Topics in Subtropics Newsletter

University of California Cooperative Extension

Fresno · Kern · Madera · Riverside · San Bernardino · San Diego · San Luis Obispo · Santa Barbara · Tulare · Ventura Counties

VOLUME 3 NO. 1 ■ JANUARY FEBRUARY MARCH 2005

News from the Subtropical Tree Crop Farm Advisors in California

Editor's Note:

Please let us know if your mailing address has changed, or you would like to add someone else to the mailing list. Call or send an email message to the farm advisor in the county where you live. Phone numbers and email addresses can be found at the end of this newsletter. Also, let us know if there are specific topics that you would like to address in subtropical crop production.

Gary Bender (editor for this issue)

Inside this issue:

Phosphorous Acid in Avocado Production Should it be a Cultural Recommendation?

Gary S. Bender, Farm Advisor

The heavy rains this winter (34 inches so far in Fallbrook) have been wonderful for leaching salts out of the soil, filling the reservoirs, raising the water level in our wells, and allowed us the luxury of "not irrigating" for awhile. However, as a plant pathologist, I wonder what might be happening under our feet. *Phytophthora cinnamomi*, the fungus that is notorious for spreading through wet soils via motile zoospores, is attracted to carbohydrates and amino acids leaking out of root tips in our avocado trees. In other words, this fungus is perfectly able to cause an epidemic in our groves with the continuity of tree to tree soil moisture, but we won't know it until early summer when the trees really start using water. I remember after the heavy rains in 1993, walking through a dying grove in the Rainbow area, asking the grower when root rot started in his grove. His reply was: "We never really saw a problem with the grove until July when the trees started to use water. There were no feeder roots left and the trees wilted and died." Indeed, due to the continuous rains through the spring, the fungus had an opportunity to spread underground; it was shocking to see an apparently healthy five-acre grove completely collapse from root rot in a short period of time.

This is not a time to be complacent. Almost all groves have some root rot, and we have plenty of ways to move the fungus through the groves, with foot traffic, ladders, picking bins, and water run-off. Various cultural methods have helped greatly to control root rot; these include: 1) mulching heavily with a wood-based mulch, 2) adding gypsum to the soil to supply calcium, 3) using the improved clonal rootstocks when replanting, 4) improving drainage by planting on broad-based mounds, and 5) maintaining an even moisture level without extremes in drying and saturation.

In addition to good cultural practices, the application of phosphorous acid to the cultural program prior to disease development appears to be beneficial. Phosphorous acid is now registered as a fungicide on avocado in California for both before and after disease development, and has been registered as a fertilizer on avocado for over ten years.

The material is applied either as a foliar spray, injection into irrigation water, or as a trunk injection (for significant root rot symptoms).

This article will explore the history and legal use of phosphorous acid, and whether it is justified to treat trees that are not diseased.

The Phosphorous Acid Story

Phosphoric acid (H_3PO_4) has long been used as a fertilizer to supply phosphate. When phosphoric acid is neutralized with a base such as potassium hydoxide (KOH), a salt results. The salt of phosphoric acid is (K_3PO_4); this is useful as a fertilizer, but does not have activity as a fungicide.

Phosphorous acid (H_3PO_3), when neutralized by KOH, forms a potassium phosphite salt. This was long thought to be not a fertilizer, but had some interesting fungicidal properties. An organic compound that contains phosphorous acid is called a phosphonic acid. When neutralized, it forms phosphonate. Phosphorous acid first came to California in the early 1980's in the form of an aluminum phosphonate salt with the chemical name fosetyl-Al, (trade name: 'Aliette'), produced by the French company Rhone-Poulenc. When injected into a tree trunk, Aliette could degrade to phosphorous acid inside the tree and move systemically in the xylem to the leaves, then to the roots via the phloem. This was truly a unique product: most chemicals move up in the tree, but very few if any move down to the roots after a trunk injection. South African plant pathologists were the first to show that root rot in avocado could be controlled by trunk injection with Aliette and phosphorous acid (Darvas, J.M. et al. 1984).

