The Concept of FOLIAR FEEDING

Stomata are sites of exchange of gases such as *Carbon Dioxide*, *Oxygen*, and *Sulfates*. Ammonia and Nitrate Nitrogen may also enter the leaf primarily through the stomata. In some industrial areas, plants may even absorb an excess of sulfur to the point of toxicity. In pastures, the intake of Nitrogen as Ammonia through the leaves has been estimated to be as high as 140 pounds/acre.

In higher plants, the uptake of minerals through the leaves may be restricted by the outer walls of epidermal cells, otherwise known as the ***cuticle***. This layer is designed to reduce or prevent excessive loss of moisture. It also acts to prevent loss of inorganic and organic solutes by simple diffusion during wet periods.

The cuticle also functions as a weak cation exchanger, partially due to the negative charge of the pectic material in the cuticle. The movement of solutes through the cuticle takes place in cavities called ***ectodesmata***. They serve to provide channels for mineral elements from foliar sprays. The rate at which minerals are taken through the leaves is dependent to some extent on the mineral balance within the plant. **Deficiencies increase uptake.** The rate of uptake is also dependent upon the age of the leaf tissue. The rate declines with age. In contrast to root uptake of minerals which takes place primarily in the dark, the uptake by leaves is stimulated by light. This is at least partially due to the ***ATP Cycle*** of energy flow during light hours. The ATP is formed during light hours in the ***chloroplasts*** and thus available to provide the energy needed for mineral transfer. However, the increase in temperature during daylight hours will usually decrease humidity and thus slow mineral intake via leaves because of evaporation of moisture from the foliar sprays. **Therefore, the uptake of foliar sprays should be *rapid* to avoid loss of moisture by evaporation.**

Foliar feeding should have one major advantage over root feeding; that is the supplying of minerals more rapidly. ***The supply is temporary*** (except, perhaps, for the trace minerals) and the supply needs to be available from the soil for a complete correction. Foliar sprays with N, P, K nutrients should be considered as a stimulant to promote better health, new root development, top growth and fruiting. It can also be used in a valuable way to help control the quality of the finished crop.

Foliar feeding becomes particularly important when plants are stressed by such problems as extreme heat, mineral deficiencies or excess, disease, and drought. Since root activity slows as the reproductive stage progresses, application of foliars to aid in quality is very important.

Summary:
1. Foliar spray nutrients enter the leaf largely through the leaf epidermis.
2. Overall health of the plant when treated affects the benefit.
3. Temperature has a dramatic effect on absorption.
4. Foliar sprays are particularly important as the fruit is maturing.

Nutrients applied to just the soil become less effective due to many contributing factors already present in the soil such as; soil bacteria, soil types, organic matter content, pH range, moisture and soil temperatures, chemicals that may have been applied such as herbicides, pesticides, insecticides, and fumigants. This means that efficiency of any fertilizer/nutrient applied to the soil is really quite low. Some have estimated as low as 15%. Finally, the number one factor in soil uptake of nutrients is activity of the root system.

Foliar sprays actually increase the effectiveness and utilization of soil applied fertilizers by changing the nature of the plant root exudates so that fertilizers are better assimilated by soils. Such stimulation or growth has often been observed and explains why dramatic responses are sometimes seen from an application of only small amounts of nutrients per acre as foliars.

Foliar nutrients applied in frequent, small dosages are more beneficial than large amounts applied less often. Multiple applications from 2 to 4 times during the season prove more economically feasible with the number of applications being fewer on short season crops. Sprays should be spaced from 7 to 10 days apart for most crops.

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