California Walnuts Sustained Freeze Injury in Fall 2020

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During the Fall of 2020, walnut orchards throughout California sustained freeze injury that would not be realized until after leaf out in the Spring of 2021. Although freeze damage was sustained throughout the state, the extent of damage varied between regions. UCCE regional newsletters included articles addressing the causes and extent of freeze injury in respective growing seasons. For convenience, regional newsletters have been compiled into a single document to provide a more comprehensive account of the impact of freezing temperatures, and compounding orchard and climate conditions, that affected walnut orchards on a statewide level.

Autumn Freeze Damage in San Joaquin and Stanislaus Counties' Walnuts: November 2020

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Background

Over the last three years, we have received several calls from walnut growers in Sacramento and northern San Joaquin Valleys reporting widespread dieback observed in both young and mature orchards during the spring. In most cases, we suspected autumn freeze to be the major cause of those dieback symptoms. We usually try to differentiate between injury during the growing season, which is referred to as frost injury and the freeze damage that occurs in late fall or winter. The term frost injury is restricted to damage due to freezing temperatures during the growing season while the tree is not dormant, which is due to a late spring frost. This was not the case for the past three years, based on our farm calls and minimum air temperature data (°F) collected from CIMIS stations located near affected walnut orchards. Figure 1 showed the minimum air temperatures data (°F) collected from the CIMIS station located in Manteca CA, for the Nov., Dec. of 2018 – Nov., Dec., Jan. and Feb. of 2019 and 2020 – and Jan., Feb., of 2021.

In mid-November 2018, sudden minimum temperatures were low (ranging from 26.4ºF to 29.8ºF) in some locations, causing damage in young vigorous orchards as well as in mature orchards. The damage observed was not as widespread compared to what we are seeing this year, which may be due in some ways to the rains that occurred after the 9-10 day freeze event (Fig. 2).

Fortunately, we went through the 2019 winter with little stress to young/mature walnut orchards, since temperatures were warm enough to protect these trees, and you can notice how much wetter the weather was during the end of November and December of 2019 compared to the 2020' November-December time (Fig. 1 and 2).

This year, from mid to late April, we received several calls reporting severe dieback/not leafing out symptoms in large areas of walnut orchards in San Joaquin and Stanislaus counties. Symptoms were observed in newly planted orchards, young vigorous orchards as well as mature orchards including Chandler, Howard, Tulare, Serr and Solano cultivars (Fig. 3 and 4).

Why was the freeze damage so severe in some locations/areas this year?

To face the November- early December freeze events walnut trees must harden by developing processes of resistance to cold and frost. We believe that the acclimation to temperatures below freezing results from exposure to the gradual decline in temperatures, which allow trees to gradually lower the freezing point of their cells, in order not to be damaged under the freezing effect. It is a very complex process: once the temperature slowly begins to drop, the trees synthesize enzymes that will break down the starch (large sugar molecules) – made by photosynthesis and stored in summer in the bark and the wood – in smaller soluble sugars with higher anti-freeze activity, which protect against ice formation in tree cells.

This was not the case with the significant temperature fluctuation we faced during November-early December of 2020. Starting with a first freeze event on November 9th and 10th of 2020 which followed a period of temperatures ranging from 37 to 44°F (first eight days of November – at least allowing the trees to harden off a little but not enough). Then, we noticed that the temperatures rose over the next ten days (ranging from 30 to 50°F), then relapsed again below freezing for a few hours early in the morning of the 21st and 22nd, and the last four days of the month. Temperatures continued to fluctuate during the first nine days of December 2020 (Fig. 1). These temperature fluctuations pose a serious threat especially for young vigorous walnut trees during the winter. Sudden temperature drops, place high amounts of stress on trees, the effects of which are much worse when followed by mild and dry weather.

Symptoms observed

The severity of symptoms is variable across and within orchard blocks. Significant damage can be observed in young vigorous orchards. Tip dieback occurs with many branches in affected trees still green or partially green (damage beneath the bark appears as brown discoloration) and not leafing out (Fig. 5).

Based on our preliminary observation, we noticed that orchards irrigated in late October to early November showed less damage compared to those irrigated early to mid-October. More information should be gathered for the irrigation practices and other practices – prior to the November- December 2020 freeze event – from these severely affected orchards.

We are in the process of developing a survey in collaboration with other Farm Advisors and PCAs, in counties showing severe freeze damage, to help identify the factors that have contributed to the freeze damage this year, and how we can mitigate their future impact.

Recommended cultural operations to manage freeze damaged trees/orchards:

For young vigorous trees as well as mature trees, the damage in some tree branches/limbs looks dramatic, but the survival of these tree parts depends more on whether they are still green/alive.

- Do NOT prune out damaged limbs now. Buds may be slow to break or may fail to completely break and adventitious buds may emerge from under the bark. Prune out the dead wood that did not revive at the time of pre- or post-
- harvest. Formed new shoots can be trained to replace the damaged wood.
- To help prevent further damage from sunburn, exposed larger limbs/branches (southwest facing area) can be painted with tree paint or white latex paint diluted 1:1 with water.
- Orchards/blocks severely affected by the freeze will have lower overall growth with an expected yield reduction, which will reduce nitrogen requirements. Much of the nitrogen demand comes from the crop, and hence must be reduced. Make fertilizer decisions based on current soil reports and leaf analysis.
- Less leaf surface area results in reduced water loss (less transpiration): Monitor your orchard carefully, and schedule irrigation using a pressure chamber and/or soil moisture measuring devices through the season. By using the pressure chamber, you directly measure the level of water stress your trees are experiencing, because it measures the plant and not the soil. Start your irrigation when pressure chamber readings are 2 to 3 bars below baseline.

Newly planted trees showing dieback symptoms due to freeze damage are more vulnerable than older trees: the lack of foliage will provide a prime target for Flathead Borer and more sunburn damage.