Aliette was registered briefly in California as an emergency Section 18 registration for trunk injection in the late 1980's, but Rhone-Poulenc soon lost interest in pursuing a full pesticide registration when it became apparent that other researchers believed phosphorous acid could be registered as a fertilizer. The company did hold onto the patents for the product and the breakdown phosphonate products that were useful in root rot control; this effectively stopped companies from pursuing a pesticide registration for phosphorous acid.

In 1990, Dr. Carol Lovatt (Dept. of Botany, U.C. Riverside) published a report that indicated applications of phosphite could replace phosphate in the fertilization of avocados suffering from phosphorus deficiency in pot culture (Lovatt, 1990). Lovatt indicated that microorganisms are not required for the conversion of phosphite to phosphate, and speculated that aerobic conditions could slowly oxidize phosphite to phosphate, thus providing a slow-release form of phosphorus to the tree. However, South African researchers found three genera of bacteria in avocado root and leaf samples that were capable of converting phosphite to phosphate (Bezuidenhout et al. 1987). At any rate, the information from Lovatt provided the basis for the registration of phosphorous acid as a fertilizer in California, and has been sold in this capacity since the early 1990's.

Is it Legal?

For many years, it was not legal to use phosphorous acid as a fungicide in California because any chemical used to control a pest must be registered with the U.S. Environmental Protection Agency and the California Dept. of Pesticide Regulation (DPR). Because Rhone-Poulenc held the patent rights, and did not pursue a registration, it was illegal for growers to trunk inject phosphorous acid to "control root rot caused by Phytophthora". However, since phosphorous acid was registered as a fertilizer with the California Dept. of Food and Agriculture (CDFA), and it is (apparently) legal to inject a fertilizer into trunks, growers who decided to trunk inject to improve phosphorus nutrition in avocado trees were considered to be within the law.

DPR notes in one of their enforcement letters "Phosphorous acid fertilizer products cannot be represented as pesticides or be sold with written or oral claims to that effect unless registered. There are currently several phosphorous acid compounds registered as pesticides. Any violations of this requirement would be subject to enforcement actions by DPR or the county agriculture commissioners."

So, there you have it. Phosphorous acid is very useful as a root rot control treatment, but pest control advisors cannot recommend the chemical for root rot control unless that particular product is registered as a pesticide, even though the ingredients might be the same. We are aware of at least two products registered by EPA and DPR as fungicides for use on avocados: 'Fosphite', produced by J.H. Biotech in Ventura; and 'Agri-Fos', produced by an Australian company, Agrichem Manufacturing Industries. Growers who wish to use phosphorous acid for root rot control must use the products that are registered for that use, and follow the label.

How does it Work?

Phosphite in roots has been shown to directly inhibit the Phytophthora fungi (Fenn and Coffey, 1984), and phosphite also stimulates defense mechanisms in plants (Guest and Bompeix 1984). The stimulation of a defense response is probably far more important, since phosphite itself is diluted out by the time it reaches all of the individual feeder roots.

Disease Prevention Program. According to the Fosphite label, 1-3 qts. of Fosphite per 100 gal/water is applied as a foliar spray at 2-4 week intervals after the trees become established. If applied through drip or mini-sprinkler irrigation, 2-3 qts. in at least 100 gal. is applied. In either case, no more than six applications per year can be made. The area should not be irrigated again for at least 24 hrs. It is important to have functional check valve, vacuum relief valve, and a low-pressure drain in order to avoid contaminating the water source.

Agri-Fos is not registered as an application through the irrigation system, but is registered as a foliar spray at ⅓ fl. oz. per gal. of water, spray to runoff at 2 – 2 ½ gal of solution per adult tree. Applications should be started in spring, with up to 4 applications per year.

