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Pest Control Through Plant Nutrition

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Author's Note: Agriculture faces the challenge of feeding an ever-increasing population. To meet that challenge, the industry can use any help it can get. Mineral plant nutrition can play a significant role in pest management, and can be a substantial tool in meeting that challenge. This article is the first of a series, based on the response I have received from individuals attending the course I have been teaching for CAPCA ED called "*Responsible Plant Nutrition and Pest Control*." As there have been requests for additional information, I will start this series covering potassium.

We know that Potassium (K) is a primary nutrient, critical for plant health. Potassium's role is essential for the synthesis of proteins, starch, and cellulose in plants. Cellulose is a primary component of cell walls. Deficiency of this critical nutrient causes cell walls to become leaky, resulting in high sugar (starch precursor) and amino acid (protein building blocks) concentrations in the apoplast. When K is sufficient, there is an increase in the synthesis of the high-molecular-weight compounds such as proteins, starches and cellulose. This depresses the concentrations of low-molecular-weight compounds such as soluble sugars, organic acids, amino acids and amides in the plant tissue. These concentrations of low-molecular-weight compounds sustain development of infections and insect infestations. The lower concentrations of those compounds brought about by sufficient levels of K leaves a plant LESS vulnerable to disease and pest attacks. Adequate K increases phenol concentrations which play a role in plant resistance. The syntheses of other defensive compounds in K-sufficient plants have resulted in higher pest mortality according to research findings.

The role of potassium has been extensively studied. One study(1) reviewed 2,449 references, and found that the use of K significantly decreased the incidence of fungal diseases by 70%, bacteria by 69%, insects and mites by 63%, viruses by 41% and nematodes by 33%. Meanwhile, K increased the yield of plants infested with fungal diseases by 41%, bacteria by 57%, insects and mites by 36%, viruses by 78% and nematodes by 19%.

If we look at some statistics (Table 1) on the impact of fungal diseases on world food supply, we can clearly paint a picture. Imagine what we could accomplish if we utilized the ability of potassium to aide in the control of pests such as Fungal, Viruses, Bacterial, Insect and Nematode.

While additional studies need to be conducted, we should understand the importance of potassium in pest management. California has hundreds of important nutritional crops such as almonds, walnuts, tomatoes, grapes, various vegetables, melons, and fruit tree crops, just to name a few. All of them are at risk of reduced production from pest pressures.

Integrated Management strategies should be used to select materials for pest control that have a minimum effect on human health. Imagine a tool that can help control multiple pests, improve the health of the plant, increase the productivity of the crop, and play the dual role of balanced plant nutrition and assist in your Intergrated Pest Management plan. Potassium (K) could be that tool. While this is only one nutrient, it shows the enormous potential nutrient management has in the IPM arsenal.

1. Perrenoud S. Potassium and Plant Health. 2nd ed. International Potash Institute; Bern, Switzerland: 1990. pp. 8–10

TABLE 1
• More than 600 million people could be fed each year by halting the spread of fungal diseases in the world's five most important crops (rice, wheat, maize, potatoes and soybeans).
• Fungal infections destroy at least 125 million tons of the top five food crops each year, which could otherwise be used to feed those who do not get enough to eat. These crops provide the majority of calories consumed by humans.
• The damage caused by fungi to rice, wheat and maize alone costs global agriculture $60 billion per year.
• World scientists are calling for new solutions to prevent the spread of existing and emerging fungal infections in plants and animals. Limiting these infections would prevent further loss of biodiversity and food shortages, and plant nutrition is part of the solution.