University of California
Agriculture and Natural Resources
Cooperative Extension Butte County

# Prune Notes

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*In this issue:*



*Submitted by:*

Dani Lightle,

UCCE Farm Advisor

## Prune Bloom, 2016.

*Franz Niederholzer, UCCE Farm Advisor, Colusa and Sutter/Yuba Counties*

It doesn't look like 2016 will see a large or even a good prune crop across the Sacramento Valley. Fruit set is very light set in many orchards around the region. Since wet weather at bloom is supposed to mean a good crop, what went wrong?

Blame the bloom weather, again, for the poor crop. It was windy, wet and cold with daily high temperatures 10°F or more below normal for early March. Good bee activity and mild to warm temperatures are needed allow both steps in fruit set; 1) pollination and 2) fertilization (pollen growth into the ovule). In Chico, there were five good bee hours (a good bee hour is when hourly average winds are below 10 MPH and temperatures above 59°F) in the eleven days from March 3 – 12, when prunes bloomed in the south Sacramento Valley. So, limited pollination could be a significant factor in the light crop. On top of that, with maximum temperatures below 60°F for much of bloom, pollen tube growth is slower compared to that in warmer (65-80°F) temperatures. If pollen tube growth is slow, the ovule may be unreceptive by the time the pollen tubes reach it. At the end of the day, how much of a role each of these factors impacted fruit set this year is hard to tell with any certainty, but these factors are most probably what hurt the crop.

**What to do in 2016 if your crop is short?**

Even if the crop is so light that it may not be harvested, don't give up on the orchard this year. If you do, it will cost you next year. Flower buds for next year are formed this summer. Water stress and/or nutrient deficiencies THIS year will harm those buds and the crop NEXT year. A healthy canopy of leaves builds strong carbohydrate reserves this summer and fall to over-winter and support strong bloom, fruit and shoot growth next spring. Leaf loss this summer from rust, spider mites or water stress will harm the trees' ability to build those reserves. The following are some suggestions for managing blocks that look lightly cropped this year. (The suggestions might seem suspiciously familiar.)

- Count fruit per tree in every orchard you farm. Know for sure what you have in the orchard. Knowing your crop load helps plan your fertilizer program. This should be done EVERY year, so you know what you are farming.
- Match your fertilizer program to your tree nutrient demand. Fruit nutrient use drives mature orchard nutrient demand, especially for nitrogen (N) and potassi-

UC Cooperative Extension, Butte County 2279 Del Oro Ave., Suite B, Oroville, CA 95965
(530) 538-7201 FAX (530) 538-7140 Email: cebutte@ucanr.edu Web Page: cebutte.ucanr.edu

um (K). A dry ton of prunes contains roughly 13 lbs of Nitrogen (N) and 20 lbs of potassium (equivalent to 24 lbs $K_2O$). Since most nitrogen and potassium fertilizers are applied to the soil and not directly into the tree, with some nutrients lost/tied up between application site and tree roots, more fertilizer should be applied to the soil than is needed in the tree to account for these losses and meet tree nutrient demand. In micro-irrigated (sprinkler or drip) orchards, a good estimate of nitrogen efficiency (N used in the crop/N applied to the orchard) is 70%, so 20 lbs N/acre should be applied to deliver 13 lbs N/acre into the trees to support the growth of one dry ton of fruit/acre. In a lightly cropped orchard, very little to no fertilizer K maybe needed during the growing season, depending on soil K levels and/or K fertilizer history.

- Don't over-fertilize, especially with N, or you will end up with excessive vegetative growth that will have to be pruned out next winter.
- Researchers at UC Davis estimate that mature prune orchards require 30 lbs N/acre to drive vegetative growth (shoots, spurs, etc.). Most of that growth is finished by the middle of June at the latest. At 70% N efficiency, that equals 43 lbs N/acre, applied to the orchard.
- Maintain adequate orchard moisture status. Research shows that moderate summer (July-August) water stress doesn't harm prune trees or production. Use a pressure bomb to track orchard water status[1]. Other options for efficient water management are ET estimates (see ET information link in this newsletter) or soil moisture sensors. Careful, efficient irrigation helps keep nitrate nitrogen in the root zone, where it is available to trees.
- Keep an eye on pests such as spider mites[2] and rust[3]. Control as needed to maintain a healthy canopy and avoid leaf loss and damage risk to the crop next year.

