



ORCHARD FACTS



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Sacramento Valley Walnut Newsletter

The Science (and Art) of Ethephon Use on Walnut

Robert Beede, UC Farm Advisor, Kings County

Note: Spring temperatures were cold enough to delay walnut maturity similar to last season. Processors are therefore anxious to receive as much product as soon as possible to refill inventory and meet European export scheduling deadlines. Many are offering financial incentives to obtain new crop at the earliest date. These conditions cause growers to consider using ethephon to accelerate harvest. The following newsletter outlines the pros and cons.

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 90° 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 90° 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.

Additional Ethephon Use Considerations in the Sacramento Valley

Janine Hasey, UC Farm Advisor, Sutter and Yuba Counties

By the time you receive this newsletter, the time to apply ethephon to early season varieties will have passed. However, the timing for late season varieties like Chandler should be very close to packing tissue brown (PTB). Sampling nuts as stated in the previous article will give you the information you need to either apply ethephon to advance harvest or try for one shake harvest once you determine the date of PTB. Chandler has been responsive to ethephon application and many local growers have found treating certain blocks a good way to spread the harvest timing and drying into more manageable allotments of this widely planted variety.

Other considerations:

- Although Howard is responsive to ethephon, avoid using it in orchards with the “yellow Howard problem” since these trees are stressed. We do not know the cause of this malady yet but are working on it.
- The benefits of ethephon application are usually seen 14 to 23 days after application. Test shake a tree and evaluate hull adhesion before committing to the harvest.
- In addition to earlier harvest reducing navel orangeworm damage by avoiding the last flight, mold damage can also be decreased by avoiding early rains.
- Nuts delivered to the huller/dryer without hulls dry quicker than nuts delivered in hull. Less drying time should be needed the earlier the hull cracks and separates from the shell.

Considerations When Replanting Individual Trees in a Walnut Orchard

Carolyn DeBuse, Farm Advisor, Solano and Yolo Counties

Bill Krueger, Farm Advisor, Glenn County

It happens often that a tree will die within a healthy orchard. The question is do you replant or do you leave that tree spot empty? If you decide to replant, what is the best way to grow the young tree while still maintaining the surrounding orchard. This article will take a look at considerations when making replant decisions and some practices that will help the interplant survive.

Sunlight availability:

When making the decision to replant or not the most important question to ask is; “Is there enough sunlight to grow the replant to production size?” In many cases the interplants are planted into a shaded orchard and they struggle to reach full size and many never do. If the tree can’t reach full size then it may not be worth the expense in time and money to replant.

- **Age of the orchard and canopy cover:** The age of the orchard is the first consideration when deciding if to replant. If it is a young orchard and sunlight at the tree location is available throughout the day replanting is a very good option. If the orchard is older and the tree canopy is at 75%-95% coverage the likelihood of the replant growing well is slim. The yield loss may be somewhat regained when the surrounding trees increase their fruiting area because of the increased light caused by the open space left by the missing tree. If this is the case it may not be worth the trouble to replant.
- **Orchard planting space:** In wide-spaced or standard spaced orchards there may be more sunlight for the replant. Trees in hedgerow orchards are so close together that the surrounding trees will quickly fill in the space left by the missing tree. It is not often recommended to replant within a hedgerow.

Why did the tree die?

It is important to understand why the tree died because it relates to the success of the replant and steps you should take when replanting. As the tree’s health declines try to evaluate the reasons it is sick by looking for symptoms of disease or pests. Take tissue samples to a plant pathology lab or request help from your PCA or Farm Advisor to identify the cause. It may be that the orchard practices can be improved or preventative measures can be taken to moderate the chance of other trees becoming sick.