- With enough healthy shoots left on the tree, cutting below the damaged tissue would help the tree rejuvenate and should not be an issue at this point (Fig. 6).
- If there are not enough leaves, damaged tissue that was not painted with a white-wash (December/January) after the freeze events should be painted now to protect against further sunburn damage and/or borer.

How to prepare and protect trees from future freeze damage?

There are additional steps you can take to prepare for a freeze events.

- Trees should enter the fall months as healthy as possible, but growth should be reduced. Cutting back some on irrigation in September and no nitrogen applications after August could help slow down growth and may help the trees harden off before a sudden freeze event comes along.

- For young trees, stop irrigating in September to set the terminal bud on the trunk to harden the trees, then resume irrigation to avoid tree stress.

- A dry fall could make freeze damage worse. If there is not enough rain by the end of harvest, irrigate walnut orchards so the soil is moist in November.

- To keep orchards slightly warmer, it is advisable to run the irrigation system a few days before an expected freeze event to ensure the soil surface is moist and help the soil store a little more heat in advance during sunny days. This will also ensure trees are hydrated enough before the freeze occurs. Moist soil absorbs more solar radiation than dry soil, and will re-emit heat overnight.

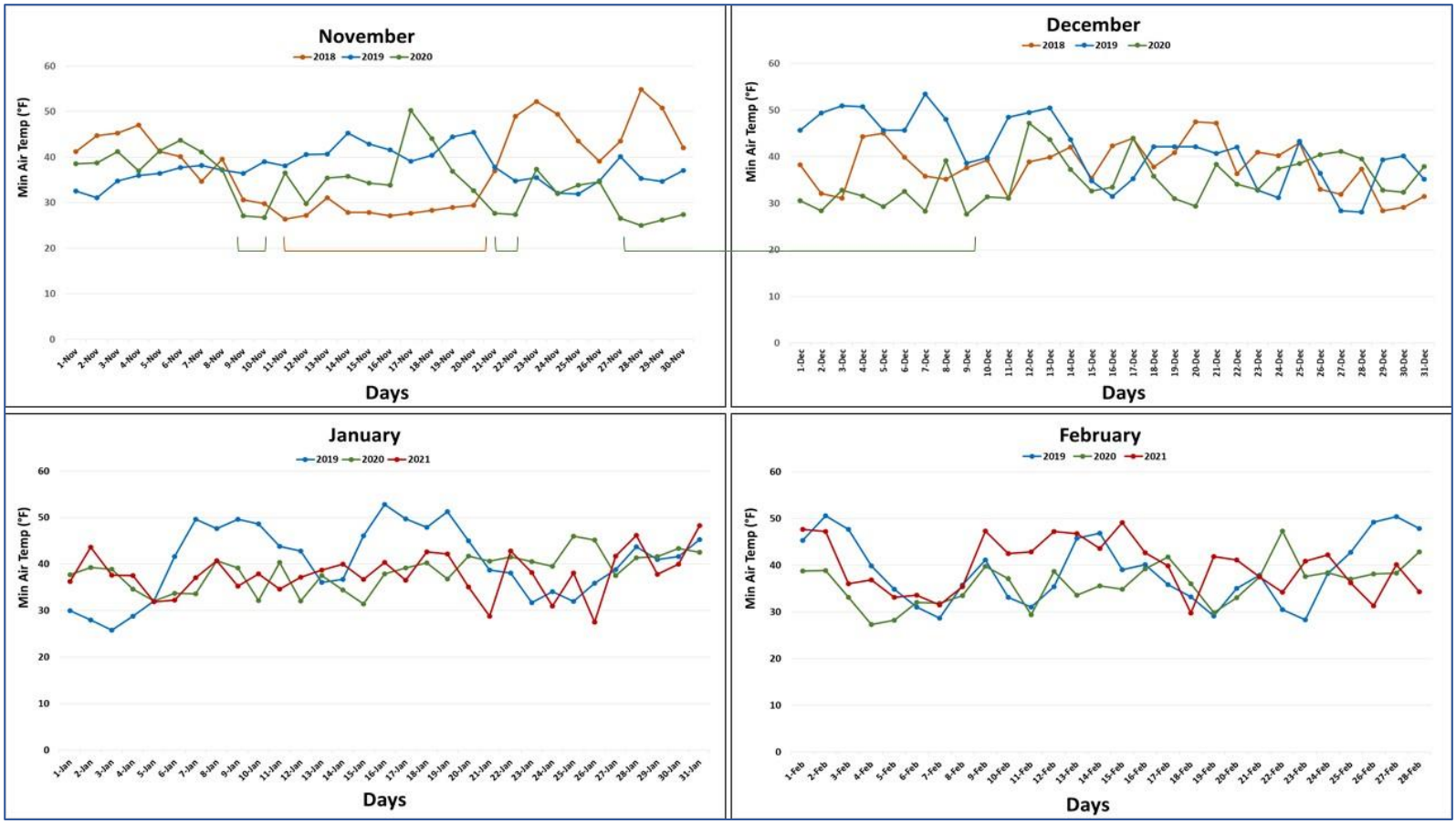

Fig. 1. Minimum air temperatures data (°F) collected from the CIMIS station located in Manteca CA, for the Nov., Dec. of 2018 – Nov., Dec., Jan. and Feb. of 2019 and 2020 – and Jan., Feb., of 2021.