1. http://fruitsandnuts.ucdavis.edu/pressure_chamber_prunes/
2. http://www.ipm.ucdavis.edu/PMG/r606400411.html
3. http://www.ipm.ucdavis.edu/PMG/r606100611.html

## Weekly Soil Moisture Loss Reports to Assist With Water Management

UC Cooperative Extension and regional offices of the Department of Water Resources have teamed up to provide **"Weekly Soil Moisture Loss Reports"** for almond, prune and walnut orchards to aid with irrigation scheduling. Each report gives the amount of water used by a healthy, bearing orchards in the previous week and for the coming week based on crop-specific evapotranspiration (ETc) estimates. Estimates integrate the crop growth stage and weather measurements from nearby CIMIS stations. These reports can help you decide when to start irrigating and how much to apply when you irrigate, based on the idea of replacing the water that has been lost from the soil by evapotranspiration.

Reports are sent by weekly emails. Reports from Allan Fulton cover Gerber, Durham and Colusa CIMIS stations, and also include pasture, olives, citrus and turf grass. Reports from Kat Pope cover Dixon, Davis, Woodland, and Verona CIMIS stations. Email Allan (aefulton@ucanr.edu) or Kat (kspope@ucanr.edu) if you would like to receive these weekly reports.

# Pocket Gopher Management: Don't Wait Too Long!

*Roger A. Baldwin, Cooperative Extension Wildlife Specialist,*
*Dept. of Wildlife, Fish, & Conservation Biology, UC Davis*

Pocket gophers are short, stout burrowing rodents, usually 6–8 inches in length. They spend most of their time below ground where they use their front legs and large incisors to create extensive burrow systems. Common forms of damage include consumption of roots and girdling of stems and trunks that result in a loss in vigor of the plant, loss of irrigation water down burrow systems, and chewing on subsurface irrigation lines. Mounds can also result in additional problems including serving as weed seed beds, causing damage to farm equipment, serving as a hazard to farm laborers, interfering with harvest operations, and causing channeling that can lead to substantial soil erosion.

In California, pocket gophers (*Thomomys* spp.) may be responsible for more damage to orchards than any other mammal species given their widespread distribution, yet many growers choose to ignore them assuming that they will not cause substantial losses. To be sure, there are many orchards where pocket gophers are found, yet damage is not apparent. However, damage to root systems may still be present, potentially reducing yields; this needs to be studied further. Additionally, pocket gophers can be present in an orchard for several years without causing apparent mortality, yet within a short period of time they can switch to feeding on tree crops leading to substantial losses. The only way to ensure that pocket gophers will not cause substantial concerns is to minimize their presence in orchards. This is particularly important for young trees which are highly susceptible to pocket gopher damage.

Pocket gophers can breed at different times throughout the year, although there is typically a pulse in reproduction toward late winter through early spring. Management efforts implemented before this reproductive pulse will often be more effective as there will be fewer individuals to remove at that time. Additionally, pocket gophers mound more frequently during this period given high natural soil moisture. This makes identification of active tunnel systems easy, thereby reducing the time required to treat an orchard while also increasing the efficacy of these management efforts. It should be pointed out that if you intend to use burrow fumigants, high soil moisture is also key for effective control. All of this points to the importance of focusing management efforts on the winter and early spring seasons to minimize pocket gopher damage.

Pocket gopher mound.

A number of options are currently available for managing pocket gophers although most control programs center on trapping, burrow fumigants, and toxic baits. Given space limitations, I will focus on these three options. For additional information on managing pocket gophers, I suggest checking out the UC IPM Pocket Gopher Pest Note (http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7433.html).

## Trapping

Trapping is safe and one of the most effective methods for controlling pocket gophers, with recent studies showing that a 90% reduction in pocket gopher density is possible after two trapping sessions separated by 1 to 2 weeks. A third trapping session has resulted in complete removal of pocket gophers from some fields. Although a bit more time-consuming than burrow fumigation and rodenticide baiting, recent research has shown that trapping is actually a very cost-effective approach when soil conditions are ideal for trapping efforts (i.e.,

moist, friable soils with relatively shallow burrow systems) given the high efficacy observed with trapping. Trapping becomes a less practical large-scale management tool when treating hard, dry soils, but it still can be a good follow-up approach to alterative management options even in more difficult trapping conditions because it allows you to target remaining individuals that other tools might miss. In short, I think trapping should be a tool that all growers employ to some extent, even if it is not the primary tool they prefer to use.