- **Soil borne pathogens:** Often a tree will succumb to root and crown disease while the rest of the orchard seems unaffected. In the case of Phytophthora or Oak Root Fungus, the fungus will remain in the soil and the interplant may become infected soon after planting. Opening the planting hole and letting the soil dry throughout the summer may reduce the fungi’s efficacy. Future irrigation should be applied carefully to avoid water logging the soil which encourages the fungi while reducing tree growth. Nematodes can also be a reason for slow tree decline and a soil sample, with roots included, should be sent to a lab to test for them. Any soil borne pathogen may be reason enough to decide not to replant if surrounding older trees are still yielding well.
- **Saturated soil problems:** If the tree succumbs to overly wet soil conditions either with over irrigating, heavy spring rains, or high water table, consider not replanting until the problem has been resolved.
- **General decline:** General decline often happens in older orchards when there are many pests or diseases that can be found on a single dying tree. The tree may have dieback caused by sunburn, lack of vigor, branch wilt, Botryosphaeria, or Phomopsis. Trunk cankers from shallow or deep bark canker are often found in declining orchards. Crown gall can by itself reduce the health of the tree and shorten its life. If the orchard has many trees in some state of general decline it may be better to

farm the orchard until it is no longer economical, after which the whole orchard should be removed and replanted. It would not be recommended to replant individual missing trees in an orchard that is in general decline.

Time and Inputs Considerations:

Your time and money are worth something so consider the effort and time needed to grow an interplanted tree. Each tree will need to be hand fertilized, staked and tied, pruned, and the irrigation modified. The cost of the tree and labor may be greater than the loss of the yield in your orchard. If the replanted trees are not well taken care of or they do not receive enough sunlight then it is doubtful that they will ever yield enough for the return in your investment.

Tips on successfully replanting individual trees

After careful consideration, you have decided to replant the missing trees. The best way to have success is to follow the good planting practices that are well known for planting a new orchard. The following are the highlights but previous newsletter articles have covered these subjects more in-depth.

- **Root removal:** When removing the dead tree excavate a large area and try to remove all the roots. The excavation area should be about 8-10 foot square. Using a backhoe will help loosen compaction, dry out and mix the soil, preparing for spot fumigation and reducing compaction.
- **Fumigation:** Spot fumigation increases the chance of replant success. There are individual tree site label rates for Chloropicrin, Telone C-35®, and Methyl Bromide. Drying out the soil and getting a good seal is important for fumigation success. Check with your county Ag Commissioner for current restrictions and regulations before applying any fumigant. For more information reread the article “Best Management of Replant Alternative Fumigants”
http://ceglenn.ucdavis.edu/newsletters/July_2009_Walnut_Newsletter24165.pdf
- **Rootstock choice:** In a replant situation you want a vigorous tree and if possible you want a rootstock that can handle the soil pests and diseases that may be there already. Paradox seedling is more vigorous than California Black and is typically a better choice in a replant situation. Clonal Paradox Vlach and VX211 are also very vigorous. VX211 has shown tolerance to nematodes and Vlach moderate resistance to crown gall. In orchards where Phytophthora is present, clonal Paradox RX1 may be a good choice. Clonal rootstocks are commercially available. For more information reread the article “Clonal Paradox Update”
http://ceglenn.ucdavis.edu/newsletters/Orchard_Facts31583.pdf
- **Plant correctly:** Good planting practices need to be followed when planting interplants. It is important to rebuild the berm and make sure the tree is planted high. It is a common mistake to replant the tree too low with a sunken area around it creating a wet situation around the crown of the tree and lowering the tree’s chance of survival. For more information reread the article “Guidelines for Planting Walnut” http://ceglenn.ucdavis.edu/newsletters/December_200824173.pdf
- **Irrigation:** Irrigation is very difficult for replants. The young tree needs less water than the older trees in the orchard but the water has to be accurately placed into their root zone. Relying on the mature orchards irrigation system can leave the little trees too wet or too dry. The best set up is a modified drip or micro sprinkler for the each tree with care to adjust it throughout the season as needed. If there are a number of replants in the orchard it may also be possible to shorten the intervals between irrigations and reduce the time or amount of application without significantly changing the total application to better meet the needs of the replant while adequately irrigating the mature trees. This would only be necessary until the replants become established.
- **Fertilization:** This is one of the most important points to remember when interplanting in a mature orchard. The young tree is being planted in the same location that the removed tree mined for

nutrients in the previous years. For success it will need to be fertilized much more regularly with small amounts each time. In many cases a full fertilizer with nitrogen, phosphorous, potassium and zinc has shown positive results in the first year of growth. Hand application is the easiest way to manage this.

