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***Are We Leaving Too Much Wood When We Train And Prune Pistachio Trees*?**

Dr. Louise Ferguson, UC Pomology Specialist at the Kearney Ag. Research Center in Parlier, and Bob Beede, UC Farm Advisor in Kings County, have both shown very convincingly that trees within an orchard subjected to greatly different experimental defruiting, pruning and/or mechanical topping/hedging treatments, generally produce similar cumulative yields (or average annual yields) when calculations are made, for example, over a six-year period. If fewer nut clusters are present, the trees compensate by producing more nuts per cluster. If fewer branches are present, the trees produce more clusters per branch. If branches are shorter, the trees produce more clusters per foot of branch. If the pruning is very severe, what the trees do not produce this year, they will make up for the following year or years. These results suggest that the limiting factor to yield in pistachio year in and year out is the supply of carbohydrate available to the tree, and not to any deficiency in locations on a branch for the tree to produce and maintain flower buds.

We as an industry, appear to be training trees not only to produce strong scaffold branches (which the tree will need), but also to maximize the number of branches which we hope will eventually result in maximum flower bud production, cluster development and maximum nut yield for that year. However, as discussed above in the first paragraph, locations for nut clusters are not the limiting factor to nut yield over the alternate bearing cycle. Environmental restrictions on the ability of the tree to produce the carbohydrate necessary to fill those nuts probably are. A case can be made that we are leaving too much wood in the tree. Training a tree for maximum branching may produce a tree with too many flowering positions probably encouraging an early appearance of alternate bearing in a young orchard. Many sites for clusters translate into a large carbohydrate drain on the tree to fill the nuts in those clusters, leaving much less carbohydrate for the tree the following year. There is no need to "save" every branch that the tree produces. In the off-bearing year in a tree expressing severe alternate bearing, that saved branch will just be one more branch of many without any nuts on it.

Encouraging excessive branching, and leaving those branches in the tree too long, can greatly complicate pruning those trees, as the trees get older. Many 14-year old or older pistachio trees on vigorous *P. integerrima* rootstocks and planted on deeper soils exhibit, as currently pruned, so many large scaffold-like branches within the canopy that these branches, themselves, do not have room to sub-branch. In trees with shaded, crowded canopies like these, the only place for new fruitwood to be produced is at the outer canopy, requiring that the tree constantly increase in size until mutual shading within and between trees is maximized, and fruitwood lower in the tree disappears. This problem appears particularly acute in closely spaced orchards.

Perhaps training and pruning should be approached with a multi-year outlook, in much the

same way that the tree appears to partition carbohydrate into nut yield. By having the pruning and training crews perform more thinning cuts (as opposed to only making heading cuts) light penetration within the tree canopy and between tree canopies may be increased. Each scaffold branch may then have space to produce a framework of smaller branches and maintain fruitwood on these branches because of less shading. Tree height can probably be reduced as well compared to trees with many branchless scaffolds, perhaps improving harvest efficiency. Any yield lost in any given year through branch removal prior to an on year will likely be returned the following year through dampening of the alternate bearing cycle.

A tree having many scaffolds that do not branch is probably a clue that the tree has too much wood left in it. A number of these branchless scaffolds could be removed with little effect on longer-term yield accumulations. A little on-farm experimentation with pruning will probably produce some informative results in terms of leaf-canopy management with little risk to cumulative tree yields calculated over the next few years.

Good Vibrations

Insect pheromones are chemical messengers produced by insects, usually the female, to attract mates. Pheromones diffuse through the air and in some species are capable of attracting prospective mates from great distances. Not all insect species produce pheromones and most pheromones are fairly specific to a single insect species. Pheromones have been commercially produced for years to attract some injurious insect pest species to traps to determine population levels and to schedule pesticide applications if necessary. Jocelyn Millar, Professor of Entomology at UC/Riverside, an expert in isolating and reconstructing insect pheromones, recently announced an entertaining breakthrough in developing a trap for stink bugs, which are major pests of pistachio. These plant bugs pierce the pistachio nut, both before an after shell hardening, which results in epicarp lesions and/or kernel necrosis.