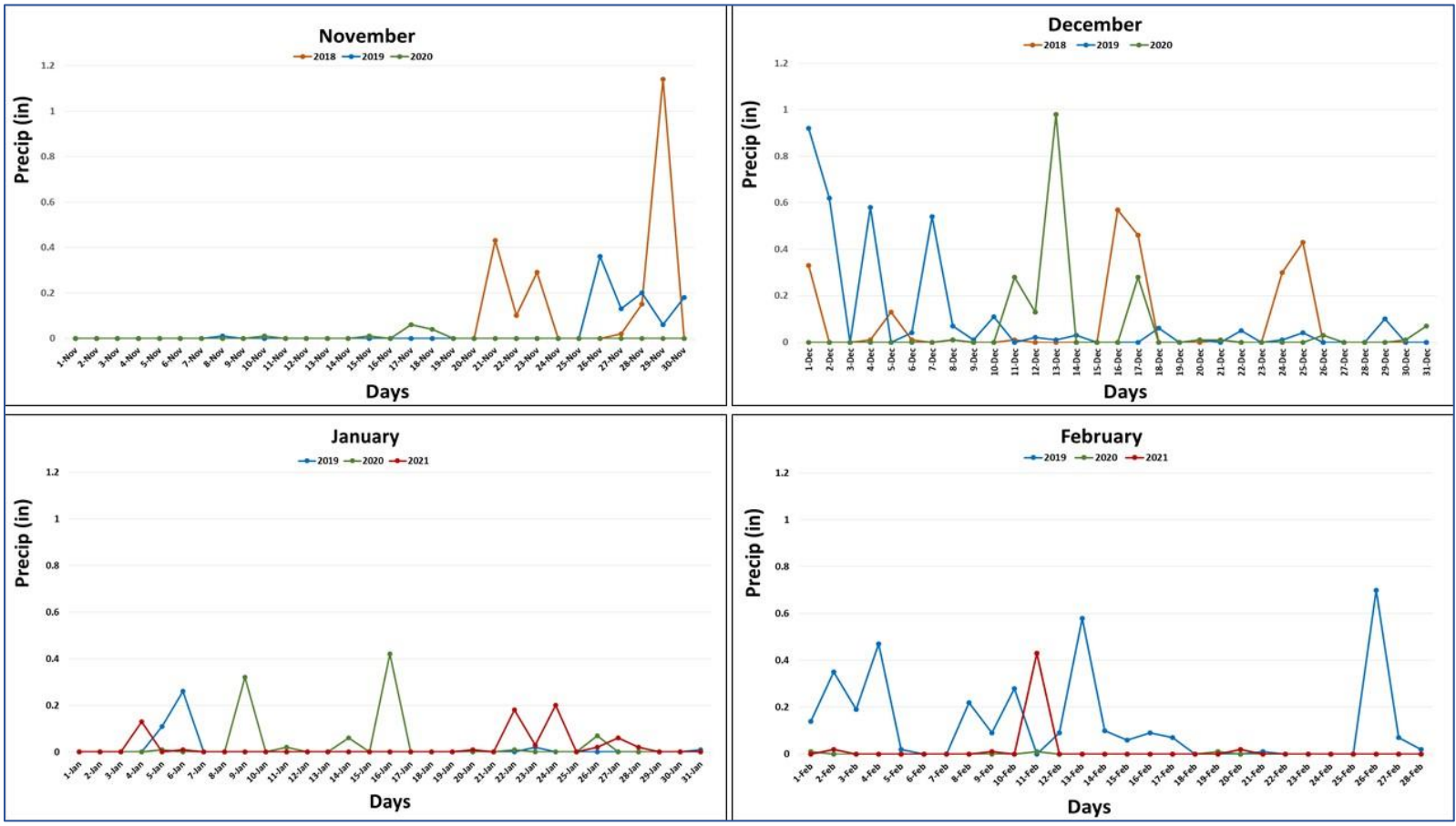

Fig. 2. Precipitation data (in) collected from the CIMIS station located in Manteca CA, for the Nov., Dec. of 2018 – Nov., Dec., Jan. and Feb. of 2019 and 2020 – and Jan., Feb., of 2021.

Fig. 3. Freeze damage in young walnut trees produces bark discoloration in the wood. Affected branches or trees dehydrate mainly from the top and show tip dieback.

