

TURFGRASS BIOSTIMULANTS - ARE THEY A VIABLE MANAGEMENT TOOL?

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Most turfgrass managers agree that the quality of the above ground portions of a turfgrass stand is largely dependent on the health and vigor of its root system. Unfortunately, because of various environmental and culturally imposed stresses, turfgrasses rarely achieve their full rooting potential. In an attempt to offset these stresses and allow the turfgrass plant to attain its full rooting and shoot quality potential, many companies have introduced products termed "biostimulants." The term "biostimulant" is very broad and not well defined. In the truest sense of the word, any product that stimulates life (bio=life) would be a biostimulant. In the case of turfgrasses we of course assume we are talking about plants, specifically, turfgrass plants. One could argue that fertilizer is a biostimulant. Water certainly can stimulate the turfgrass plant to grow particularly when under drought stress. Although the term may have been poorly chosen and virtually impossible to define, most turfgrass managers have come to recognize a biostimulant as a product/material that is non-traditional in that it is not a fertilizer or pesticide per se, but is applied to the soil or plant in hopes of improving turfgrass performance (usually both roots and shoots).

What are the Active Ingredients?

The question is often asked, "what is (are) the active ingredients in the typical biostimulant?" First, it would be hard to describe the "typical biostimulant." There is considerable variation among products. For example, a quick review of the labels of some of the products currently on the market show the following ingredients listed: " plant hormones, enzymes, bacteria, vitamins, yeast, amino acids, humic substances, carbohydrates, proteins, minerals, fungi, PGR's, plant nutrients, micronutrients, secondary nutrients, activated nutrients, nutrient broth, N-fixing bacteria, soil conditioners, wetting agents, humic/fulvic acids, sea kelp, chelates, chemical activators, growth simulators, fermentation materials, plant extracts, and carbon rich organics." If more product labels and accompanying promotional materials were examined, the list would no doubt be longer. Since the ingredients in each product vary so much, it is virtually impossible to discuss the potential benefits of biostimulants as a group. It is more logical to single out specific "active ingredients" and discuss their potential for influencing turfgrass growth.

Obviously, it would be impossible to discuss in detail the potential effectiveness of each of the ingredients listed above. Therefore, it might be more feasible to simply discuss one group compounds, the group that essentially started the biostimulant movement several years ago, namely, plant hormones. The remainder of this paper will focus on the use of plant hormones as the primary active ingredient in a biostimulant product.

Plant Hormones

What is a plant hormone? A plant hormone is an organic compound synthesized in one part of a plant and translocated to another part where, in very low concentrations, it causes a physiological response. There are five groups of hormones; auxins (indoleacetic acid, IAA), gibberellins, cytokinins, abscisic acid and ethylene. Each hormone plays a very specific role in the health and growth of plants. Without question, each can promote certain plant responses that would be deemed very favorable by the turfgrass manager, such as the promotion of adventitious rooting, seed germination, and leaf expansion. However, it is well documented that each hormone also has the potential to inhibit the same growth responses. The key to whether a hormone promotes or inhibits growth depends primarily on its level or concentration in the plant. At natural occurring or normal levels in the plant, most of these substances have a promoting effect.

However, if levels increase significantly above those normally found in the plant, an inhibitory effect may be realized. The inhibition may be the result of a direct effect of the increased hormone level on a specific plant function or an indirect effect on the concentrations of other hormones in the plant that in turn affect normal growth and development.

Plant Hormones and Turfgrass Performance

Can the application of certain biostimulants containing plant hormones improve turfgrass quality and/or stress resistance? The answer has to be a very guarded “yes.” The effectiveness of such materials would depend on many factors. First, it should be understood that under normal conditions, a plant has adequate levels of all hormones to ensure normal growth and development. Additional hormones sprayed on the plant will have no effect on growth. In fact, the addition of certain hormones beyond the normal levels already present in the plant may inhibit normal growth. On the other hand, research has shown that certain environmental and cultural stresses can limit the natural production of specific plant hormones. For example, the production of cytokinins in roots and movement to shoots may be inhibited by flooding, drought and high temperatures. Such a situation, coupled with the proper levels of other hormones in the plant and the proper combination (formulation) of a commercially applied material containing cytokinin, could result in a stimulatory plant response. It should be remembered that most physiological processes require interaction among several hormones and that a single hormone has several functions. Furthermore, the function of hormones depends not only on specific cells and organs but also on the species. It appears that different species use different hormones or rely on different interactions among them to accomplish their various functions. A study conducted several years ago by the author showed the application of gibberellic acid to bermudagrass during cool fall temperatures had a very positive effect on growth and color. The same treatment applied to St. Augustinegrass under the exact same conditions had a very negative or phytotoxic effect.

To Use or Not To Use Biostimulants?

The use of biostimulants on turfgrasses holds great potential. As mentioned earlier, there is a great range in the types of active ingredients currently being used. Certainly, those containing plant hormones can have a positive effect on turfgrass growth. However, it is evident that the right conditions must be present for a positive response to be realized. What are the “right” conditions? In the case of plant hormones, a hormone deficiency or imbalance must be present. There is no easy way for this to be determined. Research has shown that most imbalances and the greatest positive response to biostimulants appear to be when the plant is undergoing some environmental or culturally imposed stress. It has been suggested that application of the biostimulant should begin prior to entering the stress situation (summer stress for instance). However, keep in mind that the use of a biostimulant should never be a substitute for good, sound, agronomic practices. The lack of research in the area of biostimulants is the primary reason why more definitive recommendations cannot be made. The variable response (sometimes they seem to work, other times they don't) most turfgrass managers get from the use of biostimulants is evidence that shows turfgrass growth, physiology and biochemistry is very complex and it's not just a simple matter of applying a mixture of materials that have theoretically been shown to have a positive effect on plant growth. A delicate balance exists within the plant. Until we understand exactly what imbalances are present under what conditions with specific turfgrass species, we will always be using the “shotgun” approach to the use of biostimulants. Since this is the state of the science at this point, it is recommended that before purchasing large amounts of any biostimulant you first request university test results. Talk to fellow turfgrass managers, find out what products have worked for them. Test the materials on small areas leaving adjacent areas untreated to serve as a control. Be cautious about products that make far reaching claims that go beyond the realm of common sense. And above all, always practice sound agronomic practices that have years of scientific research behind them. The use of any biostimulant should only be supplemental practice never a replacement for proven turfgrass management practices.