SILICA GOLD

BACKGROUND

Silicon is a critical element for plant resilience to environmental stressors, pests, and pathogens. It is bioavailable for plants in the form of orthosilicic acid. Uptake typically occurs through roots where it transports throughout a plant's tissue.

The primary utility of this compound in plants is to aid in the building and strengthening of cell walls. This white paper aims to discuss the design, function, and purpose for the TPS Silica Gold formula.

UNIQUE TERMS

Hydroxyproline Rich Glycoprotein (HRGP)
A carbohydrate (oligosaccharide) and amino acid based protein found in cell walls. Due to its structure it naturally cross links or 'self assembles' to form flexible rigidity in growing cell walls.

Orthosilicic Acid
The form of silica which is uptaken by plants. Unbuffered, orthosilicic acid is stable in water at seven to eight millimoles per liter at room temperature.

Aquaporins Protein
Channels that help distribute water and some uncharged particles between cells and through plant tissue.

TECHNICAL SUMMARY

Function - This formula reinforces the overall strength and function of the cell wall through stimulating the biosynthesis of hydroxyproline-rich glycoproteins (HRGP).

Pathway - Soluble silicic acid is delivered through aquaporins and, in combination with salicylic acid, the biosynthesis of proteins that make up cell walls is stimulated. These proteins exist in a matrix of cross-linked filaments that protect plants from a variety of stressors, depending on the type of glycoprotein.

There are four major categories of glycoprotein, and this formula generally targets all of them, but specifically it delivers the stimulation and nutrition for those rich in proline and serine. Hydroxycitric acid, proline, and serine are provided as building blocks for the glycoproteins. These proteins are critical for structural integrity and cellular defenses against biotic and abiotic stressors.

FORMULA DESIGN THEORY

The primary goal of Silica Gold is cell wall strengthening. To achieve that goal, we needed to design a formula that would help plants build a major component of cell walls, hydroxyproline-rich glycoproteins (HPRGs). In building HPRGs, we went about locating and eliminating the limiting factors in their production: a stable and soluble silicon source, organic acids, and amino acids. In order to ensure these components could be utilized by plants, we also designed a layer of aiding compounds and buffers.

First, let's talk about the formulation of the stable silicon matrix. There are two forms of silicon in Silica Gold. We extract a number of silicon-rich plants for organo-silicon and bind them with extracted anthocyanins in order to reduce oxidative stress, thus reducing decomposition of orthosilicic acid. Organo-silicates make up 25-30% of the soluble silicon in the finished formula. The other 70-75% of silicon comes from a potassium salt of silicic acid with a pure and very small fraction of fulvic acid (approximately 100nm) for micro-chelation. This helps to complex the orthosilicic acid monomer to help it move into intracellular spaces. When diluted into feed water the fulvic acid chelated silica salts dissociate to form soluble orthosilicic acid and potassium ions, both readily available for uptake. When used in feed water at 4mL per gallon Silica Gold produces orthosilicic acid concentrations around four millimoles per liter in water at room temperature.

Second, we wanted to reduce the rate limiting of the building of hydroxyproline rich glycoproteins. To do this, we found sources for the base materials that make up HPRGs in nature. We then extract the organic building blocks for those proteins: Hydroxycitric acid, proline, and serine.

Combined with the varied soluble silicon source, these building blocks allow plants to absorb and utilize silicon at an elevated and steady rate. The net effect is increased structural integrity and cellular defenses against biotic and abiotic stressors. This effect can be seen on your plants with thicker stalks, stems, and leaves.

PURPOSE DRIVEN FORMULA COMPOUNDS

Chalconoids
Polyphenolic compounds that serve as stimuli for the biosynthesis of compounds that naturally deter aphids and mites

Rosmarinic Acid
A polyphenolic ester that acts as a non-enzymatic antioxidant to stimulate internal antioxidant pathways that prevent abiotic stress

Anthocyanins
A flavonoid derivative that prevent the oxidative decomposition of orthosilicic acid

Hydroxycitric Acid
Serves as an input for the biosynthesis of hydroxyproline-rich glycoproteins (HRGP)

Serine
A proteinogenic amino acid source for the formation of hydroxyproline rich glycoproteins (HRGP)

Proline
A proteinogenic amino acid source for the formation of hydroxyproline rich glycoproteins (HRGP)

Organo-silicon
Organic silicates that bind orthosilicic molecules in a mineral-rich matrix

Fulvic Acid (100nm)
Complex orthosilicic acid monomers and deliver them in intracellular spaces

Salicylic Acid
A hydroxy acid that drives the stimulus for biotic and abiotic stress reduction