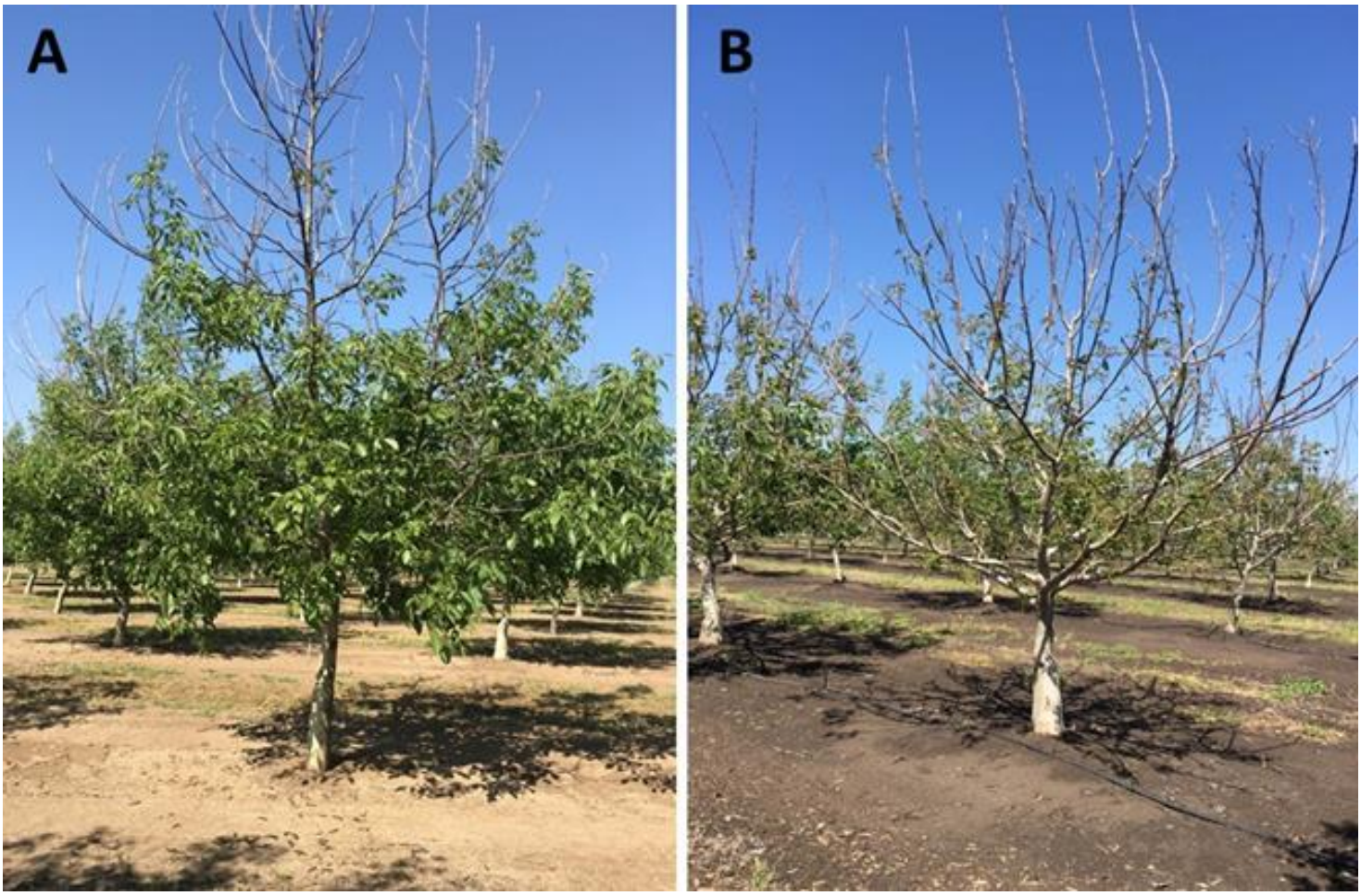

Fig. 4. Freeze damaged in, **A.** 9th leaf Solano and **B.** 9th leaf Chandler

Fig. 5. Freeze damaged in 9th leaf Solano. Severity of symptoms is variable across and within orchard blocks (damage beneath the bark appears as brown discoloration).

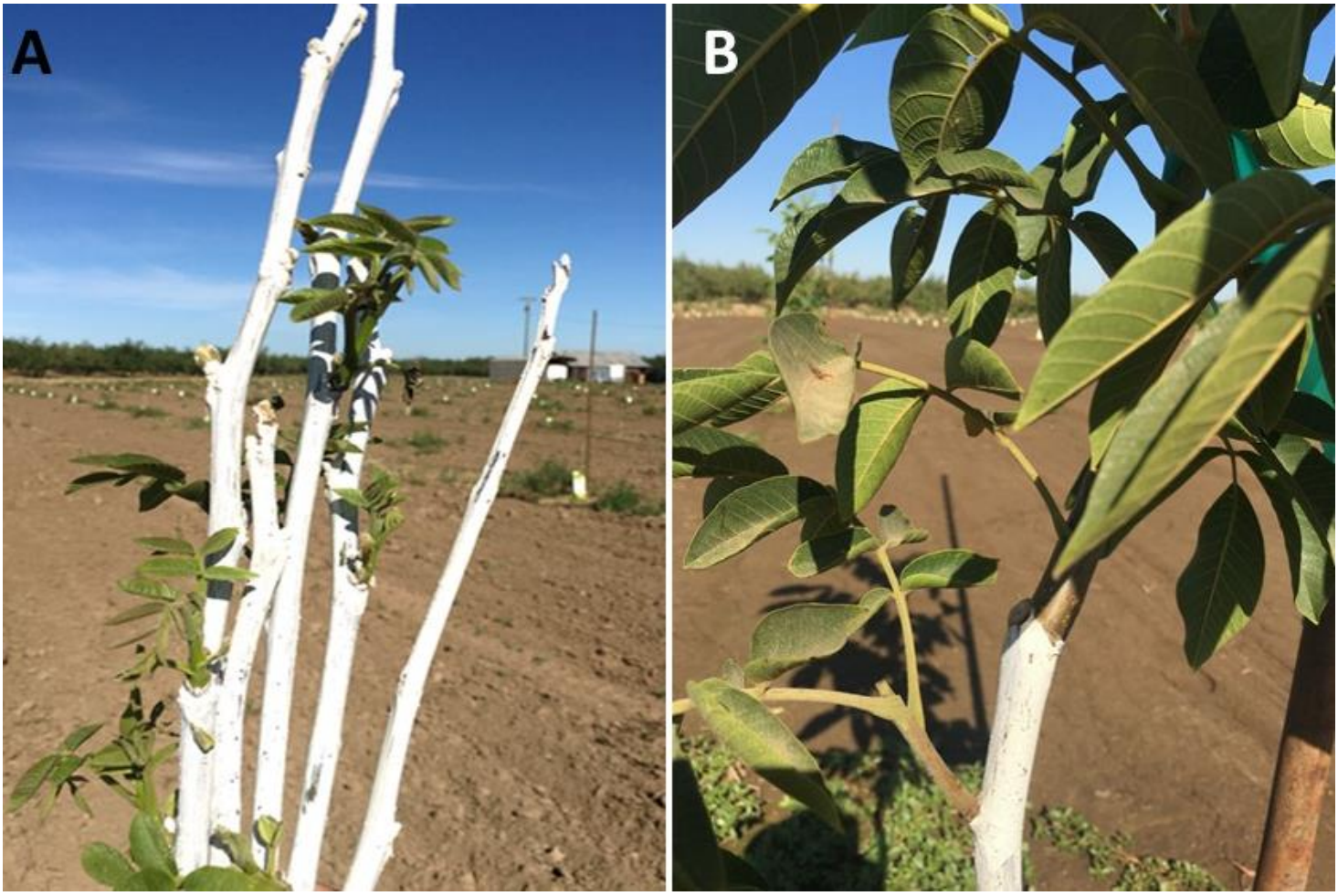

Fig. 6. Freeze damaged in 2nd leaf Chandler, **A.** pruned below the damaged tissue on April 30, 2020. **B.** Picture taken on July 30, 2020 showing tree recovery.