- **Light management:** If the decision is made to replant but shading is a concern it may be necessary to prune back the surrounding trees just enough to allow for good light penetration for the developing replant.

How Traps Are Used to Monitor Walnut Husk Fly

Richard P. Buchner, Farm Advisor, Tehama County

Cyndi K. Gilles, UCCE Tehama County

Placement – Trap placement is very important and influences how well walnut husk fly (WHF) traps work. If possible, place traps in “hot spots” where nuts were damaged the previous season. After feeding in the husk, mature larvae drop to the ground and burrow several inches into the ground to pupate. So areas infested last year are more likely to have flies this year. Traps should be hung on the north side of trees, high in the upper one third of the canopy in areas where husk flies are most likely to appear. They prefer cool, damp, shaded areas. A black walnut tree is also a good trap location. Good trap placement is particularly important when monitoring low WHF populations.

Trap Selection – “Supercharged” AM NB (apple maggot no bait in the stickem) traps are recommended to determine when WHF appear and to detect female flies with eggs. Traps are yellow sticky cards with a vial or packet containing ammonium carbonate. Ammonium carbonate makes the trap 4 to 10 times more attractive. Walnut husk fly traps are commercially available and differ in catch efficiency.

Trap Numbers – If “hot spots” are unknown, additional trap density is necessary. Even the smallest orchards should have at least three traps. For orchards between 30 and 100 acres, one trap for every ten acres is suggested. For orchards over 100 acres, one trap for every 20 acres should be adequate.

Supercharger attractant – The condition of the ammonium carbonate is crucial for trap performance. Check the effectiveness of the ammonium carbonate by smelling for ammonia. Each time you check the trap, stir or shake the container and carefully smell check for ammonia by waving your hand over the container. If you can’t smell ammonia the supercharger is not working and the ammonium carbonate needs to be replaced.

Orchard Location – Walnut husk fly development is related to the availability of food. Food availability varies from orchard to orchard causing fly development to vary as well. As a result, each orchard must be monitored and treated separately. WHF decisions based upon adjacent orchards are usually faulty.

Timing – In the Sacramento Valley WHF emerge as adults from June until early September. It is critical to get traps up before the first fly emergence and check traps frequently throughout the season. Check traps two or three times per week until three weeks before harvest.

Trap Limitations – You can determine when flies are emerging and if females contain eggs from supercharged yellow sticky panels. However, traps are not particularly good at predicting population size or damage potential. No numerical treatment thresholds are available for WHF and damage can occur with low trap catches. For the most accurate spray timing, check females for eggs and apply treatment to prevent egg laying. Figure 1 shows WHF monitoring and the associated treatment strategy.

Additional Information – Check with your extension office to buy or view the “Walnut Husk Fly: Biology, Monitoring and Control Strategies” CD.