Disease Control Program. If root rot symptoms are apparent (leaf drop, chocolate-brown colored feeder roots, slightly brittle), then trunk injection is the most effective method for getting phosphite into the tree. According to the Fosphite label, 3 teaspoons per liner yard of canopy width at breast height is applied with proper injection syringe. Applications should be repeated 2-4 times per year until root rot is under control.

According to the Agri-Fos label, ¼ fl. oz of undiluted product is injected per yard of canopy diameter for skeletal trees. For details on quantity and timing of injection, please refer to the label.

It is important to inject phosphite into trees at the right time; if new leaves are flushing, this will be a sink and most of the phosphite will go toward this sink, but if the new leaves are hardening, the sink will move to the roots to provide resources for new root growth. Therefore, phosphite should be injected just as leaves harden, usually in late spring (May) and summer (August), but these dates may vary according to local conditions.

Should phosphite be used on avocado trees that do not have root rot?

In this case we are talking about the phosphorous acid fertilizers used as fertilizers on healthy trees. Lovatt collected yield data from an avocado trial treated with soil applied potassium phosphate, soil applied potassium phosphite, foliar applied potassium phosphate, and foliar applied potassium phosphite, all compared to a non-treated control (20 replications). Soil treatments applied to provide 22.5 lbs P_2O_5/acre; foliar treatments applied to provide 1.6 lbs P_2O_5/acre. After two years of data collection, she did not record a significant difference in yield compared to the control, although there were non-significant increases in fruit numbers in the treated trees (fruit sizes were smaller). In this case, the treatments were applied at the cauliflower stage of flower development. Assuming the phosphorous nutrition of the avocado grove is adequate, we can only say that we don't have good evidence that phosphorous acid fertilizers in healthy groves are useful for increasing yield, but more work needs to be done on timing of application and amount applied.

LITERATURE CITED

Bezuidenhout, J.J., J.M. Darvas and J.M Kotze. 1987. The dynamics and distribution of phosphite in avocado trees treated with phosetyl-Al. South African Avocado Growers' Association Yearbook 1987 10:101-103.

Darvas, J.M., J.C. Toerien and D.L. Milne 1984. Control of avocado root rot by trunk injection. Plant Disease 68: 691-693.

Fenn, M.E. and M.D. Coffey. 1984. Studies on the in vitro and in vivo antifungal activity of phosetyl-Al and phosphorous acid. Phytopathology 74: 606-611.

Guest, D.J. and G. Bompeix. 1984. Phosetyl-Al as a tool in understanding the resistance response in plants. Phytophthora Newsletter 12: 62-69.

Lovatt, C.J. 1990. A definitive test to determine whether phosphite fertilization can replace phosphate fertilization to supply P in the metabolism of 'Hass' on 'Duke 7'. California Avocado Society 1990 Yearbook 74:61-64.

Lovatt, C.J. 2000. Improving fruit set and yield of the 'Hass' avocado with potassium phosphate or potassium phosphite applied during bloom. 2000 California Avocado Research Symposium (published on www.avocadoresource.com).

Emergency Farm Loans

Provided by Eta Takele, Area Farm Advisor

Pursuant to President Bush's declaration of an emergency in the State of California on February 14, 2005, several California counties have been named eligible for USDA emergency farm loans based on damages and losses caused by severe storms, flooding, debris flows and mudslides, which occurred in 2005.

Farmers in impacted counties have eight months to apply for loans to help cover losses. To be eligible, they must:

- Be established family farm operators and have sufficient farming or ranching experience;
- Have suffered at least a 30-percent loss in crop production or a physical loss to livestock, livestock products, real estate, or chattel property;
- Have an acceptable credit history;
- Be unable to receive credit from commercial sources;
- Be able to provide collateral to secure the loan; and
- Have repayment ability.