Fall 2020 Caused Cold Injury to Walnuts in Tulare and Kings Counties

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Freeze damage was reported in commercial walnut orchards throughout California during the winter of 2020. Although comprising the southern tier of the state's walnut-growing area, Tulare and Kings County orchards were not exempt from freeze damage. The damage caused by freezing temperatures in the fall are not perceptible until budbreak and leaf out the following spring. As a result, the extent of winter freeze damage is often not fully realized until well into the following season.

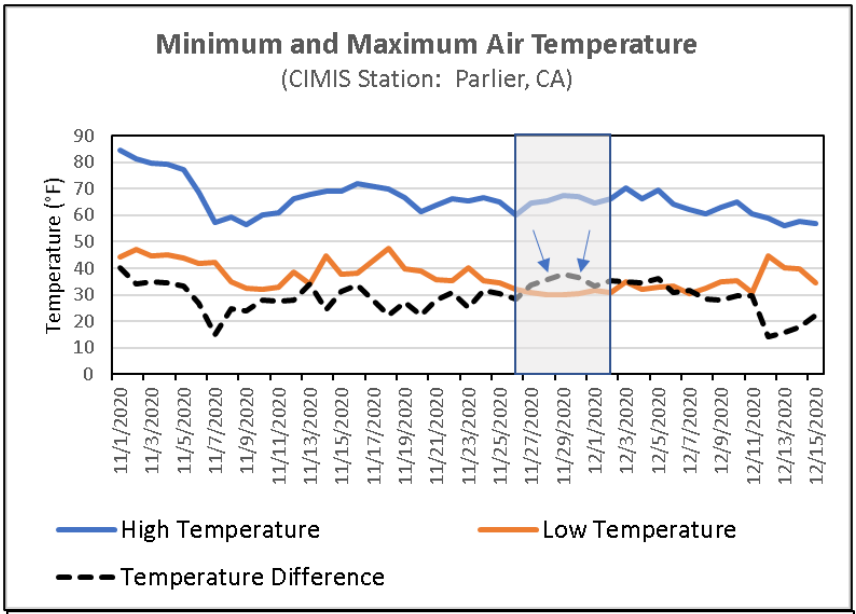

Figure 1. Minimum and maximum air temperatures acquired from a CIMIS station (Parlier, CA). The difference between high and low temperatures was also calculated and graphed.

Walnuts are most susceptible to freeze occurring in late fall and early winter, prior to onset of full dormancy. Freeze damage may be caused by either an abrupt or rapid decrease in temperatures or a large fluctuation between day and night temperatures. Both the probability and extent of freeze damage are mitigated by climatic conditions that allow for a gradual acclimatization of the trees to colder temperatures as they enter dormancy. Prior to complete dormancy, low temperatures of 22°F to 28°F may induce freeze damage; however, fully dormant trees may withstand lower temperatures (below 20°F) without sustaining damage (Sibbett, et al., 1998). Tree health and soil-water status may also influence the occurrence of freeze damage (Sibbett, et al., 1998). For example, during the winter of 2020-2021, dryland farmed mature walnut trees in Lake County were killed by freezing temperatures, whereas irrigated trees in the region did not sustain the same damage (Elkins, R. June 2021).

Freeze damage identified in young Tulare County orchards was likely caused by freezing temperatures in late November and early December 2020 (Figure 1). For seven consecutive days (11/26-12/2) temperatures plunged below freezing. This timeframe was also characterized by a large difference between high and low air temperatures, as indicated by the arrows in Figure 1. Greater differences between high and low temperatures are associated with an increased likelihood of freeze damage.

