

Adjuvants to Improve Disease Control in Apples

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The management of common apple diseases relies heavily on effective fungicide applications. However, the evolution of fungicide resistance by many pathogens has resulted in management failures and significant economic losses. With time and the increasing development of fungicide resistance in apple scab, and possibly bitter rot, more and more apple growers rely on Captan, an older fungicide, because it has a multi-site mode of action, and little risk of resistance. Label restrictions limit growers to 40 lbs of Captan per season that may not provide sufficient control of both apple scab and bitter rot in unusually wet years. As a result, apple growers are faced with two equally difficult scenarios: inadequate management of diseases due to resistant pathogens from the use of newer fungicides or insufficient management due to restrictions on Captan. The goal of this research was to identify new approaches to reduce the amount of Captan needed throughout the growing season without decreasing disease control. These studies were begun with a goal of identifying ways to improve fungicide efficacy through the use of adjuvants.

Adjuvants are tank additives that increase the coverage and retention of sprays and correct issues with the tank water by affecting the pH. The incorporation of adjuvants into current apple disease management strategies has the potential to improve disease control by increasing the efficacy of Captan sprays at reduced rates. To assess the improvement of Captan sprays, adjuvants were combined with the lowest rate of Captan and applied to apple trees every 10-14 days from bloom to harvest. Disease and phytotoxicity incidence and severity were observed on apple fruit to measure the effectiveness of the treatments. Results showed that Li700 plus Captan and Bond Max plus Captan consistently reduced disease incidence in high-pressure years by increasing the coverage and retention of Captan and lowering the pH of the tank water.

Directly improving fungicide efficacy is one approach to improve disease management. Another, less direct approach, is to reduce the amount of overwintering inoculum. In order to examine if adjuvants improved urea-driven decomposition of scab infected leaves, adjuvants were combined with urea and applied to infected leaves. These leaves were then left to overwinter on the orchard floor. Leaf area decomposition and pseudothecia and ascospore reduction were observed to measure the effectiveness of the treatments. Results showed that Li700 plus urea and Wet Betty plus urea improved urea-driven leaf decomposition, reducing pseudothecia development and ascospore release. Based on this study, the addition of these adjuvants to urea could delay an apple scab epidemic 3-8 days, saving one fungicide application and postponing initial infection past the point when apples are most susceptible infection by the apple scab pathogen.

Our last study examined the use of the non-ionic wetting agent, PenraBark, in combination with the fungicides Agri-Fos and Ridomil Gold 4EC for the control of *Phytophthora collar rot*. This was an on-farm trial working with a grower with a history of root and collar rot on trees in their orchard. Trees were approximately eight inches in diameter, and at the quarter-inch green stage of development. For the bark treatments, the main trunk of the tree and the first 1 to 2 feet on the main scaffold limbs were sprayed until bark was wet, but stopped just before run-off to avoid drenching the surrounding soil. Approximately 1 pint of liquid was applied per tree depending upon treatment. The

Ridomil Gold 4EC soil drench treatment was applied at the same time as the other five treatments. Treatments were applied once per year. Mean canker size was measured and evaluated on the basis of lesion to stem ration. Fungicide treatments differed in their ability to reduce canker size. All treatments significantly inhibited canker development. However, a combination of Pentra-bark and Ridomil Gold 4EC gave consistently better results, even with a reduced rate of fungicide.

The addition of adjuvants to Captan, Ridomil, phosphorous acid or urea has the potential to improve disease management by reducing fungicide rates and reducing overwintering inoculum. Together these factors may reduce the number and dose of fungicide sprays required for apple scab and bitter rot management throughout the growing season and ultimately increase a grower's net return in apple production.