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# GROWERS BULLETIN

ULTRA GRO PLANT FOOD COMPANY

## Manage Disease With Nutrients

By Bob Dixon

Soil Fertility is an important part of a plants environment. It may affect the severity of a disease by influencing over wintering and survival of pathogens, pathogen reproduction, and the host susceptibility.

Known effects of nutrients and disease development has varied so much that it is difficult to generalize. However, two conclusions can be drawn.

- Some organisms attack only slow-growing or weak plants, others do better on lush, vigorous plants. Therefore, a plant's response to its nutrient supply will determine the effect the disease itself will have on the plant.
- The relative amounts of other elements may influence the effect on individual nutrients. For example, nitrogen alone produces certain effects, but these effects may be quite different if there is a proper balance with other elements, particularly phosphorus and potassium.

The form in which the nutrient is supplied also may bring a different effect. For example, ammonium sulfate in time makes the soil more acid, but calcium nitrate makes it more alkaline. Alkaline reactions favor potato scab, but may suppress club root of cabbage and certain wilt diseases.

It is true that nitrogen fertilization without regard to balanced nutrition and the interaction of other nutrients has led to more causes of apparent and real disease susceptibility than resistance. The reverse – more disease resistance – is true with phosphorus and potassium.

No one would suggest the use of only fertilizers to control plant diseases. But knowing the effect of

fertilizers on the host-pathogen-interactions is important to the total crop production program. How then does plant nutrition affect disease development? An imbalance of nutrients, rather than the absolute amount of each nutrient, usually favors disease development. Nutrient balance is the key to the fertilizer effect on the host-pathogen interactions. When a nutrient affects plant disease development, it does not act as a direct control agent. It augments the natural resistance mechanism of the plant.

Several plant diseases are influenced so directly that much of the damage from them can be avoided by attention to soil nutrient levels. These diseases include:

- Take-All of wheat
- Wheat root rot
- Texas root rot of cotton
- Club root of cabbage
- Common scab of potatoes
- Bacterial leaf spot of peaches
- Powdery mildew and leaf rusts of grains

In fact, an adequate level of boron in plant tissue is associated with disease reduction of 18 fungal diseases and at least three viral diseases in plants. A deficiency of any plant nutrient may influence disease development.

Nitrogen, phosphorus, potassium, calcium, sulfur, silicon, manganese, and boron all exert considerable influence on the prevalence of plant diseases.

### Nitrogen

- Promotes vigorous growth.
- Essential for production of proteins, growth regulators, and new cell protoplasm.
- When used in excess, nitrogen encourages rank, soft, vegetative growth; delays maturity

and tends to cause thin cell walls which increases a plants susceptibility to fungi attacks and lodging.

## **Phosphorus**

- Essential for utilization of carbohydrates.
- Vital for cell division.
- Promotes root growth and seed development.
- Applications are most beneficial against seedling diseases and certain root rots where vigorous development of roots permits the plants to escape destruction. Because of its use in building new cells, any imbalance with nitrogen may cause disease losses to increase.
- On the other hand, phosphorus is essential for the multiplication of viruses in the host plant cells and may increase the susceptibility to viruses and other diseases if it is in too abundant supply.

## **Potassium**

- Does not become a structural part of plant tissue.
- Mobile regulator of cell activity.
- Promotes use of nitrate nitrogen.
- Encourages production of amino acids.
- Promotes thicker outer cell walls.
- Encourages firm tissue which resists collapse. More plant diseases have been retarded by the use of potassium than any other nutrient because, potassium is essential for catalyzing cell activities.

## **Calcium**

- Essential for normal growth.
- Important for cell division and cell development.
- Assimilated into the structure of all new cell walls.
- Neutralizes acids produced within the plant.
- Influences plant disease indirectly by its effect on soil acidity.
- Neutralizes toxins produced by wilt-inducing fungi.

In certain diseases like galls, calcium and potassium balance becomes very important since both components contribute to the division and growth of cells.

