THE BENEFITS OF APPYING SEAWEED EXTRACTS and other NON-FOOD SUBSTANCES TO PLANTS

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Research on substances other than traditional nutrients (N, P, K, etc) is increasing and science is finding benefits to non-food ingredients sprayed on turfgrass. These substances include humic acid, amino acid, seaweed, and a variety of hormones and vitamins. Some argue that applying these elements to the foliage of plants provides little, if any, benefit. Others say that exogenous (foliar applied) applications of these compounds do provide plant health benefits. Research about what types of compounds are foliar absorbed shows that a large number of various compounds are indeed foliar absorbed quite easily. Hormones, for example, are rapidly absorbed. A common example is the synthetic herbicide hormone, 2-4, D.

Planet Turf sells a number of foliar absorbed compounds that elicit positive response by plants. Kelp Grow, a seaweed extract from kelp, is one such product. The kelp plants are macerated, pressed under high pressure, and the extracts remain intact, not damaged by heat. Kelp Grow has a very high percentage of the essential growth stimulating compounds naturally found in seaweed.

Seaweed contains every nutrient essential for plant growth, and many whose function is not known, but is found in all plants. In fact, because the ocean is a 'sink' for sediment on the earth, the entire periodic table can be found there! Seaweed/kelp contains a number of compounds that elicit a hormone-like response in land plants, and have been shown to improve stress resistance, improve nutrient uptake and utilization, reduce disease occurrence, and improve overall plant health.

Recent research on the hormone-like compounds in kelp reveal that the benefits of applying kelp extract to plants are not actually from individual hormones, but rather a synergist effect of the kelp extract as a whole. Plants behave as though they have been injected with hormones resulting in shoot and root growth.

Other plant stimulating compounds contained in Planet Turf's stable of foliar applied products include the following.

Amino acids are molecules containing an amine group, a carboxylic acid group and a side chain that varies between different amino acids. These molecules are particularly important in biochemistry, and have many functions in metabolism. One particularly important function is as the building blocks of proteins, Amino acids are also important in many other biological molecules, such as forming parts of coenzymes, and in N transport. We use only L-Amino acids that act as complexing agents, and are used by the plant once absorbed.

The foliar application of micronutrients provides a means of supplying nutrients to crops more rapidly than methods involving soil application. However, foliar applied micronutrients can be ineffective for the following reasons:

1) Low penetration rates, particularly in leaves with thick cuticles.

2) Run-off from waxy leaves.
3) Washing off by rain or irrigation.
4) Rapid drying of the spray solution.
5) Limited rates of re-translocation of some mineral nutrients, such as calcium, to other parts of the plant.
6) Leaf damage (phytotoxicity, necrosis, or 'burning')

MICRONUTRIENTS: PLAIN, CHELATED or COMPLEXED?

In agriculture, micronutrients are applied either as the plain metal ion (e.g. Zinc Sulfate), a chelated ion (EDTA), or as a complexed ion (Planet Turf Polyamines). Each formulation will supply some micronutrient to the plant whether soil or foliar applied. But there are significant differences in the percentage of each that the plant utilizes.

Chelates, such as EDTA, are large ring structures that completely surround the metallic ion. This protects the ion from reacting with other materials. This is especially important in soils that contain anions such as bicarbonate that will form insoluble salts with the metallic ion.

PLANT PHYSIOLOGY BACKGROUND

The leaf is covered with a layer of waxes, the cuticle. The major function of the cuticle is to protect the leaf from excessive water loss by transpiration. This layer is penetrated by stomata with which the plant controls transpiration. Experimental evidence does not support the idea that foliar applied nutrients enter the leaf through the stomata. Ion uptake rates from foliar sprays are usually higher at night, when the stomata are closed, than during the day when the stomata are open.

The literature indicates that mineral nutrients enter the leaf through hydrophilic pores within the cuticle. These pores have a diameter of less than 1nm (10^{-9} m) and a density of about 10^{10} pores cm^{-2}. Most micronutrient elements of interest have diameters of about 1 angstrom (10^{-10} m) or $1/10^{th}$ nm, so restrictions to entry because of size are not an issue. However, the hydrophilic pores are lined with fixed negative charges, probably from the carboxyl group of galacturonic acids. Therefore, these hydrophilic pores act as cation exchange surfaces. The charge density increases from the outside to the inside of the pore. This helps the penetration of cations but repels anions. However, if exchange surface becomes filled with cations, penetration can slow and uptake stops. Please note that small uncharged molecules like urea (radii 0.44 nm) pass through easily. Larger molecules, such as FeEDTA are too big to penetrate these pores.

There are larger hydrophilic pores near the stomata that will allow EDTA chelates to enter the leaf. However, it is relatively slower that the penetration rate of the smaller, electrically neutral pore. What Planet Turf has done to increase both the rate and quantity of micronutrient penetration is to complex the metal cations in the Polyamine materials with several small organic acids. The complex of the organic acids and the metallic cation is both small and electrically neutral (like urea). This combination passes easily through these hydrophilic pores while neither clogging the pores nor restricting further penetration. Therefore, the percentage of applied material that enters the leaf is quite high and can occur over a longer time period.

In addition, Planet Turf has chosen these complexing agents from among those that are the naturally occurring metal complexing agents inside the plant. This has the advantage, when compared to EDTA and other synthetic chelates, that the plant can immediately use the organic acids to maintain charge balance, for an energy source, and for a source of carbon skeletons. Since all of the organic acids come from natural sources, the plant can metabolize all of the material added. The result of this chemistry is that a major portion of the micronutrient that hits the leaf surface is rapidly absorbed and utilized by the plant.