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# "Growth retardant and stimulants in vegetable crops"

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**Introduction:**

Under global warming conditions, there are different challenges facing horticulture production, and it is expected to get worse shortly. Therefore, focusing on improving horticulture crop productivity considered the main target for many researchers to achieved food security. Climate changes have affected the rain precipitation and reduce the growth and productivity of various crops. The water shortage is one of the severe problems in horticulture production, it affects various metabolisms, impaired photosynthetic activity, reduce vegetative growth, decrease total yield, and produce poor fruits, the water shortage is one of the severe problems in horticulture resulting in yield loss and affects negatively fruit quality. In recent decades, due to the rapid increase in the world population, there is a more growing demand for food worldwide, it is necessary to increase crop yield, even under stressful conditions, like water deficit, salinity, and rising temperature. Currently, there is more attention to understanding tree behavior under this condition to sustain crop productivity.

Researchers looking for new ingredients to sustain the production systems for horticultural crops and reducing the negative effects of abiotic stress particularly drought and salinity, application of bio stimulants is more efficient in promoting the recovery of different crops after subjecting to water shortage stress.

**Growth retardants:** Plant growth retardants can be successfully used for the treatment of vegetable crops supplying the food industry with raw materials in order to increase the yields and to improve the quality of the products. The results of the tests regarding the Phyto regulating action, made on some vegetable cultivars (tomatoes, red peppers, cucumbers, onion), proved that the product Romtrel, obtained according to a procedure of our own, has similar effects, in expression and intensity, with those of Ethrel (produced by Amchem). The plant growth retardants are synthetic substances, which inhibit, for a period of time, the elongation of stem and shoots, without irreversible blocking the vital metabolic and developmental processes in plants. Besides the growth

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retardant effect, which, in most cases is the main purpose, some other physiological effects, with beneficial implications may occur. In some cases, the retardant effect may even become of secondary importance. By influencing some metabolic processes, the treatments with retardants can induce the more intense accumulation of compounds that give taste, color, flavor, thus improving the quality and the commercial value of the products. Such treatments can also influence the fruit acidity, the content in sugars, proteins, vitamins, minerals etc. The treatments with retardants can accelerate and uniform the fruits ripening, can promote the defoliation and promote the abscission of fruits, so allowing the mechanical harvesting to be made more efficiently, reducing the losses on varieties which have a tendency to shatter and improving the quality of the obtained products. The retardants don't create problems due to the pollution or the remanence in the food products, being used in very small quantities (ppm) and being metabolized by plants (Neamţu, 1991).

The 2-chloroethylphosphonic acid (CEPA) is one of the most valuable retardants, because of its wide action area and efficiency as plant growthregulator. CEPA can modulate plant growth and metabolism by releasing ethylene (a phytohormone) from root, bloom, fruit and other tissues. It can be used to prevent lodging in cereals, maize and flax, to promote pre-harvest ripening of top fruit, soft fruit, tomatoes, sugar beet, fodder beet, coffee and many other products, to facilitate the harvest of fruit and berry crops (by loosening the fruit) and to accelerate post-harvest ripening (Saupe, 2004). CEPA is a plant growth regulator with systemic properties.

| Active Ingredient | Relative Activity | Difficulty of Use | Absorption Sites | Application Methods | Shelf Life (Years) |
|---|---|---|---|---|---|
| Ancymidol | Medium | Medium | Leaves, roots | Spray, dip, drench | 3 |
| Chlormequat chloride | Low | Low | Leaves, roots | Spray | 3 |
| Daminozide | Low | Low | Leaves | Spray | 2 |
| Ethephon | Medium | Low | Leaves | Spray | Indefinite |
| Flurprimidol | High | High | Stems, roots | Spray, dip, drench | 2 |
| Paclobutrazol | High | High | Stems, roots | Spray, dip, drench | 4 |
| Uniconazole | High | High | Stems, roots | Spray, dip, drench | 2 |

**Source: J. Barrett (2001, Mechanisms of Action) and A. Hammer (2001, Calculations)**

It penetrates into tissues and is translocated. It decomposes at cytoplasmic pH with the formation of ethylene (the active metabolite), phosphate and chloride ion (**Tseng**, 2000). CEPA is considered relatively non-toxic to animals and humans, its potential

for contamination of soil or groundwater is low and it don't creates problems due to the remanence in food products (Puga, 2002).