The most common type of trap is a two-pronged, pincher trap such as the Macabee, Easy Set, or Gophinator, which the pocket gopher triggers when it pushes against a flat, vertical pan. Another popular type is the choker-style box trap, although these traps require extra excavation to place and may be a bit bulky to be practical in a large field setting. All pocket gopher traps can be effective, although the Gophinator has proven to be the most effective in recent trials. We have not seen a substantial benefit to covering trap sets. As such, it is generally easier to leave trap sets uncovered to speed up the trapping process. We have not observed any impact of human scent on traps, nor have we been able to identify an attractant that increases capture success.

**Fumigation**

Burrow fumigants can be effective at managing pocket gopher populations. Primary burrow fumigants have historically included aluminum phosphide and gas cartridges. However, as of January 1, 2012, carbon monoxide producing machines can now be used to apply pressurized exhaust to burrow systems.

Aluminum phosphide is the primary fumigant used for pocket gopher control; it is quite effective (around a 90% removal rate after two treatment periods) and has a low material cost, although labor costs can be higher. The primary method for applying aluminum phosphide is similar to that of hand baiting. You use a probe to find a pocket gopher tunnel, and drop the label designated number of tablets into the probe hole. The opening is then sealed to eliminate light from entering and the toxic gases from exiting the tunnel. Typically, you treat each burrow system twice to maximize efficacy. The key with aluminum phosphide treatments is to only apply when soil moisture is relatively high. Because of this, fumigation is typically most effective in late winter and early spring. However, fumigation after irrigation can also be a good strategy. Please note that aluminum phosphide is a restricted-use material. Applicators must be licensed and trained on its proper use.

Carbon monoxide producing machines are increasing in popularity for managing pocket gopher populations. The most common and best studied device is the Pressurized Exhaust Rodent Controller (PERC) machine. Efficacy with this device (~55 to 65%) has been lower than with aluminum phosphide, trapping, and strychnine baiting. Additionally, purchase costs for the machine are quite high. That being said, multiple burrow systems can be treated at once (up to 6), allowing applicators to treat fields much more rapidly. If the PERC machine is used very extensively, it appears to provide cost effective results, but it must be used very extensively to be considered as cost effective as burrow fumigation with aluminum phosphide, trapping, or strychnine baiting.

Burrow fumigation with gas cartridges is generally ineffective and expensive for pocket gophers, although their efficacy may be somewhat increased if a blower is used to diffuse the smoke throughout the burrow system.

**Toxic baits**

There are three baits for pocket gopher control: 1) strychnine, 2) zinc phosphide, and 3) anticoagulants (e.g., chlorophacinone and diphacinone). Both strychnine and zinc phosphide are considered acute toxicants. This means that they kill after a single feeding. Strychnine has historically been available in two concentrations in California: 0.5% and 1.8%. However, due to supply issues, strychnine importation into the U.S. is currently very low. As such, the 1.8% strychnine bait is no longer available for purchase. That being said, a recent in-

vestigation showed that 0.5% strychnine is still highly efficacious, with 100% removal rates observed across three fields. Keep in mind that pocket gophers can develop a behavioral resistance to strychnine if repeatedly used over time. As such, strychnine baiting should be supplemented with other management approaches to reduce this potential.

Zinc phosphide is also available for pocket gopher control; it comes in a 2.0% concentration. Bait acceptance can be low with zinc phosphide, as it has a distinctive odor and taste that pocket gophers are often averse to. Anticoagulants such as chlorophacinone and diphacinone are multiple feeding toxicants. With these rodenticides, individuals must consume the bait multiple times over the course of 3 to 5 days to receive a toxic dose. This means larger amounts of bait are required to maintain a ready bait supply over this time period. Because of this, acute toxicants are typically preferred over anticoagulants for pocket gopher control although none of these products have proven as consistently effective as strychnine.