Also, FSA loan requirements may be different from those of other lenders. Some of the requirements are:

- Borrowers must keep acceptable farm records;
- Borrowers must operate in accordance with a farm plan they develop and agree to with local FSA staff; and
- Borrowers may be required to participate in a financial management-training program and obtain crop insurance.
-

Emergency loan funds may be used to:

- Restore or replace essential property;
- Pay all or part of production costs associated with the disaster year;
- Pay essential family living expenses;
- Reorganize the farming operation; and
- Refinance certain debts.

Producers can borrow up to 100 percent of actual production or physical losses, to a maximum amount of $500,000. The current annual interest rate for emergency loans is 3.75 percent.

Loans for crop, livestock, and non-real estate losses are normally repaid within 1 to 7 years; depending on the loan purpose, repayment ability, and collateral available as loan security. In special circumstances, terms of up to 20 years may be authorized. Loans for physical losses to real estate are normally repaid within 30 years. In certain circumstances, repayment may be made over a maximum of 40 years.

Please link to the following for more information and if you or someone you know may be interested in pursuing an Emergency (EM) Loan (2005 rainfall damage) through FSA: http://disaster.fsa.usda.gov/emloan.htm.

For local information please link to local USDA Service Centers

To apply, you can contact:

Tom Hunton, FSA Farm Loan Manager for SoCal
Kern County FSA Office.
5000 California Ave., Ste. 100.
Bakersfield, CA. 93309-0711
Tel: (661)336-0967 Ext.2.

New 24C Registration of Isopropyl Ester 2,4-D (Alco Citrus Fix) for Fruit Size Increase of Mandarins and Mandarin Hybrids in California

C. Thomas Chao, Assistant Extension Horticulturist

A 24C registration of Isopropyl Ester 2,4-D (Alco Citrus Fix, manufactured by AMVAC Chemical Corporation) for fruit size increase of mandarins and mandarin hybrids in California was granted by the Department of Pesticide Regulation (DPR), California Environmental Protection Agency in January 2005. Growers in California can begin using this application for 2005 season. This addition to the current 2,4-D label allows growers to implement one application of 24 ppm of 2,4-D (0.67 oz per 100 gallons) at 21-35 days after 75% petal fall to increase fruit size of mandarins and mandarin hybrids in California.

Before this addition to the 2,4-D label, 2.4-D has been used for (1) pre-harvest fruit drop control of Navel, Valencia, grapefruit, lemons, and tangelos and other citrus hybrids, (2) as a counteract of leaf and fruit drop control caused by oil sprays, and (3) increasing fruit size of Navel, Valencia, and grapefruit. There was no label for fruit size increase of mandarins and mandarin hybrids.

Since 1999, research led by C.T. Chao, C.J. Lovatt, Department of Botany and Plant Sciences, UCR and L. Ferguson, Plant Sciences Department, UCD and funded by California Citrus Research Board (CRB) began to investigate the use of plant growth regulators (PGRs) for increasing fruit set and fruit size of 'Fina Sodea' Clementine mandarin at southern San Joaquin Valley SJV. We have tried PGRs such as 3,5,6-TPA and 2,4-DP based on the recommendation from CRB. These two PGRs were used in Spain, Israel and Morocco for fruit size increase of Clementine mandarins. We found the 3,5,6-TPA was effective in increasing fruit size of 'Fina Sodea' Clementine mandarin in SJV. However, these two PGRs are currently not registered to be used in the USA or California and it will be very costly to register a new PGR in the USA. The prospect of using these two PGRs was minimal. Our initial trial of using 2,4-D for fruit size increase of 'Fina Sodea' Clementine with application time at mid-July was not significant and consistent. In 2002 and 2003, we applied the 2,4-D at a much earlier timing of early June, 30 days after 75% petal fall, and the results were significant (see Table 1). The 24 ppm of 2,4-D treatment was able to increase the overall yield and large sized fruit. In 2002, an "ON" year, the 24 ppm treatment increased the Large-Jumbo-Mammoth sized classes of fruit to an average of 143 lb per tree versus average 104 lb of large sized fruit per tree for the control (non-treated). That was an increase of 39.53 lb (38.19%) of large sized fruit per tree for the 24 ppm 2,4-D treatment. If there are 340 trees per acre (8' x 16' planting spacing), it would be an increase of 13,440 lb large sized fruit per acre. In 2003, an "OFF" year, the 24 ppm 2,4-D treatment was able to increase the Large-Jumbo-Mammoth sized classes of fruit to an average of 55 lb per tree versus 36 lb of large sized fruit per tree for the control. That was an average 18.84 lb (51.76%) increase of large sized fruit per tree for the 24 ppm 2,4-D treatment. If there are 340 trees per acre, it would be an increase of 6,406 lb of large sized fruit per acre. The 24 ppm of 2,4-D treatment was able to significantly increase large sized fruit of 'Fina Sodea' Clementine mandarin in an "ON" year and in an "OFF" year. Based on these positive results, I worked with AMVAC and applied for the 24C registration in spring 2004 and the 24C registration was granted in January 2005.