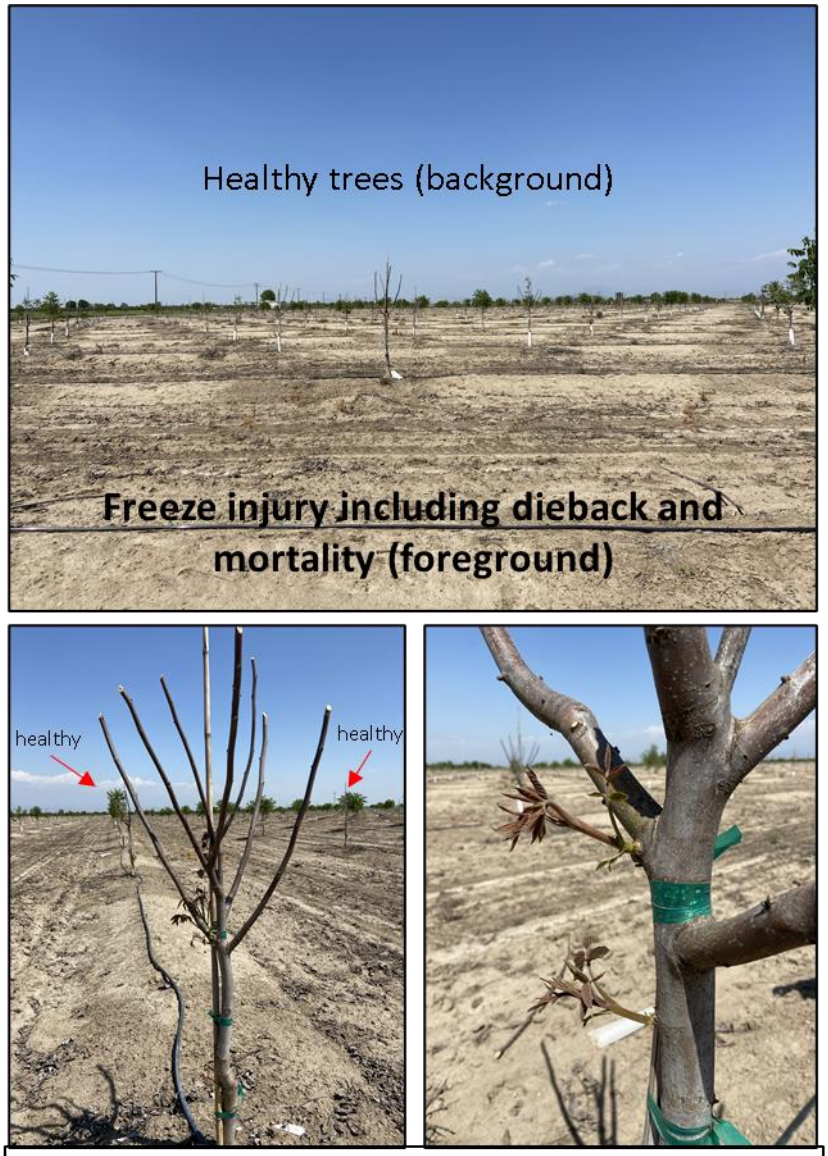

Figure 2. Cold damage may be limited to low-lying pockets in an orchard where cold air may settle. As a result, affected trees may be in discreet areas of the orchard and not evenly distributed throughout the site (A). Affected trees may be adjacent to healthy trees (B). Lower buds may survive (C) and push in the spring, and can be used to re-select scaffolds, if desired.

Diagnosing freeze damage is largely based upon the distribution of the symptomatic trees in the orchard as well as the distribution of tissue damage on individual trees. Freeze damage may appear in low areas of the orchard where cold pockets of air settle (Figure 2A). Affected trees may be adjacent to unaffected trees (Figure 2B). The outermost branches may die back but buds closer to the ground may survive and push in the spring (Figure 2C). Rootstocks are often less suscept to freeze injury due to the re-radiation of heat from the ground; however, excessively cold temperatures or cold air trapped by an inversion may offset the benefit of radiated heat from the soil surface. To diagnose freeze damage on a given tree or tissue, expose the cambium below the bark and look for darkened tissue. Growers may consider the potential to retrain scaffolds from surviving buds and shoots. The decision to retrain vs. replant may be based upon several factors including tree availability in the nursery trade, number of viable buds remaining, and overall extent of damage in the orchard.

Several methods have been suggested for preventing freeze damage in walnut orchards (Jarvis-Shean, 2016). Limiting nitrogen application and irrigation in September and during the post-harvest time will reduce the production of succulent shoot growth that may be more susceptible to cold damage as temperatures drop. Additionally, research studies conducted by Bruce Lampinen, CE Specialist, UC Davis, demonstrate that painting the trunks and shoots with dilute (50%) white interior latex paint after leaf fall will reduce the extent of temperature fluctuations at the plant surface,

particularly on the southwest side of the tree. Studies conducted by Wilbur Reil, Farm Advisor Emeritus, demonstrated that application of the paint after a freeze event can still mitigate the damage.

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K. Jarvis-Shean. 2016. Sac Valley Orchard Source. Avoiding Freeze Damage. (https://www.sacvalleyorchards.com/walnuts/horticulture-walnuts/avoiding-freeze-damage/)
Sibbett, S., Coates, W.W., Edstrom, J. 1998. Orchard Planning, Design, and Planting. In: Walnut Production Manual. UC ANR Publication 3373.

CAUSE AND MANAGEMENT OF LATE FALL COLD INJURY TO WALNUTS

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Growers throughout Lake County reported severe dieback of both young and older walnut trees. The following summary of major factors will be updated periodically as the season progresses.

Cause of Dieback – Though commonly labelled "winter injury" or "winter kill", the observed dieback was initially caused by defined periods of extreme cold during late fall, in many cases just before or during harvest. In fact, nuts suffered cold injury on the trees, resulting in substantial loss (without accounting for previously incurred sunburn). Western Weather Lake County *(http://westernwx.com/lakeco)* data for October, November, and December delineates the most likely date(s) damaging freezes occurred. While this article utilizes three stations in Kelseyville (Big Valley), Scotts Valley, and Upper Lake, you can locate your nearest station on the website. Scotts Valley was always coldest and recorded the most events and number of hours per event (duration) of temperatures below 32°F, with Upper Lake recording the least. However, *all* districts suffered damage during two major events occurring November 8-9 and November 11-12. These were preceded, and followed by, multiple events depending on growing location (e.g. Scotts Valley fell below 20°F in October, exacerbating damage). This period of freezing nights followed a period of warm, dry weather through November 6, with maximum daytime temperatures reaching the low 80s, resulting in severe damage to still actively growing trees not yet acclimated to cold.

Temperatures – In "normal" years, the combination of short days, dropping fall temperatures, and rainfall pattern allows trees to go into dormancy in a stepwise pattern. As temperatures drop into the low 30s and days shorten, carbohydrates move from leaves to wood and starch converts to soluble sugars. Sugars act as "antifreeze" to protect cells from freezing, as does adequate soil moisture, which keeps cells hydrated. Carbohydrate movement is likely disrupted when temperatures suddenly and prematurely drop below 32°F before the acclimation process is completed, rendering trees unable to acclimate properly. Winter injury most commonly affects vigorously growing young trees or 1 to 2 year old wood. When soils are dry and temperatures drop suddenly into the low 20's and teens, otherwise mild winter injury can become severe and affect mature trees normally less prone to "mild" freezing temperature above 27°F.