There are two primary methods for baiting in fields: 1) hand baiting with an all-in-one probe and bait dispenser, and 2) a burrow builder. Hand baiting can be effective if you have relatively few pocket gophers in a field. For this approach, an all-in-one probe and bait dispenser is used to locate a tunnel. Once the tunnel is located, bait is directly deposited via a hand-crank or lever. Typically, it is recommended that each burrow system be treated at least twice to maximize efficacy.

Although hand baiting can be effective for smaller pocket gopher populations, the burrow builder can be a more practical method for treating larger areas. The burrow builder is a device that is pulled behind a tractor on a 3-point hitch and creates an artificial burrow at a set depth. Bait is then deposited at set intervals along the artificial burrow. While engaging in normal burrowing activity, pocket gophers will come across these artificial burrows and consume the bait within. This device must be used when soil moisture is just right. If the soil is too dry, the artificial burrow will cave in, but if it is too wet, the burrow will not seal properly and will allow light to filter in; pocket gophers will not travel down burrows if they are not sealed. Although convenient, the efficacy of this method has varied extensively among growers. Experimentation is key to determining the applicability of this approach for each grower.

Adult pocket gopher.

All of the techniques listed previously can be effective at removing pocket gophers from orchards. However, it is important to understand that most, if not all, techniques will require multiple applications to maximize removal rates. Not all individuals in a population will be actively creating mounds at a given time; you will not be able to target treatment applications if you do not know that a pocket gopher is present. As such, it is strongly recommended that you treat fields at least twice, preferably separated by 1 to 2 weeks, so as to maximize the likelihood that you will encounter all, or almost all, pocket gophers in the field. Your ultimate goal should be a reduction in population size of at least 90%. Even with effective removal, reinvasion into orchards will occur. As such, long-term monitoring will be required to remove reinvaders before populations have a chance to reestablish.

It is important to utilize pocket gopher management tools in an integrated manner. Continued reliance of one technique will ultimately result in lower efficacy as pocket gophers will adapt to avoid the management tool (e.g., strychnine behavioral resistance). Incorporating these tools with other management options such as flood irrigation and habitat manipulation will further increase the effectiveness of pocket gopher management programs.

## Prune Orchard Management Considerations – Fruit Development to Harvest

*Katherine Pope, UCCE Orchard Advisor Yolo, Solano, & Sacramento Cos.*

**MAY**

- *Check crop load and decide whether to shaker thin.* Track pit hardening and reference date so that crop load can be checked as soon as reference date is reached.
- *Plan fertilizer application for the season based on crop load.* Several smaller applications of potassium and/or nitrogen will increase the percent that is taken up by the tree compared to one large application.
  - **For nitrogen**, UC research has found prunes need about 12 lbs N/dry ton of harvested fruit, plus an estimated 30 lbs N/ac for tree growth in a mature orchard.
  - **For potassium**, if a large crop is set and potassium nutrition a question, apply foliar potassium sprays to avoid potassium deficiency. Rates of 20-30 lbs potassium nitrate per acre are commonly used. Lower rates in that range avoid leaf burn. If using foliar potassium sprays as your only source of K fertilizer, apply at least 100 lbs of potassium nitrate (50 lbs $K_2O$) per acre in four to five sprays through the season (April through July).
- *Judge when to start irrigating based on soil moisture monitoring, ETc water use and/or stem water potential.* Late rains mean soil moisture storage is higher this spring than we've seen in a few years. Be sure water is needed before you start irrigating. For more on using stem potential to know when to start irrigating, see http://anrcatalog.ucanr.edu/pdf/8503.pdf. For more on soil moisture use, see "Weekly ETc Emails" in this newsletter.
- *Monitor San Jose scale for crawler timing.* If dormant scale monitoring indicated control measures are prudent *and* dormant sprays were not applied, crawler treatment is another option for scale control. If you caught San Jose scale males in pheromone traps, wait 600-700 degree-days after first male trap to treat crawlers. Alternatively, wrap limbs with double sided sticky tape. Flag the branch and check the tape to watch for crawlers. For degree-day calculator and treatment options, see ipm.ucanr.edu/PMG/r606302111.html.
- *Obliquebanded leafroller (OBLR) pheromone traps should already be placed to stay ahead of larval damage.* Biofix is when moths have been caught two observation dates in a row. Start watching for larval damage 930 degree-days after biofix. Degree-day calculator: ipm.ucanr.edu/PMG/r606300511.html.
- *Walk the orchard weekly looking for leaf damage from aphids and rust.* To monitor thoroughly, inspect 40 pairs of trees weekly, walking down the row and examining the half of the tree on your left that faces you and the half of the tree on your right that faces you. Spend no more than 15 seconds per tree pair.
  - **For rust,** watch for bright, angular spots on leaves, checking low branches, replants, vigorous growth and previous hot spots. Treat at the first detection. Continue monitoring after treatment, and treat again if rust increases. For treatment options, see ipm.ucanr.edu/PMG/r606100611.html.
  - **For aphids**, watch for curled, waxy or silvery leaves, honeydew, and bees, ants or beneficials that prey on aphids. Trees with 10% of their leaf area showing aphid symptoms have a 'significant' population. Confirm damaging aphids (the young, wingless stage) are present. If more than twelve trees have significant populations, treat the orchard. If fewer than four trees have significant populations, no treatment is needed that week. For appropriate action if between five and twelve trees have significant populations, and for treatment options, see ipm.ucanr.edu/PMG/r606900211.html. If aphid populations are low after eight weeks of monitoring, monitoring can be cut down to every other week.
- *Cut out branches that are dead or damaged by Cytospora* now that leaf-out has occurred and dead limbs are obvious, but spring rains have mostly wrapped up. Be sure to cut several inches below canker symptoms to remove all infected tissue. Don't prune if there's rain in the forecast in the coming two weeks. Spores from dead wood can move in the air, so remove prunings and dead wood from the orchard.

