TWO NEW TOOLS IN THE MANAGEMENT OF GRAY MOLD OF KIWIFRUIT IN 2005: SCHOLAR® FOR POSTHARVEST USE AND ELEVATE® FOR PRE- OR POSTHARVEST USE

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The "reduced-risk" fungicide Scholar® 50WP (fludioxonil) was fully registered this July in California as a new postharvest treatment on kiwifruit to control postharvest gray mold caused by *Botrytis cinerea.* This registration follows the full registration of the "reduced-risk" fungicide Elevate® 50WDG (fenhexamid) last September (2004) as the first postharvest treatment of kiwifruit. Both Section 3 full registrations were successfully done in cooperation with the IR-4 minor crop pesticide registration program. The "reduced-risk" United States Environmental Protection Agency (EPA) classification represents one of the safest categories of pesticides. Both fungicides have a very low mammalian toxicity and thus, accommodate safety issues of packinghouse workers and consumers. Furthermore, fungicide usage on kiwifruit is considered of low risk because the peel is rarely consumed. Based on our studies, the residue tolerance (or maximum residue limit – MRL) for Scholar® was set at 20 ppm (mg fludioxonil/Kg fruit tissue), whereas for Elevate® it was set at 15 ppm (mg fenhexamid/Kg fruit tissue).

Additionally this August, the label for Elevate® was modified in a Section 24C (Special Local Needs) to include either pre- *or* postharvest usage of the fungicide for managing gray mold. Both pre- *and* postharvest applications are not allowed on the same fruit lot and growers are required to notify packinghouses if preharvest applications of Elevate® were done to ensure that no postharvest treatments would occur. Growers will be allowed to make two preharvest applications between 30 and 1 day(s) before harvest (30 to 1 day(s) PHI or preharvest interval). Obtaining these new tools for managing kiwifruit decay were goals of our research that was funded by the California Kiwifruit Commission to identify and develop new materials to prevent crop losses in harvested kiwifruit following the cancellation of Ronilan® (vinclozolin).

Still pending preharvest registration on kiwifruit is Vangard (cyprodinil). The registration process is continuing through the IR-4 program. Strategic goals of multi-registrations of these materials included: 1) Providing three new fungicides (Elevate, Scholar, and Vangard) that each represent different classes of single-site mode of action fungicides to reduce the risk for selecting resistant populations of the gray mold pathogen when they are used in rotation; 2) Allowing growers several choices of competitive products to use; and 3) Decreasing industry dependency on any one product (e.g., historically Ronilan was the only fungicide available for preharvest disease management) and to allow for replacements to be developed if any one fungicide is cancelled.

Gray mold of kiwifruit is caused by the ubiquitous fungus *B. cinerea.* The pathogen has a large host range and colonizes senescent plant tissues or enters plants through wounds and

subsequently colonizes healthy tissue. On kiwifruit, most infections originate at the wound where the stem was snapped off during harvest. Some infections may also originate from other wounds or colonized plant tissues such as flower parts and sepals. Preharvest fungicide treatments reduce the amount of inoculum (spores) of *B. cinerea* in the kiwi vineyard by direct contact and by protecting the fruit before inoculum arrives. Still, cultural practices including orchard floor management may allow for high populations of *B. cinerea* to occur and air-borne spores may contaminate the stem wound and other fruit injuries during harvest. The susceptible stem wound of the harvested kiwifruit is not directly protected from gray mold infections by preharvest fungicides because most fungicides (including Elevate®) are not systemic. Our trials have shown that preharvest applications either 7 and 1 day or 1 day before harvest significantly reduced postharvest decays as compared to non-treated fruit after cold-temperature storage. Thus, with the label change for Elevate® the fungicide can be applied preharvest to reduce inoculum by direct contact or by contact after re-distribution by rain and to provide a protective barrier before inoculum arrival on fruit wounds. In all studies, two preharvest applications did not exceed the established residue tolerance for Elevate®.

Our research over the last several years has demonstrated that postharvest application of fungicides is the most effective way to prevent postharvest losses of kiwifruit from decay caused by *B. cinerea.* Both Elevate® and Scholar® are highly effective postharvest fruit treatments that provide protection of non-wounded and wounded plant surfaces (including stem-wounds) when applied within several days after harvest and then stored at low temperature (32 F or 0 C). The labeled postharvest application rate for Elevate® is 24 oz and for Scholar® is 8-16 oz of product per 200,000 lb of fruit. Low-volume treatments are applied with controlled droplet or air-nozzle systems at 8-25 gal, whereas high-volume treatments (e.g., dips or drenches) are applied at 100 gal/200,000 lb fruit. Application method is the most important parameter determining the efficacy of a postharvest fungicide treatment for kiwifruit. In our trials, decay was reduced to zero or near zero levels when applied as a dip, flood, or other high-volume application. Applications of the fungicide in low-volume systems (e.g., controlled droplet application or CDA) reduced postharvest decay but were less effective as compared to high volume systems because coverage of stem wounds is not easily obtained using low volumes. Residues of 4 to 7 ppm fenhexamid (Elevate®) or 3 to 5 ppm fludioxonil (Scholar®) should be targeted to obtain excellent decay control.

Because kiwifruit are traditionally kept dry during postharvest handling, wetting the fruit is of concern to some packers because of the potential of fruit staining. Two types of fruit staining may occur: staining from water and staining from “sooty molds”. Sooty molds are dark-colored fungi that grow superficially on plant surfaces using plant exudates for nutrition, but generally do not cause decay. Species of *Cladosporium* are common sooty mold fungi causing staining of kiwifruit because they can grow at low storage temperatures (32 F or 0 C). In laboratory studies by other researchers and by us, water staining occurred only on a small percentage (< 1%) of fruit treated in water application systems. Water staining may be a problem when large amounts of kiwifruit are treated in a high-volume fungicide application system. Scholar, but not Elevate is effective against sooty molds. Still, if fruit are brushed and washed with chlorinated water (100 ppm free chlorine) to eliminate surface contamination, rinsed with potable water, damp dried, and treated with either postharvest fungicide, sooty mold stains have not developed in our research trials. Slowing down roller brushes should minimize removal of kiwifruit trichomes (fruit hairs) and other handling injuries. Before packing, excess wetness on

the fruit surface can be removed by brushing or by using sponge rollers. Thus, postharvest sooty mold stains and decay of kiwifruit in storage can be effectively managed using this new system for handling kiwifruit. Another strategy is to store fungicide-treated and/or graded fruit in bins until orders are received from retailers, thus allowing time for drying. Damp fruit that is put into storage should dry within a few days.

Preharvest treatment of kiwifruit with the newly registered fungicide Elevate® with or without a postharvest application of Scholar® or postharvest applications of either or both fungicides should keep postharvest decay losses caused by *B. cinerea* to a minimum. An important consideration before treating fruit with a postharvest fungicide application is to order fruit identification code stickers with the proper adhesive for wet fruit. In our tests, labels with adhesive for wet peaches worked fine for washed, damp kiwifruit. Furthermore, because different export markets have their own regulations for acceptance of pre- and postharvest treatments of fruit, the use of Elevate® or Scholar® should be considered based on specific requirements of export destinations. Many countries default to US-EPA established tolerances, however, some countries do not. Therefore, the importer or the country that the kiwifruit shipment will be exported to should be consulted. For further information contact the California Kiwifruit Commission.

Warning on the Use of Chemicals
Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked. Do not place containers containing pesticide in the trash nor pour pesticides down sink or toilet. Either use the pesticide according to the label or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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