Pest Control Through Plant Nutrition II: Calcium

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In the February issue of the *CAPCA Adviser*, we discussed potassium and how it aids in the challenge of feeding an ever-increasing population. Mineral plant nutrition has a critical role in integrated pest management. Almost every primary, secondary and micro nutrient can play a major role in the plant's ability to develop primary pest resistance. Agriculture faces environmental pressure to find ways to reduce the amount of pesticides we use. Mineral plant nutrition can provide a significant tool for Pest Control Advisers. Pests can develop resistance to important pest control chemicals. It is up to us as Advisers to try to extend the life of such chemicals. In this article we will discuss calcium, one more nutrient key to the plant's own defense mechanism to reduce pest pressure.

Potassium is considered a primary nutrient. Therefore, I decided to discuss calcium as it is considered a secondary nutrient. In no way is it less important in the growth and health of a plant. Calcium is essential in cell wall development. It has also been found that calcium helps develop calcium oxalate crystals in some plants. Data presented in research clearly shows calcium oxalate contributes as an effective defense against chewing insects. Some larvae can detect its presence and simply avoid leaf tissue containing calcium oxalate crystals. The striking abrasive effect that the crystals have on insect mandibles suggests it deters the insects by physical means.[1]

Because calcium is immobile in the phloem, calcium-based fertilizers are widely used by the orchard industry to reduce calcium-deficient fruit disorders such as bitter pit of apples, and cork spot of pears. However, there is also a growing body of evidence noting that enhanced calcium concentrations in leaf, stem, and root tissue by calcium fertilization can aid in reducing pathogen severity caused by several fungi and bacteria. Calcium also inhibits the production of pathogenic enzymes that dissolve plant tissues.[2]

Results of one recent study have shown that there are significant differences in the fertilizer effect of calcium and the controlling efficacy of both Oriental fruit flies and red scale insects when treated with Nano particles. Furthermore, Nano-calcium carbonate could protect fruit from the oviposition of Oriental fruit flies.

As plant protection agents, calcium carbonate particles are relatively safe and friendly for human and environmental use as compared with chemical pesticides. Another advantage of calcium particles is the lower resistance possibility. Oriental fruit flies, as well as other tephritid flies, have shown resistance against various recently used insecticides including organophosphate, pyrethroids, and spinosad. Of the two Ca particles in the study, Nano-Ca showed better performance in fertilization, plant protection, and pest control over colloidal Ca.

Once more we see plant nutrition can play the dual role of feeding and protecting the crop. We will continue to bring additional nutrients to the forefront of their role in pest control. With continuing concerns and environmental pressure, the PCA needs to understand these tools. In their standalone role as a pest deterrent, or as a supplement to existing pest control materials, mineral nutrition plays a valuable role in plant disease and pest resistance. It can also extend the length of efficacy of pest control chemicals by extending their life before pests gain resistance to our current crop protection chemicals.

[1] *journals.plos.org/plosone/article?id=10.1371/journal.pone.0141982*

[2] *Pertinent examples include enhanced resistance against soft rot of potato caused by Erwinia carotovora subsp. Amylovora (McGuire and Kelman 1984; McGuire and Kelman 1986; Bain et al. 1996), Phoma exigua (gangrene) and Fusarium solani (dry rot) of potato (Olsson 1998), Botrytis cinerea of apple (Conway et al. 1991), sweet cherries (Ippolito et al. 2005), and brown rot of peach caused by Monilinia fructicola (Elmer et al. 2006). Recent research also indicates the form of calcium is potentially important for disease suppression (Elmer et al. 2006). For example, calcium nitrate reduced the incidence of brown rot of cherries in two of a three-year trial while calcium chloride forms had no effect on brown rot incidence (Wojcik 2001). Commercially, a wide range of calcium fertilizers exists to include calcium nitrate, calcium sulfate, calcium chloride, etc. Now findings from recent Nano technology have shown promise.*