- *Stay ahead of brown rot.* Prunes are susceptible to brown rot infection around pit hardening in early May that will often only show full-blown symptoms at harvest. Consider a preventative fungicide application if there's a history of brown rot and/or rain is likely in late April or early May. For more on brown rot, see ipm.ucanr.edu/PMG/r606100911.html.
- *Target fugitive weeds.* Survey weeds after summer annuals have germinated to identify 'the ones that got away' and how future weed management could be improved. Mow or cultivate as required. A weed survey sheet and weed ID photos can be found at ipm.ucanr.edu/PMG/C606/m606fcweeds.html.

**JUNE**

- *Continue monitoring for aphids and rust.*
- *Scout for OBLR.* When it's 930 degree-days since OBLR biofix, visually inspect 15 fruit from 80 trees (1200 fruit total) looking for larvae or larval damage. Treat if more than 2% of fruit (24 fruits) have larvae or larval damage. Treatment options at ipm.ucanr.edu/PMG/r606300511.html.
- *Add "watch for spider mites" to weekly monitoring starting June 1.* Check two different sections of the orchard each week. Spend about five minutes in each section checking 2-3 leaves (some inside and outside of the canopy) on 10 trees. Look for spider mites *and* predators (predaceous mites and sixspotted thrips). Treatment decisions should be based on population levels of both mites and predators. If more than 20% of leaves have mites, but less than 50% of the leaves have predators, treat for mites. If more than 60% of leaves have mites, treat even if most leaves have predators. For more on mites, see ipm.ucanr.edu/PMG/r606400411.html.

**JULY**

- *Continue monitoring for aphids, spider mites, and rust through July 15$^{th}$.*
- *Decide if preharvest fungicide for fruit brown rot is needed.* See ipm.ucanr.edu/PMG/r606100911.html.
- *Start measuring fruit pressure once fruit start to color.* Usually, it is 30 days, roughly, from first color to fruit maturity.
- *Use pressure readings to determine when to cut off irrigation ahead of harvest.* Fruit is mature between 3-4 lbs. internal pressure. Fruit lose 1-2 lbs fruit pressure per week. Hot weather = slower fruit maturity. Cool weather = faster maturity.
- *Gauge whether trees are receiving sufficient nutrients by taking a leaf sample mid-July for nitrogen and potassium.* Collect leaves from four non-fruiting spurs spread around the canopy from 30 trees. Include other nutrients in the analysis if there are local concerns. For example, add chloride analysis if groundwater is high in $Cl^-$ or if potassium chloride (muriate of potash) was used as a K source.

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