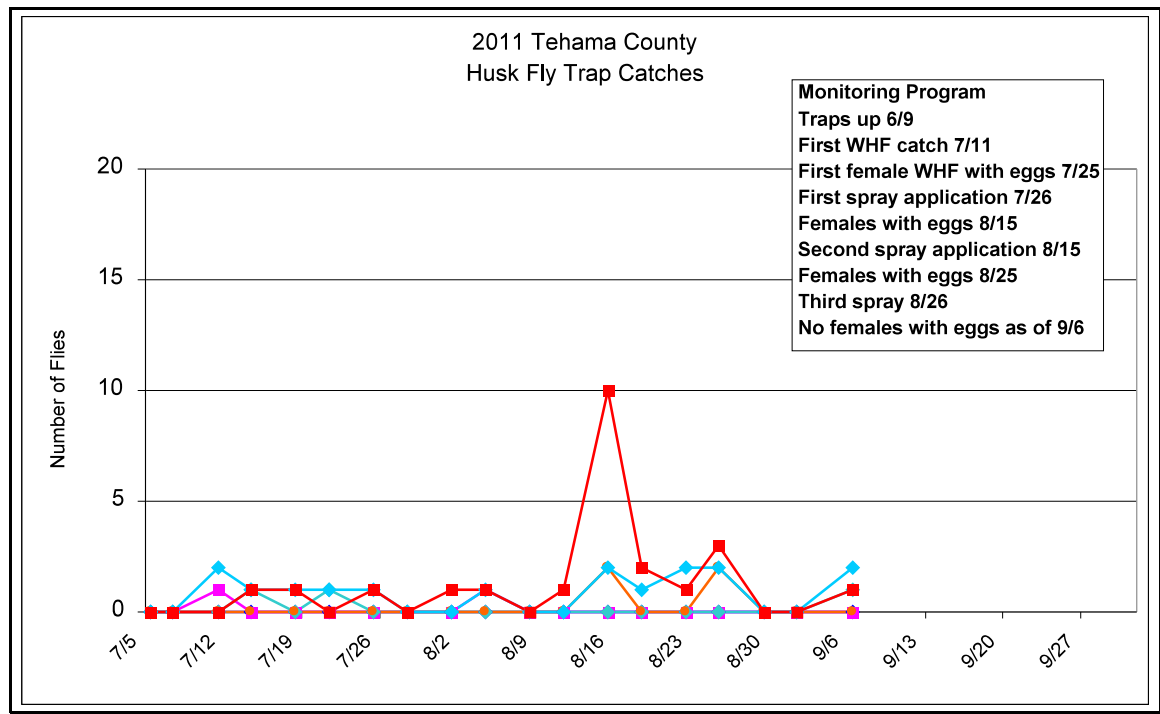


Figure 1. 2011 Walnut husk fly activity for a Tehama County Hartley orchard. Multiple lines represent different traps and locations within the same orchard.

Walnut Huller and Dehydrator Food Safety Good Manufacturing Practices (GMP) Checklist

Janine Hasey, UC Farm Advisor, Sutter and Yuba Counties

A huller and dehydrator good manufacturing practices (GMP) handout has been developed by the Grades and Standards Committee of the California Walnut Board. The checklist describes the actions you can take to help prepare your operation for an FDA inspection. Although these standards are voluntary only, they are well-accepted and reflect the best practices available today. Contact Carl Eidsath (CEidsath@Walnuts.org) at the California Walnut Board if you would like a copy of the handout.

Useful Websites Related to Walnut Production

Bill Krueger UCCE Farm Advisor Glenn County

The internet is one of the greatest developments of recent history. It allows us to have a great source of information at our fingertips. Following are some links to websites that I have found useful for information related to walnut production and related topics. This is by no means an exhaustive list and is in no particular order.

UC Fruit and Nut Research and Information Center –Information related to the production of fruit and nut crops: <http://fruitsandnuts.ucdavis.edu/>

For the Walnut page- Click on “Fruit and Nut information” then choose “walnut”

Walnut Research Reports – contains all of the walnut research reports from projects funded by the California Walnut Board from 1971 through 2010 and is searchable by subject and author:

<http://walnutresearch.ucdavis.edu/> -

UC IPM – Integrated Pest Management of a wide variety of pests including Pest Management Guidelines (PMG) for a wide variety of crops: <http://www.ipm.ucdavis.edu/>.

