GREENAIR PRODUCTS

PLANTS EDU

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A plant is any living organism yet it operates much like a machine, governed by the laws of physics. This being the case it stands to reason that anyone can learn to grow plants, especially with the technology and automated systems available today. Maybe it's not necessary to understand the internal workings of a plant to successfully manage a growing operation and produce plentiful crops but it can be helpful.

Plant systems are dependent upon these basic constituents: light, heat, humidity, water, co2 and essential nutrients and minerals. As growers our task is to provide all of these requirements in a properly balanced fashion.

PLANT COMPOSITION

Plants consist of a complex arrangement of cells. These cells are made up of proteins, polysaccharides, amino acids, lignin's etc. These compounds are comprised of principle elements hydrogen, nitrogen, silicon, potassium, calcium, sulfur, phosphorus, magnesium, aluminum, iron, chlorine, sodium, manganese, boron, copper, zinc, molybdenum and other assorted scarce minerals. Different combinations of these elements form molecules to construct new cells and tissues. This is why essential elements must be readily available and along with water and sunlight plants are able to synthesize all the compounds they require as well as vitamins and enzymes.

These essential elements can be provided immediately in their elemental form with the application of high quality inorganic fertilizers. These essential elements can also be found in organic molecules (such as found in soils) however organic materials must be broken down into their pure elemental (inorganic) form before they can be utilized by the plant, additional energy is required to disassociate these more complex organic commodities. Plants can also absorb nonessential elements they uptake, breakdown, or retain. If these substances are beneficial it could be desirable but if they are toxic it could be disastrous. Many elements have been found in plant tissues which are not known to have any influence on plant metabolism. Lead, arsenic, mercury, gold and fluoride are among the more than 60 other known elements.

ROOTS

Roots not only provide a means of support, but they act as receptors providing pathways for select solutions and substances to be regulated into the plants circulatory systems. Root anatomy consists primarily of a xylem and phloem core of vascular tissue, surrounded by a cortex tissue and an outer layer of epidermal tissue. Microscopic projections called root hairs usually develop on the epidermal cell to further enhance the water absorption capability of the root surface. These follicles are very delicate and should be protected from dryness, extreme temperatures, harsh chemicals or abrasion. Root health is vital to the survival of the whole plant.

Roots are specially adapted tissues which readily absorb nutrients and transport them into the plants main vascular system. This vascular network originates at the tips of the roots and is continuous throughout the plant. Nutrient ions will diffuse into the roots and through the endodermal layer into the vascular bundles. Xylem and phloem bundles guide solutions through the plants roots and stem. The xylem tissue forms the vessels that channel solutions up into the plant and the phloem tissues primarily distribute internally manufactured foods throughout the plant.

WATER TRANSPORT

The movement of solution through the plant is a complex combination of internal and external forces. This force is then used by the plant in a variety of ways, some of which include:

1. To deliver essential substances to the various internal mechanisms as well as removing waste products.
2. To provide systemic pressure to give the plant structural integrity.

3. To facilitate cooling of plant tissues by transfer and evaporation.

Solutions travel throughout the plants leaves and stems via capillary channels called veins. These vascular bundles perform two modes of transport. First delivering water and nutrients to all cellular tissues for assimilation, and second to translocate manufactured food substances from the point of photosynthesis to all parts of the plant (flowers, fruit, meristems, etc.). These conduits are called the xylem and the phloem tissues.

Many factors play a role in moving solutions through the plant's circulatory system: absorption, capillary action, cohesion, menisci, hydration and root pressure, to mention a few. The combination of these forces serves to propel solution up and throughout the plant. Transpiration is the major contributor to this process. Simply put, it is the affinity of dry air to obtain water vapor. As the air removes water from the leaf, it literally draws more up into the plant to replace it. This captivation relies upon the cohesion of water molecules (a term for the attraction of one water molecule for another) which literally pulls water up the plants vascular capillaries like a chain. These fluids are the lifeblood of the plant and must be available consistently for good health and the use of a high quality plant nutrient will assure that the transport system will function properly.

NUTRIENT UPTAKE

Within a plant's structure exists many types of cells, these cells vary in their ability to absorb solutes by the nature of their membranes. A solute could be anything dissolved in a solvent (water). Membranes are thin permeable tissues which surround the cell bodies. These cell membranes are designed to be specific to which elements are able to pass through them. The following forces control this flow (flux) process.

1. Osmosis is the tendency for a solvent (in our case water) to pass through a membrane from the side of less soluble salts to the side of higher concentration. It is attempting to dilute the solution to gain equilibrium on each side. This action is regulated by particle concentration, not by their properties. When this activity is measured it is termed the chemical potential.

2. The second type of membrane flow is called the electrical potential. This force is driven by the exchange of positive (cation) and negative (anions) ions creating a + or - potential within the cell. A positive affinity will generally attract negative ions to balance its polarity (and vice versa). This creates a flow of ions by electrical attraction.

3. Another method involves the use of a carrier molecule, often part of the membrane itself. If an ion is attracted to a site on a carrier molecule, it may then diffuse readily across the membrane to be released on the other side. This method controls ion selectivity by the ability of the carrier to combine with a specific element ion. This explains why only certain ions are able to pass through a given membrane tissue type.

Many factors and conditions affect these processes and their ability to absorb essential elements. Among these are, nutrient solution concentration, balance, pH, temperature, or the presence of incompatible chemicals which may bind and inhibit important minerals from being available to the plants.