For a number of years Dr. Millar in association with Dick Rice, Agricultural Experiment Station researcher at the UC Kearney Ag Center, have been developing a trapping system for several of the stink bug and other plant bug species attacking pistachios. Although the pheromones involved were quickly isolated, identified, and produced for several of the species, they did not appear to be especially attractive. The pheromones would lure the insects to the general area of the trap, but often not into the trap itself. As it turns out, the pheromone was only part of the message system. The final messages that bring the mating pair together are vibrational "love" songs. Dr. Millar, by holding a diaphragm attached to an oscilloscope next to a bean plant housing a male and/or female stink bug, was able to record the mate-attracting vibrations the stink bugs were making. These oscillations could then be rendered into sound for human ears, although the stink bug receiving the message would sense only the vibrations traveling through bean tissue or pistachio wood. Different species of stink bugs each appear to have their own individual mating songs, and the songs differ between the sexes. The vibrations are capable of being sent for an appreciable distance through hard, dense wood like pistachio. Stink bugs have a special structure under the wings that help them produce strong vibrations. Developing a silicon chip (much like the chips that sing "Happy Birthday" when greeting cards are open) that mimics these vibrations has been assigned as a project to an engineering class at UC/Riverside. With this new information, a useful trap for monitoring various stink bug species may

be available in the not so distant future.

Stink Bug and Leaffooted Bug Damage Confusing

Damage to pistachio nuts by stink bugs is not always easy to associate with stink bug populations in the field. Commonly, the blackening and shriveling of nuts, called epicarp lesion, associated with stink bug feeding may not be apparent until a month or so after the stink bugs and/or other plant bugs have done their damage and left the orchard. Epicarp damage done in June and July may not be obvious to the eye until August or September. One reason that it took time for science to recognize that plant bugs were causing this kind of damage was that often that by the time the harm was discovered in the field, there did not appear to be anything of a biological nature in the orchard capable of causing it. Obviously, if stink bugs are no longer there it will do no good to treat with pesticides. Later in the season after mid June, the bigger plant bugs have the ability to penetrate pistachio nuts that have a hard shell. For a period of time after the nuts have been punctured, little visible damage to the nuts will be visible on the hull. However, this puncturing of the nut does cause the kernel within the shell to die (called kernel necrosis). The big plant bugs can do a lot of damage that may not be visible until harvest.

The point of this article is that to reduce damage from stink bugs and leaffooted bugs orchards need to be monitored for bug activity. Consult the UC Pistachio Pest Management Guidelines or your pest control advisor for guidelines on how, when and if to treat. Guidelines can be downloaded from the UC Integrated Pest Management Web Site at *www.ipm.ucdavis.edu*.

It Looks Worse Than It Bites

Obliquebanded leafroller (OBLR) has been more of a problem for the past few years than in the past, especially in localized areas. Although it is called a leafroller, OBLR tends to glue leaves together more than it rolls them up. In addition, they feed on the rachis of the cluster and on the insides of young, green nuts. Leafrollers, and the OBLR is no exception, are famous for making trees look messy. However, experiments with leafrollers in other crops, have demonstrated that it usually takes a very severe infestation of leaf rollers to hurt yields. The reason that trees can tolerate large populations of leafrollers, again, is related to the ability of the tree to compensate for lost leaf and fruit producing area. Most leaves fix photosynthate (i.e. use the sun's energy to turn carbon dioxide gas into carbohydrate to feed itself and fill the nuts) at only a fraction of their peak efficiency. The ability of a given leaf to produce food is often limited by the ability of the tree to move this food from the leaves to the rest of the tree and is also limited by shading of other leaves. A tree can lose a substantial part of its leaf area with negligible changes in the rate nuts are filled. Leafrollers, while they do make a mess, often do not entirely destroy the leaves they roll or bind. Many of leaves still remain functional factories for food production for the tree and previously shaded leaves increase the amount of food they produce once exposed to full sun. The ability of the tree to compensate for lost clusters, either in the season of loss or in subsequent seasons, has already been discussed above.