## **Silicon**

- Affects availability of potassium.
- Combines with other components to increase cell wall strength.
- Silicon aids primarily in the prevention of infection by powdery mildew. This fungus disease develops externally and usually

penetrates the host cell through the cell wall.

**Sulfur** Sulfur oxidizes to sulfate to promote soil acidity which discourages the growth and survival of some bacteria and fungi.

**Soil Reaction**The influence of soil pH on the growth and persistence of some fungi and bacteria must be considered. Organisms with thin-walled bodies may have difficulty multiplying and infecting roots. The soil reaction affects the availability of essential nutrients in the soil, thereby altering the balance between plant parasites and saprophytic soil-inhabiting fungi and bacteria.

**Organic matter/crop residues** The addition of crop residues and its decomposition furnishes essential nutrients to crops by strongly influencing chemical and biological changes in the soil. Soil organisms that fix atmospheric nitrogen and others that hold available nitrate-nitrogen are nourished by crop residues. Soil particles are massed together to improve aeration and increase water holding capacity.

Certain chemical by-products of crop residue decomposition are known to exert an antibiotic activity to suppress plant diseases. However, crop residues can also promote the growth and dispersal of some plant parasites. Decomposition products may increase the susceptibility of roots to invasion by plant disease organisms.

**Nitrogen-Phosphorus Balance** The soil's nitrogen-phosphorus balance is very important in such diseases as take-all, foot-rot, and pythium root rot of wheat. Since phosphorus promotes good root development, proper N-P balance insures rapid regrowth of roots from the crown of diseased plants. This promotes quick recovery from loss of diseased plants.

Phosphorus is needed to reduce corn ear smut. The disease was most evident in plants showing a phosphorus deficiency. Cob rot in corn was reduced by phosphate applications when the soil level of phosphorus was low and the fusarium organism was present. In other tests phosphorus failed to alter stalk rot or the amount of stalk breakage.

With wheat, phosphorus reduces root rot. The maximum benefit apparently came from uptake of applied fertilizer phosphate which is greatest two to six weeks after plant emergence and tapers off as the wheat plant reaches heading. In Oregon it is reported that yield and test weight was increased by applying both phosphate and potash when yellow dwarf virus disease was severe.

**Nitrogen-Potassium Balance** Wilt diseases seem to be influenced more by the nitrogen-potassium balance than by nitrogen-phosphorus. High nitrogen levels increase the severity of bacterial wilt of corn while nitrogen deficiency reduces wilting. However, at optimum nitrogen levels, the addition of potassium increased wilt resistance. Cabbage yellows (a wilt disease) and tomato wilt were recorded to hit potassium deficient plants more severely than the plants receiving balanced nutrition. Potash fertilizers have probably reduced damage from more diseases than any other nutrient application.

In summary, plant nutrients can help plants resist or withstand attacks of both parasitic and non-parasitic diseases. In many cases, the relationship concerns a lack of balanced nutrition rather than the direct effect of any one element. The vigorous root and top growth of plants supplied with adequate and balanced nutrients can help plants resist attacks of many disease organisms or to outgrow the effects of a disease invasion.

We know nitrogen is needed to promote vigorous green growth, high in protein. However, when large amounts are used with an inadequate supply of other essential nutrients, the plant usually develops soft, lush growth with weakened cell walls – a plant more susceptible to disease attack.

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## Ultra Gro Thoughts

We at Ultra Gro Plant Food have elected to present this article in our newsletter because it supports much of our basic approach and philosophy. Ultra Gro products are made from pure food-grade chemicals, blended for compatibility. This is to insure that no extraneous chemicals are introduced into the soil to upset nutritional balance and that the plant nutrients are readily soluble and available for uptake.

In addition we supply beneficial microbes to help in the formation and release of plant nutrients. Pre and post-application testing of soils and tissues is a procedure against the creation of unhealthy nutrient imbalances. All of the above is our approach to reach and maintain nutrient balance and bring about a favorable effect on plant-disease reactions.

*Dominic Colasito, Ph.D.*