For the walnut PMG add /PMG/selectnewpest.walnuts.html to the address or choose “Agriculture and floriculture” then click on “walnut”.

UC Cost Studies – Establishment and production cost studies for a wide variety of California crops. <http://coststudies.ucdavis.edu/> for walnuts in the Sacramento valley add /files/walnutsv2007r.pdf to the address.

UC Cooperative Extension County websites – Individual websites for the counties are written all the same except differing only in the county name: cecountyname.ucdavis.edu. Put your county name in the place of countyname in the address which will take you to that counties website. An example would be: ceglenn.ucdavis.edu . In addition to other information, you can find back issues of this newsletter.

Kearney Agricultural Research and Extension Center - <http://www.uckac.edu/>

For the latest information on managing nematodes in perennial crops add /programs/Nematodes to the address.

For the latest on fungicide and bactericide efficacy and timing of tree fruit, nut, strawberry, and vine crops add /files/106962.pdf to the Kearney website address. This can also be found at the UC IPM website at the bottom of the walnut page.

Natural Resources Conservation Services (NRCS) web soil survey- for soil maps for your area of interest, <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

Weed Research and Information Center- <http://wric.ucdavis.edu/index.htm>

Ground Squirrel management – http://ucanr.org/sites/Ground_Squirrel_BMP/

Fall, 2011 Regional Prune Newsletter

New Prune Rootstock Research is Underway

Carolyn DeBuse, UCCE Farm advisor, Solano and Yolo Counties

It has been a long time since a rootstock research project has been undertaken for prune. The prune industry has been lucky to have a small selection of durable, proven rootstocks that have worked well enough. There is hope that we can find a better rootstock for many of the problems the industry faces such as excessive suckering, poor anchorage, soil borne nematodes and fungal pathogens. UC Cooperative Extension advisors and specialists have initiated a rootstock research project to look at rootstocks that have been imported from other countries or bred for *Prunus* species but not yet tested in the California climate with French prune.

The project consists of two large replicated trials of the most promising rootstocks placed in growers orchards and one smaller trial of rootstocks that may have a possibility but have had very little testing until now. The rootstocks to be tested in the large trials are M30, M40, M58(all three are from the Marianna plum series), HBOK 50(Peach), Krymsk 1(plum hybrid), Krymsk 86(peach/plum hybrid), Rootpack R(plum/almond hybrid), and Empyrean 2(European plum: *P. domestica*). These are being compared to currently grown rootstocks – Myro 29C, M2624, Myro seedling, and Lovell seedling. The large rootstock trials were planted this spring in Yuba and Butte Counties. In following years, we'll provide research updates on these trials as we observe effects on anchorage, tolerance to Bacterial Canker, nematode resistance, compatibility, yield and fruit quality, and overall performance.

Considerations When Removing Prune Orchards

Joe Connell, UC Farm Advisor, Butte County

If you're removing an old prune orchard to replant prunes or if you're taking out a block with plans to convert to another orchard crop there are some things you should consider before the trees are removed. We know that Sacramento Valley prune orchards are primarily hosts to ring and root lesion nematodes (*Criconemoides xenoplax* and *Pratylenchus vulnus* respectively). These nematodes can affect establishment of a new prune orchard since high ring nematode populations aggravate the bacterial canker problem in young trees.

The root lesion nematode can be especially problematic if a prune orchard is removed and the new orchard is planted to walnuts. Walnuts are an excellent host for root lesion nematode and this nematode will stunt the growth of new walnut trees if populations are not controlled. If root knot nematode (*Meloidogyne incognita*) is present in the prune orchard, following prunes with an almond orchard planted on Krymsk 86 rootstock could also be problematic since this rootstock is especially susceptible to root knot nematodes.

Sampling and diagnosis for the presence or absence of nematodes should be done **before** an existing orchard is removed. Having a nematode test done on soil sampled from a site will help inform your decisions about how to remove the existing orchard and what needs to be done before replanting the specific block.