Obliquebanded leafroller damage is almost always more of an eyesore than the cause of significant economic loss. The intended message of this article is that if you can tolerate the appearance of OBLR infested trees, you are probably going to come out ahead economically, on

average, if you don't treat them. If phytocoris, a small plant bug, is part of your integrated pest management plan to help control soft scales, phytocoris also preys on OBLR. Parasitoid wasps also are capable of reducing OBLR population.

If OBLR is an increasing problem, and populations have been extremely high and building over a number of years, an application of spinosad (i.e. Success®) just after bloom has been documented by Walt Bentley, UC entomology specialist at the Kearney Ag Center, to greatly reduce populations of this moth for the remainder of the season. Some growers have had success with BT sprays as well. Both of these materials have the advantage of being less harmful to beneficial insect populations in the orchard than longer-residual organophosphate or carbamate pesticides.

Pistachio Bloom Happens Quickly Once Pistachio Trees Leaf Out

Pistachio is wind pollinated and the only unusual structures on the female flower during bloom that indicate something different is happening are tiny stigmas exposed to the air to catch pollen wandering or flying by. With Kerman, early bloom can be estimated by examining the female flowers for these exposed stigmas. Early bloom usually occurs when the first leaves have expanded about ½ inch and late bloom can be estimated when the leaves have expanded to about two inches in length. The bloom period usually occurs sometime in the period from late March to early April in Kern County. In Kern County, most growers do not treat with benomyl for protection from botrytis leaf and shoot blight unless we have significant rain throughout the bloom period. Benomyl is most effective if applied during bloom.

Botryosphaeria Still Very Rare In Kern County And That's The Way We Like It

Botryosphaeria blight of pistachio caused problems in some orchards, mostly from Madera County north this year. Infestations of this fungal pathogen have been very rare in Kern County historically and none were brought to this office's attention last year.

Recent work from the lab of Themis Michailides, UC Plant Pathology Researcher at the Kearney Ag Research Center, suggests Kern County will remain relatively free of this pathogen as our climate usually provides growers with few precipitation events (i.e. rain). Should we have years with unusually high rainfall, this rain combined with our naturally warm temperatures will greatly encourage the growth of this pathogen here. A high rainfall, "Miracle March," while great for the reservoirs, might be enough to start the disease here in some orchards. Generally, however, it would appear that our dry climate has saved pistachio growers in the Southern San Joaquin a small fortune in hand pruning expenses and the cost of up to four annual fungicidal sprays. Knowledge is power and knowing how to recognize this disease is important for anyone growing pistachios regardless of location. An excellent identification and control guide for this disease is available from the California Pistachio Commission.

Themis has identified at least one pistachio genotype that appears to have substantial resistance to Botryosphaeria infection. However, the nuts from this tree are not nearly of Kerman quality. Once the mechanism for resistance is known, the process for getting Botryosphaeria-resistant genes into a commercially acceptable cultivar may begin.

Put Young Pistachios To Sleep As Winter Approaches

For the second year in a row, several growers are reporting significant freeze damage on young Kerman trees planted on *P. integerrima* rootstock. Some of these trees were as old as five

years. As was the case last year, most of the damage is being reported in low-lying areas where cold air ponds. In early November, thermometers in these areas recorded temperatures much lower than most other areas of the county. Mid-November temperatures were as low at 18EF. in some of these locations. Because of the known propensity for young, vigorous Kerman trees on *P. integerrima* rootstocks to freeze in the fall in years when there is an abrupt transition from summer to winter-like temperatures, young trees are often assisted into dormancy with a spray of 40 lbs/acre of zinc sulfate in October, and/or through cessation of irrigation in mid-August on heavier soils and later on lighter soils. A defoliating zinc spray and increasing water stress reduce vegetative vigor, pushing the tree toward earlier dormancy and reducing the chance of damage from a sudden, early freeze.

Craig Kallsen, Farm Advisor
Citrus, Subtropical Horticulture, Pistachios

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