**Bio-stimulants:** Bio stimulants play important role in controlling the adverse effects of abiotic stresses like water deficit and have an anti-stress role on plant metabolism, consequently improve the growth and productivity of different horticulture crops, also, plant stimulants that contain seaweed and fulvic acid had antioxidant effects and protect plant through reducing produce free radical. Plant stimulants are used to increase agricultural production under serious challenges facing humanity, which represented by feeding a growing population worldwide and reducing the impact of agricultural agrochemicals on human health and the environment. Many bio stimulants improve plant nutrition, for instance, bio-fertilizers as a subcategory of bio stimulants, improve nutrient use efficiency, and increase nutrients acquisition uptake by plants. The role of plant stimulants in the horticultural sector, their effects on nutrient absorption, both primary and secondary metabolisms

**Plant stimulants:** Plant stimulants are defined as those substance /or micro-organisms whose function when applied to plants or the rhizosphere is to stimulate natural processes to increase the utilization of nutrients, increase their efficiency, and raising the plants' tolerance to abiotic stress, and to enhancing fruit quality. Furthermore, plant bio stimulants including any materials or microorganisms used to improve nutrition efficiency, enhance tolerance of abiotic stress, and improve crop quality.

**Classification of plant stimulants**: Bio stimulants categorize according to their nature, modes of action, and types of effects on crops.

**Main categories of plant bio stimulants**

1. Protein hydrolysates (PHs) and other N-containing compounds.
2. Humate substances.
3. Seaweed extracts.
4. Biopolymers (Chitosan and other polymers).
5. Microbial bio stimulants include mycorrhizal and non-mycorrhizal fungi, *Rhizobium*, *Trichoderma*, and Plant Growth-Promoting *Rhizobacteria*.

**Protein hydrolysates (PHs):** Protein hydrolysates (PHs) considered one of the important plant stimulants, consist of a mixture of peptides and amino acids produced from animal or plant-derived raw materials,14 currently there more attention to (PHs) as an important tool for sustainable plant production, PHs have to promote effects as plant bio stimulants on plant growth, it can increase yield and product quality of various plants particularly horticultural crops like fruit trees,

vegetables, flower, and ornamentals plants. The PHs are classified according to the source of proteins and the method of protein hydrolysis, PHs enhancing plant enzymatic and non-enzymatic antioxidants, affects plant metabolism both primary and secondary through various biochemical and physiological processes like increased nitrate reductase and glutamine synthetase activities, and Fe (III)-chelate reductase activity, also, due to the presence of peptides in PHs, there is numerous work indicating a strong gibberellin-like activity of PHs on plant growth Cola ***et al.*** studies on dwarf Peas (Pisum sativum L.); Ertani ***et al***. studied on lettuce (***Lactuca sativa***); the most regular benefit to the use of bio stimulant are the alleviate negative impacts of the abiotic stress on plant growth and productivity, abiotic stresses are the main reason for losing 60–70% of the yield in various crops. PHs plays an important role in alleviating abiotic stresses.

**Humic substances**: Humic substances play an important role in plant metabolism, it is widely used in sustainable agriculture, the intensification of agriculture production facing critical situations in providing enough food for a growing world population, in addition to the negative impacts of climate change on the agriculture productivity worldwide, therefore, plant bio stimulants based on humic substances represent a potential solution to induce sustainable intensification for agricultural products, it stimulates plant growth, increases plant tolerating for stress conditions, modifies whole-plant growth, as well as promoting plant health.

**Seaweed extracts:** Seaweeds extracts as plant bio stimulants in horticulture Seaweeds have various stimulation effects on horticulture crops including promote plant growth, increase plant tolerance for biotic and abiotic stress like drought,30 salinity, rising temperatures, fungal disease;31 herbicides,32 and nutrient deficiency, also, increase yield, and improve fruit quality particularly shelf life,33 high intensity of Ultra Violet. Seaweed extract includes numerous chemical ingredients like complex polysaccharides, Phytohormones, fatty acids, vitamins, and mineral nutrients. The uses of extracts of brown algae are the major one in the horticultural sector.

**Bio-stimulant activity of Chitosan:** Chitosan-based materials have numerous interesting characters, which make them beneficial substances in agriculture production, Chitosan used as a bio stimulant to enhancing plant growth, increase plant tolerance for abiotic stress, and to increase various pathogen resistances, while their stimulating effects considered one of the interesting applications in horticulture crops.37 Chitosan plays an important role in enhancing the defense system

in plants against pathogens through stimulating various defensive genes in plants, also, induces several enzymes like peroxidase, superoxide dismutase, and catalase.

**The main actions of bio stimulants**:

1- Working as the auxin-like effect.
2- Enhancing Nitrogen uptake.
3- Stimulate plant growth
4- Improve crop quality.
5- Enhancing nutrient efficiency.
6- Increasing tolerance of environmental stress.

**Conclusion:** Plant stimulants play an important role in improving horticulture crop productivity particularly under abiotic stress, plant stimulants. Plant stimulants and horticultural production applied in small doses in both soil or foliar application, there are different types of plant stimulants such as Protein hydrolysates (PHs), Humate substances, Seaweed extracts, Biopolymers, and Microbial bio stimulants. Plant stimulants enhancing Nitrogen absorption, and due to auxin-like effects, they stimulate plant growth, increase yield, and enhancing fruit quality.