Tree Water Status **–** Young trees and wood suffer some winter injury to some trees almost every year, as described above. **So WHY Is Damage So Severe This Year??? *It is because it is SO DRY!*** Longtime walnut growers know cold damage is worst during a drought. The association between winter damage and dry soil conditions is well known and discussed in numerous UC and industry articles and newsletters going back decades. As summarized in the UC ANR publication *Understanding Your Orchard's Water Requirements (https://anrcatalog.ucanr.edu/Details.aspx?itemNo=8212),* walnuts require about 33 inches of water to meet evapotranspiration (ET) in Lake County. 2020 rainfall in the major growing areas ranged from about 8 (Kelseyville) to 11.5 inches (Upper Lake), *less than one-third* the amount
required to meet water use needs of both trees and ground cover (transpiration) and loss from the soil surface (evaporation). Rainfall was also relatively low in 2018 (range 20-27 inches) but recovered to 32-45 inches in 2019. The 'perfect storm' of conditions occurred in 2020: dry soil, sudden cold, and many trees weakened by two prior years of early cold damage and other factors described below.

In visiting orchards throughout the county, it is clear that trees with better water status GOING INTO THE FALL AND WINTER, mainly due to irrigation, were more likely to emerge from dormancy with at least a semblance of normal leaf out; many are growing very well. Adequately watered trees potentially benefitted in two ways. First, good late season water status allowed for normal carbohydrate assimilation and cold protection going into dormancy (Lake County orchards seldom suffer from excessive *early* season irrigation, thus "adequate" water refers to amount applied from about June through October). Second, these trees had more leaves during periods of late season warm weather. This is important because pre-mature senescence can 1) further reduce sugar reserves, and 2) increase direct infrared radiation to the open sky during cold events since leaves protect by keeping wood hydrated. Conversely, dryland or trees under late-season water stress (generally August - early September) likely had fewer reserves and fewer protective leaves. We will see how these trees fare during upcoming periods of extreme heat.

Carbohydrate Status **–** The Lake County growing season is restricted at each end by cold. The growing season starts later and ends earlier, with fewer frost-free (250 vs. 275-300) and fewer growing degree-days >50°F than the valley districts. Local growers have been sending walnut twigs from 14 orchard sites as part of the Carbohydrate Observatory Project managed by the Zwieniecki Lab. The purpose of the project is to learn how levels of various forms of carbohydrates (non-structural (NSC), starch, and soluble sugars) change over the season and how they affect growth and cropping (yield). Raw data from statewide orchards, including from Lake County, is available at *http://zlab-carb-observatory.herokuapp.com/* and most recent project results at *https://ucanr.edu/sites/cawalnut/showyears/2020/*. Because yield relates to conditions conducive to photosynthesis and carbohydrate assimilation, this unique effort is providing actual data to explain *why* it is more difficult for Lake County to attain similar yields as the valley districts on the same cultivars, e.g. Chandler (*NOTE*: yields and profit are different!).

Carbohydrate Observatory data from multiple statewide sites shows late fall is the critical time to restore sugars needed for dormancy and early, synchronous bloom. High carbohydrate reserves in early spring are also positively associated with high yield. Related research also found that early defoliation and girdling (to injure the phloem) impeded carbohydrate movement, resulting in delayed and asynchronous bloom. Trees were still leafed out and assimilating carbohydrates during the 2020 cold events (see above); one can thus surmise that sudden fall cold damage reduced carbohydrate levels going into dormancy, leading to late, erratic leafout and lower yields the following season[1]. It is interesting to note that total October-December 2019 carbohydrate levels from twigs submitted from Lake County were lower than the statewide average likely, translating into even greater propensity for inadequate reserves budbreak.

[1]If the temperature drops over 8°F per hour trees may not digest starch fast enough to produce soluble sugar or accumulate enough nitrogen in the stem to produce the compatible solute proline that would protect from ice crystals

formation in cells and cellular membrane damage. Fortunately, temperatures only dropped 1-2°F per hour during these freezing events.

Growing Site **–**There is much variation in the amount and severity of cold damage among and within orchards as **i**ndividual trees can be more or less susceptible to cold damage (see photos). Why one tree expresses injury adjacent to an apparent healthy tree of the same age and rootstock/cultivar is unfortunately often a mystery. Since root system health certainly influences overall tree health some answers likely lie underground. Any condition impeding root growth impairs water and nutrient movement and consequent ability of a tree to survive adverse conditions. Despite much variation and unknowns, damage often correlates with low areas, exposed southwest edges or corners, at the base of hills where cold air drains, and most importantly, on gravelly soils that hold less moisture. These gravel patches or streaks often correspond to old creek beds, drainages, or fill sites. Trees growing in these sites may look "normal" with adequate rainfall but show real stress in dry years. At the other extreme, Lake County seldom suffers from excess ***early*** irrigation common in valley orchards, but any condition impeding infiltration can also damage roots by reducing soil oxygen (anoxia).

Symptoms **–** Many "normal" appearing trees entering winter failed to "wake up". Trees of all ages showed damage symptoms, the extent of which was only observable at leaf out (when your calls, texts and emails started!). Symptoms this spring ranged from weak or dead terminal budwood and smaller upper limbs, to major limb death - mainly in the upper and exposed portions of the tree - to apparent whole tree death. Fortunately, in many cases, branches and whole trees that at first appeared dead eventually leafed out and are continuing to rapidly do so as the weather warms. Cutting below the bark reveals gray/black streaking the cambium, typical of discoloration from leakage after frozen cells ruptured. Darkened wood appears similar to sunburn, which may also be present, especially on south and west facing wood. New growth occurs below the damaged/dead locations. In most cases, the rootstock is fine (English are most susceptible to cold injury) and there may be root suckers at the base of trees.

