Effects Nutritional Status Has on Resistance of Plants

FACT SHEET

Both disease and insect resistance can be influenced by nutrition and health of plants. This complex mechanism of nutritional balances takes place in both above and below ground parts of any plant. Too much of something can be as detrimental as not enough, this is why I continually work on a balanced nutrition to accomplish what we are trying to achieve.

Plants receiving an adequate and balanced supply of nutrients are able to respond more rapidly and effectively by defense mechanisms that are triggered by the pathogens or insects themselves. These built in mechanisms are part of the metabolic process within the plant and therefore very much influenced by mineral nutrition.

These mechanisms are well defined and described in the literature. The following is a description of the various mechanisms that a plant uses to defend itself from its environment.

Synthesis of phytoalexins; these are fungi static agents synthesized in the plant tissue as a reaction to fungi or their metabolic products.

Hypersensitivity; this denotes the rapid death of cells around the point of infection, thus preventing the disease from spreading.

Preimmunity; after a mild primary reaction the plant may become resistant to secondary infection (similar to immunization in human medicine)

Demarcation; this denotes the isolation of the point of infection by suberification as a reaction to the wound.

Other reactions that I have mentioned in other newsletters are part of these processes such as the plants ability to change the sap in a wound area so that it is of the same consistency as a glue that will repair damage and insects do not like it.

All living plants also have a complex system that is occurring below ground that is also influenced by nutrition.

In order for a plant to take up nutrients it must have a healthy root system, anything that causes damage or poor growth to the root system restricts nutrient uptake. Root hair growth particularly as it is the root hair growth that increases the surface area (absorption are) of the root by 20 times. These tiny little root hairs only remain active for about 6 days therefore we must continually be promoting the production of new root hair formation. The biological activity in the root zone is critical.

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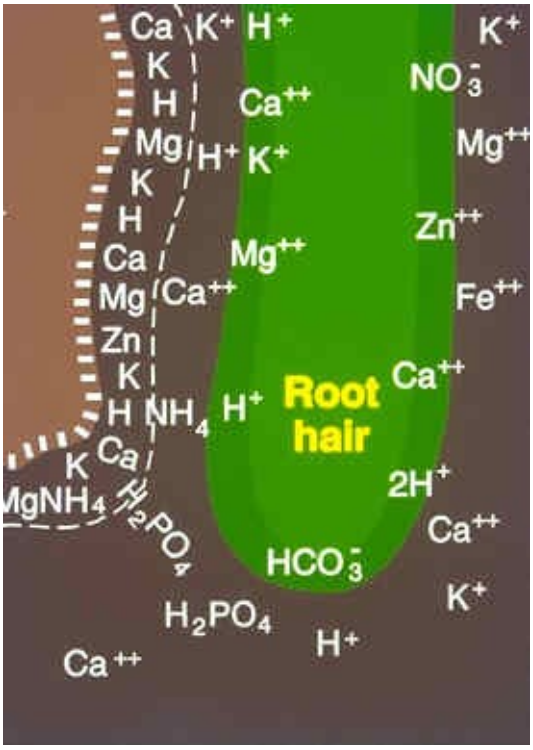
Fact Sheet No. 421
Revised 11/2013



Sugar production, carbohydrate production by the plant, moving to the root system stimulates new root growth.

During times of stress carbohydrate movement to the root system will stop and the valuable life force enzymes produced in the root system also stop, making the root system go dormant or activity slows down.

This happens during times of extreme dry weather or wet weather where root activity and nutrient uptake is limited or in times of stress or heavy fruit load when nutrition is inadequate.

Factors that can cause stress and reduce root activity are:

-Droughty soils
-Flower initiation
-Heavy crop demand
-Heat/cold
-pH imbalance
-Chemical application causing phytotoxicity

Foliar feeding a plant through these stress periods helps maintain high sugar levels in the plant to help the root system during stress. Under heavy production systems a root system cannot meet the demands of the fruit therefore it is important to supplement. However supplemental nutrition has to be in place before a problem occurs. Responding to a problem is usually too late.

The soils health is also critical. There are a number of bacteria in the soil, some parasitic and some beneficial. The balance between these bacteria is critical.

Two identical fields may not have the same level of beneficials. Good nutrition helps increase beneficial bacteria populations. This is because a healthy plant exudes amino acid, growth hormones, vitamins, and enzymes that stimulate good bacteria to grow. The symbiotic relationship is part of the delicate ecosystem. Anything we do to destroy this will effect how our crop performs. This good bacteria not only destroys the parasitic bacteria but it also helps in the uptake of nutrients by roots in breaking organic nutrients down into the available form for plant uptake and in some cases aiding in the uptake of nutrients into the plant. Harsh chemical applications (i.e. soil fumigation) can destroy good bacteria and if the population of bad bacteria gets re- established first it may flourish.

Another factor in the regulation of these soil organisms is that in a stressed plant as the system shuts down it will exude compounds that feed the parasitic bacteria and not the good bacteria allowing the population of the bad guys to grow and destroy the plant growth in the area. It not only destroys the existing crop but allows for the population of the pathogen to build to a high level that will cause problems for future crops. Even healthy crops will eventually have difficulty in tolerating the pathogen at high levels.

This is a factor we often do not pay attention to but as we upset the delicate balance in a field it sometimes takes longer for us to turn things around as we not only have to increase the nutritional status but we have to bring these biological populations within the soil back into balance.

Therefore for these reasons we have identified yet another balance of nature that plays a major role in crop production and is very much influenced by nutritional balance.

It is well documented that there is a multitude of functions performed by mineral elements within plants and it is quite reasonable to suggest that they can influence both plant resistance to disease and insect damage. It is also reasonable to suggest that based on some of these other cumulative responses that happen that we cannot simply assume that the "optimal" use of fertilizer in the terms of economic yield is necessarily also best from the phytomedical standpoint.

Plant nutrition becomes a delicate balance and too much or too little creates problems where the same amount in proportion would not.

An example of this is the N:K balance and its effect on insect damage. It has been well documented that the increased application of Nitrogenous materials has a great effect on the mortality of chewing insects largely the larvae of most insects because of the changes in the sugar content within the plants that these insects cannot digest. On the other hand excessive Nitrogen application will promote the severity of attack from sucking insects unless large applications of Potassium is given at the same time because K has a specific inhibitory effect on sucking insects.

Another research group concentrating on plant pathogens has documented that many pathogens depend on the soluble sugar and amino acid concentration in the plants they attack, plants with above normal concentrations of these compounds are often found to have relatively high nitrogen and relatively low potassium contents. Also plants with elevated nitrogen levels have been linked to reduced levels of phenolic compounds, which are toxic to pathogens.

As you can see from this brief description of N:K balance the nature and mechanisms within a plant promoting or inhibiting pests and pathogens differ and therefore timing, balance, placement and observation become a management puzzle that we have to solve.

We do know that Nitrogen application will suppress a plants immune system and reduce the levels of phenolic compounds which are toxic to pathogens, where Boron applications reverse this process. Therefore in season application of Boron becomes a management tool when we are using Nitrogen to push production.

The relationship between disease and nutrition although well documented often becomes confusing because there is a lot of overlap between nutritional disorders and related disease. One disease caused by more than one nutritional disorder.