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ORCHARD NOTES

E-MAIL EXTRA FOR WALNUTS:

DECEMBER 10, 2009

Freezing Temperature Effects on Walnuts

by Janine Hasey

The freezing temperatures we are experiencing and calls from growers regarding irrigating for frost protection has prompted me to check historical and current weather data, my files, photos and my memory on winter kill from cold injury on walnuts from past local freeze events, and to consult our biometeorology specialist Rick Snyder at UC Davis. I'm also including three articles from the Sacramento Valley Walnut Newsletter Winter 2008/2009 issue for your reference due to our freeze this week. Below is a simplified summary of what can be rather complex information:

1. *At what temperatures may you see freeze damage on mature and young walnut trees?* There are many factors that will affect the cold hardiness and the temperatures a walnut tree can withstand when a freeze event occurs including hardening against low temperature, moisture level in root zone, tree age and stress level.
 - Trees with adequate soil moisture are better able to withstand low temperatures without damage than trees that are dry.
 - Using the Nicolaus CIMIS weather station (typically cooler than temperatures in Yuba City), before the severe cold temperatures the last few nights, there were 18 days of below 32°F temperatures between November 13-December 6, 2009. These temperatures should be more than sufficient for **mature dormant walnut trees**, which are not stressed, to be acclimated. Our low on December 8 was 20°F. English walnut trees in France have tolerated temperatures from 10°F to 5°F. Back in 1990, the "Yukon Express" brought temperatures in the teens for several days with a low of 12°F (Nicolaus) on December 23 when the trees were fully dormant. There was no rainfall recorded in November or December preceding the cold spell. Typically the mature trees that were damaged were those that had low vigor or were stressed.

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- Most of the winter kill we see on **young walnut trees** occurs from sudden autumn frosts in November on vigorously growing trees not hardened off (see DeBuse article) such as in 1985, 1993, and 2000. In autumn frosts, there can be damage to young walnut trees at 28°F. As with the mature trees discussed above, most young walnut orchards should be acclimated for this December freeze. However, with the low temperatures experienced the last few nights, young walnut orchards, especially those with low soil moisture, should be examined for freeze damaged cambium tissue that is discolored and dry (Figure 1). Follow the instructions in the DeBuse article on whitewashing and delaying pruning into summer if necessary if any damage is seen or suspected. It is common to see sunburn during the winter months on damaged tissue especially on the southwest side on unpainted limbs. The photos (Figures 2-5 taken May 1991) show the damage to one and two year old Chandlers that were whitewashed after the 1990 freeze. The two year old trees also had the irrigation withheld during August so the soil was dry making them more susceptible to cold injury.

2. What should I do to protect walnuts if a freeze is expected and I'm concerned my young walnut trees could be damaged?

The following points are from Rick Snyder and his website at <http://biomet.ucdavis.edu>:

- For weather forecasts, go to the National Weather Service Forecast Office website at <http://www.wrh.noaa.gov/sto>, click on “Forecast Weather Stations” on left, set the interval in hours and the duration in days, and enter your zip code or location. These forecasts are very helpful for predicting autumn frosts, winter freeze and spring frost events.
- If the soil is dry, it should be wetted at least 3-5 days ahead of a freeze. If there is water on the soil surface before a freeze, it will make the soil surface colder because of evaporative cooling. Water conducts and stores more heat than air spaces, so wetting the soil 3-5 days prior to a frost night will fill the air spaces and the soil will store more heat. You don't want water on the surface during the frost night unless you keep re-wetting it all night with sprinklers or with continuous running furrows.
- If you decide to turn on under tree sprinklers to prevent freeze damage in young walnut orchards, they should be turned on before the wet-bulb temperature falls to the critical damage temperature and turn them off the next morning after the wet-bulb temperature goes above the damage temperature. To be really safe, you turn off the sprinklers when the wet-bulb temperature exceeds 32°F. For example, from Rick's website <http://biomet.ucdavis.edu>, click on “Frost Protection” and then “When to turn the sprinklers on or off for frost protection”. Table 1, in that webpage article, indicates that at a wet-bulb temperature of 32°F and a dew-point temperature of 25°F, the sprinklers should be turned off at an air temperature above 36°F. If sprinklers are run all night, the temperature of the wetted soil will normally stay around 32°F, which is warmer than if the sprinklers are not operated. This is true unless the application rate is really low or if the wind speed is high and the dew-point temperature is low.
- The website also shows methods to measure the dew-point and to estimate the wet-bulb temperature and has guidelines for the application rates. The application rate of the sprinklers becomes important as the dew-point decreases and/or the wind speed increases because evaporation increases. The key to whether the application is beneficial or not is whether or not the soil surface temperature is warmer with the irrigation or without the irrigation. You can test that by placing minimum recording thermometers on dry and wetted ground.
- Refer to Rick's website, <http://biomet.ucdavis.edu>, for more detailed information on frost protection.