1. Cold injured trees

2. Delayed leaf out

3. New growth subtending dead wood

Photos 1-3. Fall cold injury on 5th leaf 'Chandler' trees, May 2021 (photos: Rachel Elkins).

4. Healthy appearing well-irrigated trees

5. Cold injured (left), adjacent to health trees (right)

Photos 4-5. Young bearing 'Chandler' trees differentially affected by Fall 2020 cold damage (photos: Bruce Lampinen)

4. Healthy appearing well-irrigated trees

5. Cold injured (left), adjacent to health trees (right)

Photos 4-5. Young bearing 'Chandler' trees differentially affected by Fall 2020 cold damage (photos: Bruce Lampinen)

***Summer Management Implications* –** It is best to assess final canopy status once trees complete their regrowth process. Focus pruning efforts on removing damaged wood exposed to sunburn and consequential branch wilt, borers, etc., or branches that will interfere with the harvest process. **Paint exposed south and west facing trunks and major branches of *all* trees with 50% diluted water-based latex white paint (or organic alternative) to protect from sunburn.** Research performed by (retired) Yolo County Farm Advisor Wilbur Reil demonstrated that sun-exposed surfaces painted before and even shortly after cold events can also minimize winter injury. *Non-bearing trees* can be retrained if re-growing adequately. Allow some rootstock growth until the scion can support itself, then focus tree energy on the chosen leader, keeping side shoots pinched to about 12 inches. Young trees will grow late into fall as they lack crop. While every growing situation differs, we suggest tapering back irrigations in

September, then restarting (if water is available) *after* terminal buds on branches arising from the trunk are set to prevent going into winter too dry for all trees. *Mature trees* are less likely to grow late into the fall, but are more prone to stress during drought. Fertilize normally depending on crop (crop appears light this year, but this may or may not be due to the cold).

Given the drought and limited water supplies in many cases, irrigate all trees as normally as possible, emphasizing the hottest periods (several growers have begun using the pressure chamber to time irrigations this year). If no or little rain falls prior to or after harvest, growers with adequate water should *plan to irrigate down to at least one foot about (2 inches water) and preferably two feet about (4 inches) in the fall to replace soil moisture normally supplied by November-December rainfall.*

Pest Management - Consult UCIPM Pest Management Guidelines – Walnut *(https://www2.ipm.ucanr.edu/agriculture/walnut)* for details on seasonal pests. Remove sunburned branches to prevent branch wilt infection. Growers have asked about walnut husk fly (WHF) since many orchards currently lack "shaded" canopy. Hang WHF traps as usual since growth is occurring. Keep dust to a minimum to prevent spider mite build up if it remains hot and dry; these will further reduce photosynthesis and carbohydrate nutrition. Area IPM Advisor Cindy Kron identified bean thrips last season in one Upper Lake orchard; these move into trees from drying weeds and can also reduce photosynthesis and weaken trees prior to winter. CONTROL SUMMER WEEDS AND GROUNDCOVER, especially in dryland orchards that rely on natural moisture to survive (this makes reducing dust more difficult, but do your best). Manage gophers since they can weaken root systems. Watch for crown gall; bacteria can enter through damaged wood and cracks.

Frost Protection **–** Growers have inquired about frost protecting in the fall. No commonly employed frost protection method will protect trees from the extremely low temperatures and dew points sustained last fall, and most Lake County walnut orchards lack suitable irrigation systems needed for standard frost protection coverage. *However*, if water is available, irrigating several days ***ahead*** of a predicted radiation frost will supply moisture and warm the soil (see Tree Water Status).

Thoughts on the Crop **–** Growers have mentioned that catkins came and fell well before the pistillate bloom was ready to be pollinated, and it does appear the primary (first) nuts are relatively sparse (there are small nuts on the late growth). The lighter crop is likely due to multiple factors, i.e. *directly* due to a reduced number of growing points from previous and current years' damage, or *indirectly* as the result of poor carbohydrate status going into winter, resulting in weakened, erratic, delayed bloom and nut set. I believe that as the season goes on and growing weather improves (happening now!) the crop, as with the trees, will look very different by July. Until then, monitor the orchard, protect from sunburn, irrigate (if practiced), fertilize, and control weeds and rodents. **CONTROL WHAT YOU CAN!**

Thoughts on the Future **–** As stated above, Lake County walnut trees have endured multiple drought-related winter injury events, often over successive years. The fact that many grand old trees still exist testifies to their ability to eventually recover. However, after three successive years of untimely fall cold spells, multiple years of sub-par rainfall, and, very importantly, the changing *economic* landscape, one should consider the future. Some questions: 1) Is my growing location prone to low temperatures and its consequences in terms of restarting and regrowing trees and harvesting a sound crop? 2) Is it worth continuing to invest in aging trees and old varieties that provide lower returns? 3) Can I continue farming dry land trees during a drought? 4) If I irrigate, can I supply the trees adequately? 5) Finally, AND MOST

IMPORTANTLY, am I managing my orchard optimally to ensure the greatest chance of success in the event of ANY environmental and related circumstance? Are my cultural practices adequate? Do I control weeds and rodents, fertilize and irrigate properly, paint my trees (or trunk/southwest scaffolds) white to protect from sunburn and winter injury?

There are many questions to answer; we have only touched on the major aspects of the 2020-2021 winter injury event. Thank you to all who have contact us and offered valuable insight and experience; we welcome your continuing thoughts and observations. Please be encouraged that day-by-day tree growth will continue to improve; in fact, you may not recognize them by July! Finally, as always, all of us at UCCE are glad to answer your questions and to assist with your individual orchard situation; contact us via email or phone. The 2021 harvest season will be here in no time!