Nematode soil pests can persist for the lifetime of the orchard and must be dealt with when replanting.

Instructions for soil sampling for nematode testing can be found at:

<http://www.ipm.ucdavis.edu/PMG/r606200111.html>

Dr. Michael McKenry, Nematologist at the UC Kearney Agricultural Center, has suggested that starving an existing nematode population by killing the complete root system before stumps are pulled out and switching to an unrelated rootstock can help with the replant problem and potentially reduce nematodes. To employ

this strategy, harvest fruit as soon as possible, then, before mid-October, irrigate deeply, sample for nematodes, cut off old trees at trunk level, and apply a systemic herbicide to the cambium on cut trunks. Used this way, glyphosate will effectively kill prune roots. Wait at least 60 days before removal of the old treated tree trunks. Then, it's essential to wait for at least one full year (12 to 18 months) before replanting to minimize the replant problem. The longer the period the greater the likelihood of success. This herbicide treatment will not reduce populations of root lesion or other nematodes living in the soil, only those within roots. It effectively removes the roots as a food source for nematodes. The ring nematode, if prevalent in a potential bacterial canker site, can be reduced in number without causing a biological vacuum by growing sorghum x sudangrass for one full year.

Adequate nematode control is accomplished by fumigating the surface five feet of soil profile. Spot treatments at tree sites or strip treatments 8 to 12 feet wide will only provide one year of nematode relief. If root lesion or ring nematodes are considered to be a future problem, solid fumigation should be employed or expect to treat the new orchard annually with post-plant nematicides. For more information refer to Dr. McKenry's website at http://www.uckac.edu/programs/Nematodes/IPM_guidelines_for_replanting/

Prune Orchard Fertility Review: Focus on the “Key 3”

Franz Niederholzer, UC Farm Advisor, Colusa/Sutter/Yuba Counties

Fall is a good time to review the past season and plan for the next. What was new or different this past year? What are the basic inputs required to maintain high yields and return a profit?

Some things don't change. Adequate prune orchard mineral nutrition is critical to maintaining high yields and good orchard health. Focus on maintaining the “Key 3” – nitrogen (N), potassium (K), and zinc (Zn). Although in certain orchards other elements may be important based on local conditions, adequate N, K, and Zn are needed across the region for good prune orchard yields.

Some things do change. Fertilizer costs are up. Prune prices are steady to dropping. Maintaining good return on your fertilizer investment is key to staying profitable. Don't pay more for fertilizer than you need.

Here's a quick prune orchard fertility review, in order of importance to prune production.

Potassium (K) is the most important mineral nutrient in prune production. Prune fruit accumulate potassium steadily from bloom through harvest. In July and early August, as root growth slows and soil moisture is used rapidly, tree K uptake may decrease. However, fruit K needs are unchanged and fruit “pull” K from the rest of the tree, especially leaves. This causes leaf K content to drop, risking potassium deficiency if leaf K levels were not high enough going into summer. Potassium deficiency starts a devastating cascade of trouble -- potassium deficiency à leaf scorch and drop à sunburn à *cytospora* infection à leading to limb or scaffold death and à a loss of orchard production that can last for years. Keeping adequate potassium in a prune orchard is essential to sustainable production.

Prune fruit need a lot of potassium. Prune orchards with a heavy crop need a lot of potassium. Traditional University of California annual K fertilizer maintenance programs suggests 400-500 pounds of potassium sulfate (0-0-50; sulfate of potash) per acre banded in the fall in orchards that are solid set irrigated or shanked in where orchards are cultivated or flood irrigated. Orchards with well drained soils that receive significant winter rains can use potassium chloride (0-0-60; muriate of potash) at about the same rate. Those rates cost \$200-220/acre in today's market – a huge amount of money to ante up before you know what your crop will be like the next year.