Figure 1. Freeze damaged wood on walnut is discolored and dry.

Photo taken in April 1994 by J. Hasey.



Figure 2. 1-year old Chandler painted white after December 1990 freeze. Damage (no upper shoots) on southwest side of tree.

Photo taken in May 1991 by J. Hasey.



Figures 3, 4, 5. 2-year old Chandlers showing damage from December 1990 freeze. The irrigation was cut off in August and did not resume before the December 1990 freeze, nor was there recorded rainfall in November and December..

Photos taken in May 1991 by J. Hasey.

Managing Walnuts for Cold Temperatures

Carolyn DeBuse, UC Farm Advisor, Solano and Yolo

There are two types of cold damage that can happen to your walnut trees when winter arrives. Autumn frost damage occurs if the temperature drops below freezing rapidly in the late fall or early winter following mild warm autumn weather. This type of autumn frost often damages vigorous non-dormant young trees. The second type is “winter kill” which happens when extremely low temperatures occur during the winter months damaging mature and young dormant trees. Water stressed or trees planted in sandy soil are most susceptible to this type of injury.

Both types of cold damage show similar symptoms of darkening bark and streaks of grey on the inner wood. In the spring, buds are slow to break or fail to break altogether. In cases where the branch dies the winter kill acts as severe pruning and vigorous shoots grow from below the damaged area. Sunburn often accompanies the cold damage increasing the amount of injury. In the harshest instances, entire young trees can die.

Primary steps to reduce the risk of cold injury

1. Hardening off the trees: Hardening off is a process where the tree stops growing and begin to enter dormancy. With a warm autumn and plentiful irrigation, walnut trees may not naturally harden off early enough to avoid frost damage. You should help the trees harden off by withholding irrigation in September. Hold off irrigation until the terminal growth has stopped and there are no new emerging leaves at the shoot tips. Do not let them dry out so much that leaves are turning yellow or dropping. Trees that have been hardened off are less susceptible to damage in an autumn frost
2. Irrigating for winter: Dry trees are more susceptible to cold damage so make sure trees are not stressed as they go into winter. After trees are hardened off in September, restart the normal irrigation schedule and continue until the first rains. The soil profile should be rewetted by beginning to apply the normal ETc that is needed for that time of year. (also see Winter Irrigation article)

Secondary steps to take if cold injury occurs

Just after the freeze event: If a freeze/frost occurs in the late fall or early winter before the trees have hardened off or acclimatized, you can reduce the wood damage by painting the trees with white paint. This is effective in reducing damage to young trees after a November frost. Paint the tree trunks and primary scaffolds above the crotch with a whitewash made of white interior latex paint diluted with 50% water. The paint will help prevent sunburn and help heal the damaged wood by reducing evaporation from the injury. In a study by Wilbur Reil, Yolo/Solano Farm Advisor Emeritus, 46% of unpainted trees sustained cold damage while only 8% of the trees painted 8 days after the event showed damage.

In the spring: If you suspect cold damage, do NOT prune out the damaged limbs. The buds may be slow in opening or buds from deep in the bark may grow to rejuvenate the limb. In the late summer, prune out the dead wood that did not revive. New scaffolds that grew can be trained to replace the damaged wood. Reduce or delay spring fertilizer applications where cold damage is evident.

Winter Irrigation During Drought

Joseph H. Connell, UC Farm Advisor, Butte Co.

We know that during the winter months walnuts can be hurt by either too much or too little water. It's been a dry fall so far and the deep soil profile in most walnut orchards takes significant rainfall to be recharged. Cutting back on water earlier in the fall slows down the trees growth and helps harden them off. However, drought conditions during winter can make winter kill worse if we get cold temperatures as discussed in Carolyn DeBuse's article on winter freeze injury.

