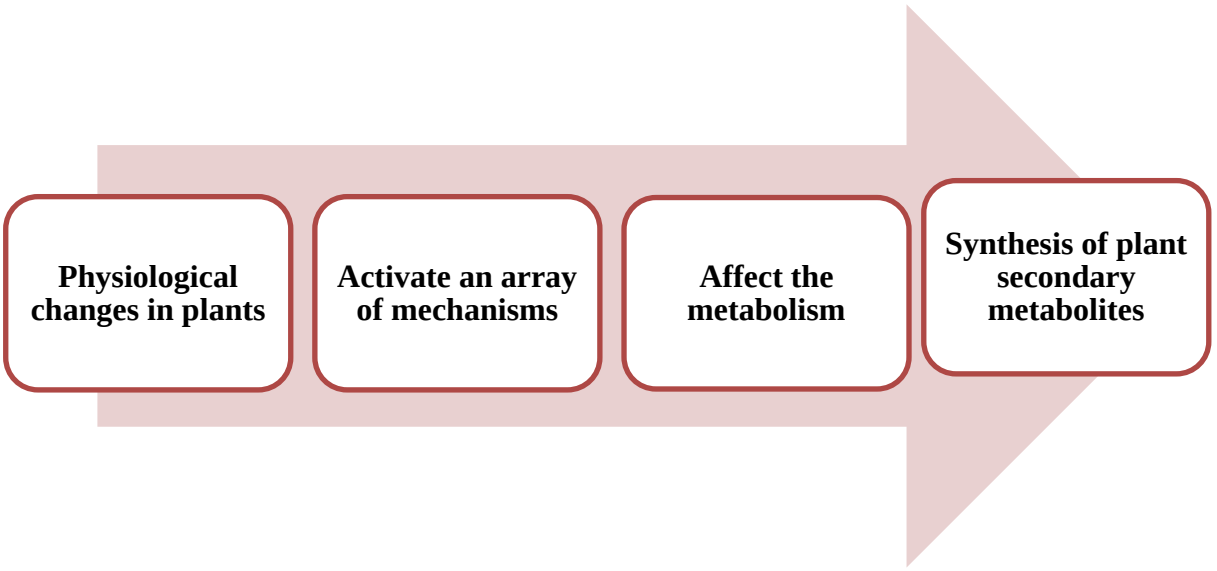
Molecular mechanism of elicitation

- When elicitor come into contact with the plant, the receptor presents in the plasma membrane recognize & bind with the elicitor
- This will initiate series of biochemical activities like – ion influx, etc.
- Initially K & Cl- efflux and ca2+ & H+ influx takes place
- The most important is Ca2+ influx, beacuse Ca2+ regulate ROS burst etc.
- Ca2+ promote secondary messengers' production like IP3 & diacylglycerol (DAG) through G- protein activation
- These 3 processes will mediate the MAP Kinase phosphorylation which will produce signals to hormone for defence & mediate gene expression through transcription & translation
- With the help enzyme reactions secondary metabolites will produce.

Main Functions of Defense modulators



Commonly used elicitors

- ✓ Salicylic Acid
- ✓ Methyl Jasmonate
- ✓ Ascorbic Acid
- ✓ Sea Weed Extract
- ✓ Chitosan

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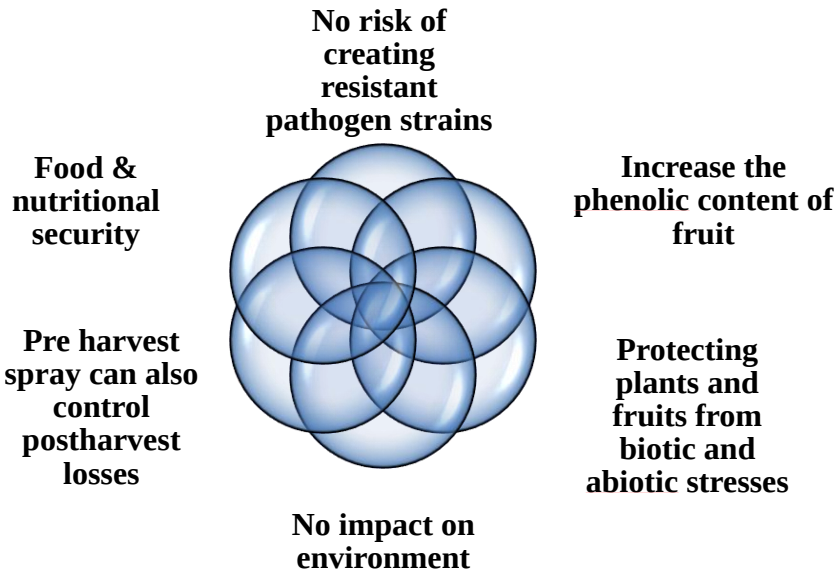
Advantages



Conclusion

- ✓ Defense modulators have the potential of increasing plant **productivity** and **quality** through influence on various metabolic processes.
- ✓ Reduced **environmental hazards** as elicitors affect directly the crop plants, and their **acute toxicity** to other organisms is lower than that of **pesticides**.
- ✓ Elicitors are compounds that play major role in **plant defence mechanism**.
- ✓ Improvement in quality, colour, appearance, shelf life, firmness and spot-free fruits will be of **great boon to farmers**.
- ✓ The use of elicitors in crop protection and pest management is a viable option for enhancement of growth, yield and quality

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