Based on the communication with DPR, in order to apply for the permanent registration of 2,4-D for fruit size increase of mandarins and mandarin hybrids, efficacy data of more 2,4-D concentrations and on other mandarins or mandarin hybrids is needed. A new CRB funded research project was initiated in 2003. I applied three concentrations of 2,4-D (12 ppm, 24 ppm and 48 ppm) at two timings on 'Afourer' mandarin (also called 'W. Murcott') at two locations and 'Minneola' tangelo at one location. So far the results on the 'Afourer' mandarin is also positive. For example, for the 2004 season, the 48 ppm 2,4-D treatment at 14 days after 75% petal fall was able to increase large sized fruit of 'Afourer' mandarin to an average of 75 lb large sized fruit per tree versus 60 lb of large sized fruit per tree for the control for a trial at S. Bakersfield. That was an average increase of 14.55 lb (24.08%) of large sized fruit per tree. For an acre with 340 trees, that would translate an increase of 4,947 lb of large sized fruit per acre. More data may be required by the DPR for the permanent registration of 2,4-D for fruit size increase of mandarins and mandarin hybrids in California. We definitely need to have more data from more cycles of "ON" and "OFF" years to learn how best to use this effective treatment for fruit size increase of mandarins and mandarin hybrids in California. Different cultivars of mandarins and mandarin hybrids may need different concentrations of 2,4-D at different timings to achieve the best results.

Last but not least, to use 2,4-D on citrus, there are some routine use precautions you need to follow: do not use as an herbicide; do not use on citrus trees less than 6 years old; do not apply during a flush of leaf growth; do not allow drift to susceptible plants such as cotton, grapes, roses, beans, peas, alfalfa, lettuce, ornamentals and broadleaf plants; and do not use equipment that has been used to spray 2,4-D on sensitive plants.

If there is any question regarding this new application of 2,4-D, please contact me at any time.

Department of Botany and Plant Sciences
University of California at Riverside
E-mail: ctchao@citrus.ucr.edu

***Table 1*.** **Fruit weight (lb/tree) of 'Fina Sodea' Clementine mandarin with 2,4-D treatment at 30 days after 75% petal in 2002 and 2003**

Treatments	Year	Large-Jumbo-Mammoth	Total
24 ppm 2,4-D	2002	143.04 lb	171.25 lb
	2003	55.24 lb	85.20 lb
	2002 & 2003	198.28 lb	256.45 lb
Control	2002	103.51 lb	135.48 lb
	2003	36.40 lb	70.04 lb
	2002 & 2003	139.90 lb	205.52.lb

Difference	Large-Jumbo-Mammoth	Per acre increase estimate (340 trees)
2002	39.53 lb (+38.19%)	13,440 lb
2003	18.84 lb (+51.76%)	6,406 lb
2002 & 2003	58.38 lb (+41.73%)	19,846 lb

Asphyxiation

Ben Faber, Farm Advisor

Thank goodness for the rains. They have come and washed the accumulated salts of the last two years out of the root zones of citrus and avocado. But it has been a little too much of the good stuff. As of March 1, 2005 Ventura has gotten 30" of rain, which is 292% of what is normally received at this time. The last time big rains occurred was in the winter of 1997-98. That year the rains were evenly spaced on almost a weekly basis through the winter and into the late spring. That year we had major problems with both citrus and avocados collapsing from asphyxiation. This year there has also been some collapse occurring.