So, how do we best apply water during the winter to alleviate drought? If you have water available, I'd suggest a light 1½ to 2 inch irrigation that simulates typical rainfall patterns. If we're still dry in December as you're reading this then beginning to gradually refill the soil profile with occasional 2 inch irrigations would be a good idea starting about now. Keep an eye on rainfall forecasts and amounts of rain received in your neighborhood so your irrigation timing doesn't end up creating a condition where the orchard is too wet. Although unlikely if current conditions persist, saturated soils can kill roots from water logging or can increase the chance of crown or root rots developing. Check soil moisture as the winter progresses to see how deep the soil profile has been re-wetted so you can make sure you don't have dry soil in the root zone. The ultimate goal is to make sure the soil reservoir is completely refilled either by rain or winter irrigations by the time your walnut trees begin to wake up next March.

Pruning Tips for One and Two Year Old Walnut Trees

Janine Hasey, UC Farm Advisor, Sutter and Yuba Counties

Young walnut trees are sensitive to freezing temperatures which can kill or damage wood so it is best to delay pruning until March or late February at the earliest. (**December 10th addendum: For any young trees suspected of freeze damage, delay pruning until summer. See DeBuse article**) The method used to train young trees will vary depending on whether the planting is a standard- spaced orchard or hedgerow system.

Standard-spaced orchards

Pruning one-year old walnut trees in the modified central leader system:

- The leader, or shoot selected to be the trunk, should have reached a height of at least 7 to 8 feet. Ten feet or more of growth is better. The height at which the leader is headed will establish the height of the first primary scaffold.
- Heading the leader at 8 feet will give more area for the scaffolds. The leader should not be headed any less than 6 ½ feet since the first primary scaffold should be at least 6 feet above the ground so as not to interfere with equipment operation. Make the heading cut into mature round wood.
- Any lateral shoots on the leader should be removed. 1 or 2 non-vigorous shoots arising below the leader can be stubbed to 2 to 3 buds to provide shade on the south and west sides and to aid caliper growth. They will be removed in the next dormant season.
- Any primary buds above 5 feet from the ground that are necked should be rubbed off to the side so as not to damage the secondary bud. If left, necked buds form weak limb attachments that are subject to breakage. The secondary bud which is forced to grow will form a wide angle and develop a strong crotch.

- If the shoot selected to be the trunk has not reached sufficient height, cut it 3 to 6 buds above the point of origin and remove competing shoots. A stronger shoot can then be trained as the trunk over the summer.

Pruning two-year old walnut trees in the modified central leader system:

The general goal is to select four to six primary scaffolds arising from the trunk in years two and three.

- The first primary scaffold should be at least six feet above ground.
- Select other primary scaffolds to form a spiral pattern around the trunk. Ideally they should be one foot apart vertically, but in reality, try to space them at least eight inches apart.
- Primary scaffolds should never originate directly opposite each other; this will ensure the leader does not get 'choked out'.
- Selected scaffolds should be angled about 45 degrees from the vertical. Limbs with narrower angles or bark inclusions are usually poorly attached and cannot support heavy crops and branches with wider angles of attachment may fail to grow vigorously.
- For lateral bearing varieties (most except Hartley and Franquette), head all primary scaffolds $\frac{1}{4}$ to $\frac{1}{2}$ depending on vigor and variety. The leader should be left the longest.
- Remove vigorous lateral limbs close to or competing with the main scaffolds. Small branches can be left unheaded to fruit early on vigorous trees.

Hedgerow Planting System

Pruning one-year old hedgerow walnut trees:

- Head the leader (trunk) at about 5 to 6 feet. The buds left below will develop into the tree's framework.
- The lowest framework branch should be a minimum of three feet from the ground; above this, side shoots and necked buds should be removed.

Pruning two-year old hedgerow walnut trees:

- Select a central leader and two to four side limbs that are oriented in opposite directions in the tree row.
- Remove branches below three feet that will interfere with shaking and flat limbs that grow out into the middles.
- Depending on variety and vigor, selected framework limbs should be headed $\frac{1}{4}$ to $\frac{1}{2}$ their length; cut to an outside bud facing into the tree row. Other branches can be left unheaded to fruit early.

Always remove suckers from the rootstock on all trees.