

The Science (and Art) of Ethephon Use on Walnut

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The following article outlines the pros and cons of using Ethephon as a harvest aid.

What is Ethephon? Ethephon, also known as Ethrel®, is an ethylene-based plant growth regulator applied at walnut maturity, or shortly thereafter, which accelerates hull cracking and separation from the shell. This advances walnut harvest by four to seven days, depending on the season and variety, and nut value is increased by lighter kernel color and possibly less insect damage. The performance of ethephon improves with experience. Proper application and timing are essential for a successful response.

When are walnuts mature? Walnut kernels are physiologically mature well ahead of their natural drop from the tree. Kernels achieve maximum oil accumulation when the packing tissue surrounding the kernel has changed from a bright white to the color of oak. This is commonly referred to as Packing Tissue Brown (PTB). The nuts in figure 1 are **NOT** at PTB, including the top nut, which still has flecks of white dispersed among the packing tissue. It is two to three days away from being uniformly oak colored. The nuts in figure 2 **ARE** at PTB. **Do Not Treat Until All The Nuts You Cut Are At This Stage!!** The packing tissue continues to darken to a mahogany color as the nut ages. Kernel maturity often occurs 21 or more days ahead of unaided commercial harvest (at least 80% removal with 10% or less sticktights). During this period, the green hull tissue surrounding the nut undergoes separation of its vascular tissue from the nut, and the hull also cracks from tissue breakdown and moisture absorption. Unfortunately, the kernel also ages, resulting in darker, less valuable nuts. The risk of insect damage, principally from navel orangeworm, also increases due to longer exposure to the last generations of the season.

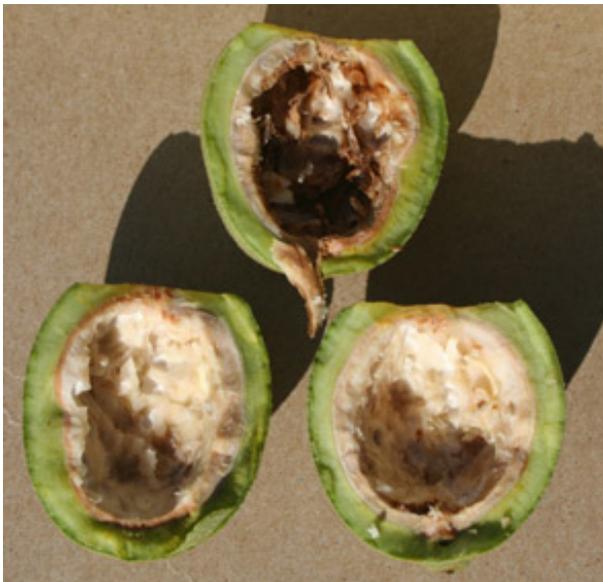


Figure 1. Immature walnuts



Figure 2. Mature and ready for treatment

Is Ethephon right for me? Perhaps not. Users must commit to monitoring the orchard once or twice weekly for PTB, applying the product at night or early morning to avoid temperatures approaching 90⁰ F, and then have control over harvest timing to take advantage of the accelerated maturity. Your dehydrator must also be open and prepared to process your nuts promptly to further minimize quality losses.

How do I time treatment? Three years research in Kings County shows **PTB occurs last in the bottom of the canopy**, and that fully shaded walnut canopies have greater maturity variability than those with full sunlight. **Orchards deficit irrigated or stressed from low water infiltration also develop PTB sooner than well watered orchards.** Early walnut varieties such as Serr develop PTB sooner (mid-August) than late varieties such as Chandler (mid-September). Begin sampling at least two weeks ahead of when PTB is expected. **Walk diagonally across the orchard and collect at least 100 nuts. Do not include nuts obviously advanced in maturity, since they are often oil-less and atypical. Cut each collected nut in half.** This is often done by insertion of a knife blade into the stem end of the nut, followed by a twisting of the blade to split the nut down its suture. Care must be taken to prevent the sudden loss of resistance to the knife blade, with subsequent puncture of your hand palm! Wear leather gloves over latex ones to reduce the risk of injury and severe hand staining from the hull tissue. Place one half of each nut into either a “yes” or “no” group for PTB. **Only nuts with complete browning of the packing tissue, including the area near the stem end, qualify for the “yes” group. It is better to be two days late in application than two days early, since losses in weight, nut quality, and hullability result from early ethephon application!** Application delayed five to seven days after PTB improves percent nut removal and the chances of having to only harvest once. Consider crop load, weather, and variety susceptibility to darkening in electing this option.

Do all walnut varieties respond similarly? No, research in Kings County suggests walnut cultivars differ in their sensitivity to ethephon. Laboratory testing of Serr, Payne, Tulare, and Chandler suggests that Serr produces the least amount of ethylene after treatment of these four varieties, and Tulare the most. This agrees with field experience in the Southern San Joaquin Valley, where Serr is often marginal in response, and Tulare falls off the tree shortly after treatment. Growers report Howard is also very responsive to ethephon in Northern California, resulting in greatly enhanced quality and value. The responsiveness of Tulare in the South has now made it a standard cultural practice. Collaborative research with the UC Davis Plant Sciences Department suggests that the lower ethylene production from treated Serr walnuts is possibly due to less absorption into the hull, which has smaller pore spaces than the highly responsive Payne variety. We are experimenting with adjuvants to test the absorption/improved performance hypothesis. **Thus far, the organosilicones did NOT improve ethephon activity!**

What about treating stressed orchards? Growers treat stressed orchards at their own risk. Walnut stress typically arises from under or over irrigation and heavy mite infestation. Stressed orchards can experience more leaf drop prior to and after harvest. Excessive leaf drop can vastly complicate harvest, especially in the event of rain. Remember, quality does not begin at harvest, and ethephon is an aid, not a panacea for all the quality related problems experienced during the season.

How do I apply it? Only ground application with large self-propelled speed sprayers is recommended in the South. Four to five pints of product are added to 150-200 gpa, with ground speeds between 1.5 and 2 mph, depending upon canopy size. **Ethephon does not translocate! It MUST hit the nut to create the desired response! Experience shows greater response under higher humidity and lower temperatures. Never exceed 90⁰ F. Do not apply when drying winds, typical in the North, prevail. Ethephon is rainfast within six hours of treatment. Like all plant growth regulators, application conditions which improve absorption time increase product performance.** Reports from northern California growers suggest weather conditions are favorable for effective aerial applications on responsive varieties such as Howard, Hartley and Vina. Growers and northern California county Ag Commissioners report aerial use rates of two to four pints in 40 gpa. Aerial application and ethephon concentrations greater than those recommended for ground treatment (900 ppm) are allowed by the label, **BUT** they are not supported by the manufacturers. **Rates higher than recommended may result in tree injury, such as excessive defoliation, reduced catkin formation and twig dieback. All risks for air application with higher concentrations are assumed by the grower. Check with your crop consultant for a local recommendation.**

Does Ethephon pay? Research documents improved nut value of five cents per pound, principally due to lighter kernel color. However, greater value increases may be experienced commercially under heavy navel orangeworm pressure, or with varieties prone to rapid kernel darkening. Growers in the North report improved Howard value of nine to 12 cents. Control over harvest timing is also an advantage to which a price cannot be assigned.