Alternative plans to a big slug of K in the fall are 1) injecting potassium fertilizer through drip or micro-sprinkler irrigation lines in the spring and summer, 2) a steady foliar program of a minimum of the equivalent

of 100 pounds of KNO_3 /acre or 3) some combination of option 1 & 2. In season K fertilization allows growers to check the crop size before putting on any K fertilizer. A light crop may require very little if any K fertilizer.

Traditional fertilizers such as ground applied potassium sulfate and foliar applied potassium nitrate are proven effective. Be careful when looking at new products, as those have risks as well. Here are some examples...

- Potassium thiosulfate (KTS, 0-0-25) is an effective liquid fertilizer that can be injected through micro-irrigation systems. However, high rates of KTS (more than 10 gallons/acre/application) can damage or kill trees depending on the orchard conditions.
- Alternatives to KNO_3 for foliar K fertilization are available in the market. Many are liquids that are easier to mix than solid fertilizers. Potassium nitrate (KNO_3) is a good, efficient foliar fertilizer that won't burn leaves when applied at reasonable rates (20-25 lb KNO_3 /acre in 100 gallons. When using liquid potassium foliar fertilizers to replace KNO_3 in a spray-only program (no soil applied K fertilizer) in an orchard carrying a good crop, use the amount of material equivalent to 100 lbs of KNO_3 /acre/season. Multiple sprays will be needed, just as in a KNO_3 program. Otherwise you run the risk of under supplying your orchard with potassium.

A solid potassium fertilizer program is a cornerstone of a good prune orchard management program. Cutting corners with your potassium fertilizer program can put the health of your orchard at risk.

Nitrogen (N) is essential for good prune production and tree health. Nitrogen deficient prune trees make fewer flowers and therefore set smaller crops. Prune trees with low N levels are more susceptible to bacterial canker than trees with adequate levels of N. Trees store N over the winter in woody tissue to use in spring growth. An orchard with a good leaf N level in July leaf samples (good storage reserves) shouldn't need N fertilizer until mid-April the next year once the crop can be checked. Light crops mean less N fertilizer need, much like K. If July leaf N levels are low, an application now, before trees go dormant, may be warranted. If you plan to do this, remember that trees have limited N storage space and that once leaf drop occurs, prune trees don't absorb N from the soil. If you are going to apply fertilizer N now, use low rates (<50 lb N/acre) and get it on early (not later than September).

Zinc (Zn) is important to healthy growing points in plants. Bloom thru spring is the time when the most growing points are found on plants and so is the period of highest zinc demand. To meet this timing need, zinc is usually applied as a foliar fertilizer in the fall or spring. A high rate (20+lb/acre) of zinc sulfate ((36%) sprayed in the fall once natural leaf drop begins delivers zinc to prune trees and removes leaves. In my experience, early defoliation following a fall zinc sulfate spray won't occur if the orchard is dry. A good alternative to a high rate of zinc in the fall is 4-6 lb/acre 52% zinc (neutral zinc, etc.) in the spring, preferably before leaves reach full size and no later than mid-May. There are many different zinc foliar materials. Many effectively move zinc into trees, but cost and risk of phytotoxicity vary from product to product. Talk with your PCA about the most cost effective options that supply sufficient elemental zinc.

Prune Research Reports Now Available on the Internet

Prune research reports from 1961 – 2010 are now available, free, on the internet at:

<http://ucanr.org/sites/driedplum/>. Are you curious about aphid management or potassium nutrition? Type "potassium" or "aphids" into the search "box" on the site and hit the "search" button. Not sure what topic it is you want – potassium, potash, fertilizer, or nutrition – click on "Reports by Category" to see all the categories in the data base. Want to see all the reports from a certain year? Click on "Reports by Year". This valuable web resource was supported by a grant from the California Dried Plum Board to the University of California, Davis Fruit and Nut Research and Information Center with support from the UC ANR Communications Information Service Center.

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