METHODS OF REDUCING PLANT STRESS

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is a continuation of U.S. application Ser. No. 12/892,564, filed Sep. 28, 2010, which claims the benefit of U.S. Provisional Patent Application No. 61/246,453 filed on Sep. 28, 2009, the contents of which are hereby incorporated by reference herein in their entirety.

TECHNICAL FIELD

[0002] The present invention relates to composition of matter for improving stress resistance in plants. Specifically, the method comprises contacting a part of a plant or the locus thereof with a composition of matter comprising an agriculturally acceptable complex mixture of dissolved organic material characterized by natural organic matter that is partially humified.

BACKGROUND

[0003] Various mixtures of organic compounds have been proposed in the art as fertilizer additives. Specifically, a humic acid composition, Bio-Liquid Complex™, is stated by Bio Ag Technologies International (1999) www.phelpstek.com/portfolio/humic_acid.pdf to assist in transferring micronutrients, more specifically cationic nutrients, from soil to plant.

[0004] TriFlex™ Bloom Formula nutrient composition of American Agritech is described as containing "phosphoric acid, potassium phosphate, magnesium sulfate, potassium sulfate, potassium silicate[and] sodium silicate." TriFlex™ Grow Formula 2-4-1 nutrient composition of American Agritech is described as containing "potassium nitrate, magnesium nitrate, ammonium nitrate, potassium phosphate, potassium sulfate, magnesium sulfate, potassium silicate, and sodium silicate." Both compositions are said to be "fortified with selected vitamins, botanical tissue culture ingredients, essential amino acids, seaweed, humic acid, fulvic acid and carbohydrates." See www.horticulturesource.com/product_info.php/products_id/82. These products are said to be formulated primarily for "soilless hydrogardening" (i.e., hydroponic cultivation) of fruit and flower crops, but are also said to outperform conventional chemical fertilizers in container soil gardens. Their suitability or otherwise for foliar application as opposed to application to the hydroponic or soil growing medium is not mentioned. See www.americanagritech.com/product/product_detail.asp?ID=I&pro_id_pk=4-0.

[0005] The trademark Monarch™, owned by Actagro, LLC is a fertilizer composition containing 2-20-15 primary plant nutrients with 3% non plant food organic compositions derived from natural organic materials.

[0006] Plants in general are susceptible to a variety of environmental stresses, including for example, drought, salinity, low light, water logging, disease, pests, and temperature. Conventional nutritional plant treatments are generally unable or incapable of providing plants with resistance to environmental stresses and are therefore are limited to providing benefit to otherwise healthy or flourishing plants. However, commercial agronomical processes require additional plant treatments to reduce plant stress or enhance the plants ability to resist common environmental stresses and/or to recover from such stresses quickly. Typical examples of common environmental stresses include continuous periods without water (drought), exposure to salt water, flooding, prolonged darkness, and temperature variations/frost. Exposure to such stresses generally can result in poor or no yields, but also can display reduced root growth, and/or reduced leaf growth or count, and/or reduced stalk weight and/strength, and/or reduced fruit size and/or weight and/or nutritional value. While a plant may possess some natural defenses to such stresses, there is a need to provide to plants enhanced abilities to respond and/or recover to such stresses to allow for maximizing agronomical production.

SUMMARY

[0007] Compositions of matter (hereafter also referred to as "CP"; CAS Reg. No. 1175006-56-0) providing plants enhanced stress resistance abilities so as to respond and/or recover to environmental stresses and allow for maximizing agronomical production. The disclosed compositions of matter provide for gene regulation in plants that improve and/or enhance the plants responses to common environmental stresses. This gene regulation includes, among other mechanisms, regulation of transcription factors. Application of CP to a plant prior, during, or shortly thereafter a stress condition improves the plant's ability to resistant and/or recover argronomically from the stress as compared to a similarly situated plant not treated with CP.

[0008] Greenhouse and field experiments have demonstrated that CP can promote plant growth and development so as to increase crop yields. Physiological studies indicate that the composition of matter disclosed herein provides improved nutrient availability and mobility inside the plants. Additionally, CP augments synthesis or availability of plant hormones, and/or CP possesses synergetic actions with some of these plant hormones. At the molecular level, plant growth and development activities are controlled and/or influenced by genes and gene expression. It is likely that CP acts through triggering or altering the expression of critical genes involved in plant growth, development, stress tolerance, and/or disease resistance.

[0009] The potent effects of the above-mentioned compositions of matter on plant gene expression provides for wide application of these products in agriculture, horticulture, and landscaping.

BRIEF DESCRIPTION OF THE FIGURES

[0010] FIG. **1**. Photograph representing the effect of a CP composition application on *Arabidopsis* root formation vs. control;

[0011] FIG. **2**. Photograph representing the effect of a CP composition application on *Arabidopsis* growth vs. control under normal conditions;

[0012] FIG. **3**. Photograph representing the effect of a CP composition application after salinity stress on *Arabidopsis* growth and development vs. control;

[0013] FIG. **4**. Photograph representing the effect of a CP composition application before salinity stress on *Arabidopsis* growth vs. control;

[0014] FIG. **5**. Photograph representing the effect of a CP composition application on *Arabidopsis* drought tolerance vs. control;

[0015] FIG. **6**. RNA preparation quality as determined by BioAnalyzer;

[0016] FIG. **7**. Genome-wide expression profile of *Arabidopsis* after CP application vs. control;