

Natural Plant Hormones Are Biostimulants Helping Plants Develop Higher Plant Antioxidant Activity For Multiple Benefits

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For the November, 2003 SE Strawberry Expo at Durham, NC, I was asked to make a presentation on the topic "Introduction to Foliar Feeding." Several folks helped me find background reference information on this subject, which was used to assemble this presentation and is included herein. I hope this information will help you produce better berry, fruit and vegetable crops!

In the late 1960's T.L. Senn at Clemson University and others found that high levels of natural plant hormones in seaweed, named cytokinin, stimulated plants, providing a growth stimulator effect. However, at that time, stabilizing these plant growth hormones (PGH) was difficult. When they were applied to plants results were unpredictable and inconsistent..

In the early 1990's agricultural chemists developed techniques to stabilize these plant hormones. Adding small amounts of PGH with foliar nutrients further improved plant response compared to applying foliar PGH or foliar nutrients alone. Consider the definition of a plant growth hormone-biostimulant: "a biostimulant is an organic material, that, when applied in small quantities, enhances plant growth and development such that the response cannot be attributed to application of traditional plant nutrients."

About the turn of this new century, researchers Z. Hunzhong and R.S. Schmidt, working with the turfgrass industry, were asked to help develop strategies to reduce drought stress on golf courses, putting greens and athletic playing fields. Not every team organization has replaced real turfgrass with artificial turf playing fields, for example. Also, golfers are naturally adverse to playing golf in the wet, including after, or during, sprinkler irrigations.

Their investigations led to studying the effects of cytokinin, humic acid, salicytic acid and other plant growth hormones to reduce plant stress, including drought stress. Cytokinin from brown seaweed beds near Norway and Nova Scotia were found to be highest in cytokinin PGH. Stable extracts from these sources improved root and shoot growth of turfgrass, improved photosynthetic efficiency, delayed senescence in fall weather to keep turfgrass growing green and healthy longer, and reduced diseases.

How and why does PGH cytokinin work? By increasing the in-plant (endogenous) natural production of antioxidants. In plants, antioxidants a-tocopherol (vitamin E) and ascorbic acid (vitamin C) are concentrated in the chloroplast and protect the photosynthetic apparatus when a plant is subjected to stress, by scavenging excessively reactive oxygen species known as free radicals.

From Webster's new unabridged dictionary, 2001, Definition of Antioxidants: an enzyme or other organic substance such as vitamin e and beta-carotene, that is capable of counteracting the damaging effects of oxidation in plant and animal tissues.

Definition of Free Radical: an atom or molecule that bears an unpaired electron and is extremely reactive, capable of engaging in rapid chain reactions that destabilize other molecules and generate many more free radicals. In plants and animals, free radicals are deactivated by antioxidants. For example, agricultural food science researcher E.F. Anet isolated eleven antioxidants from apple peel tissue that together helped prevent cold storage scald breakdown of fruit. Horticultural fruit researcher C.L. Barden found that apple peels containing higher levels of antioxidants had a longer storage life than fruit with peels containing lower antioxidant levels.

For crops' growth cycles, stress points-based, supplemental foliar feeding plant health programs were conceived, developed, proven and patented. The application timings are applied through the spring and summer plant stress season in this region, beginning at first spring growth flush and continuing through final harvest. Each crop program contains several nutrients, many with natural PGH cytokinin extracted from hormone-rich seaweed. Remember, independent researchers have verified that applications of soluble cytokinin plant growth hormones extracted from seaweed stimulate more in-plant production of antioxidants and thus function as biostimulants. I believe their research, cited below, helps explain the positive results with such applications on small fruits, vegetables, tree fruit, ornamentals and turfgrass. PGH/foliar nutrients programs can be a new tool for growers to improve net income, including less diseases, longer harvests with higher yields and very high fruit quality, including better shelf life after harvest.

Four berries are among the top 10 fruits and vegetables highest in antioxidants, according to USDA's 1999 analysis of over 40 fruits and vegetables. The top 10 are: blueberries, blackberries, kale, strawberries, spinach, raspberries, brussel sprouts, plums, prunes and raisins. An exciting area for further research: can applications of plant growth hormone biostimulants such as cytokinin applied with foliar nutrient programs also increase antioxidant levels of the berries, vegetables and tree fruit that we consume, to further improve both plant and human health?

FOR FURTHER READING:

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4. Schmidt, R.E., Ervin E.H. and Zhang X. 2002. Questions and Answers About Biostimulants. Turfgrass Society of America 2002 Research Notes.
5. Xiaozhong L. and B. Huang. 2002. Cytokinin Effects on Creeping Bentgrass Response to Heat Stress and Antioxidant Metabolism. *Crop Science* 42: 466-472/
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