Asphyxiation is a physiological problem of that may affect certain branches, whole limbs or the entire tree. Leaves wilt and may fall, the fruit withers and drops, and the branches die back to a greater or lesser extent. The condition develops so rapidly that it may be regarded as a form of collapse. Usually, the larger stems and branches remain alive, and after a time, vigorous new growth is put out so that the tree tends to recover.

Asphyxiation is related to the air and water conditions of the soil. The trouble appears mainly in fine-textured or shallow soils with impervious sub-soils. In 1997-98, this even occurred on slopes with normally good drainage because the rains were so frequent. When such soils are over-irrigated or wetted by rains, the water displaces the soil oxygen. The smaller roots die when deprived of oxygen. When the stress of water shortage develops, the impaired roots are unable to supply water to the leaves rapidly enough and the tree collapses. The condition is accentuated when rainy weather is followed by winds or warm conditions.

Canopy treatment in less severe instances consists of cutting back the dead branches to live wood. If leaf drop has been excessive, the tree should be whitewashed to prevent sunburn. Fruit, if mature should be harvested as soon as possible to prevent loss. In the case of young trees, less than two years of age, recovery sometimes does not occur, and replanting should be considered if vigorous re growth does not occur by July.

Asphyxiation can be reduced by proper planting and grading. If an impervious layer is identified, it should be ripped prior to planting. The field should be graded so that water has somewhere to run off the field during high rainfall years. Heavier soils might require planting on berms or mounds so that the crown roots have a better chance of being aerated.

Post-plant, if an impervious layer can be identified and is shallow enough to break through, ripping along side the tree or drilling 4-6 inch post holes at the corners of the tree can improve drainage. It is important that the ripper blade or auger gets below the impervious layer for this technique to be effective.

Dweet Mottle Virus and Citrus Leaf Blotch Virus

Robert R Krueger, John A Bash, Richard F Lee

Vein Clearing in Dweet Tangor

The UC Riverside Citrus Variety Improvement Program (CVIP), the forerunner of the Citrus Clonal Protection Program (CCPP), began indexing candidate varieties in 1958. At that time, the full range of indicator plants that is utilized today was not known. In the early 1960s, the usefulness of 'Dweet' tangor as an indicator for Citrus Concave Gum Virus as well as other psorosis-like viruses was demonstrated. Consequently, starting in 1963 over 150 varieties not previously indexed on 'Dweet' were indexed on that indicator.

One of the results of this re-indexing was that a 'Cleopatra' mandarin (CRC 270, which had been indexed as VI 92) produced a leaf mottle resembling but distinct from that of psorosis or concave gum. The source tree showed no evidence of decline due to this virus, although it did show twig die-back, produced very small fruits, and was not vigorous. The trunk did not exhibit any discoloration or pitting. Because there were other selections of 'Cleopatra' available in the CVIP, this particular selection, which had been introduced from Florida in 1914, was eliminated from the program. Types of citrus other than 'Dweet' produced no symptoms but could act as carriers. This presumptive virus did not provide any protection against psorosis-like viruses and so was considered a distinct virus. Because this virus produced symptoms only in 'Dweet', it was named 'Dweet Mottle Virus' (Roistacher and Blue, 1968).

Dweet mottle virus remained a rather obscure virus. It was not observed to produce any losses in economic situations and was not reported to occur in commercial production. In fact, it was detected in the CCPP indexing program only one time after 1963. This was in a mandarin type introduced from New Zealand in the late 1990s.

In the mid 1980s, the Spanish group at the Instituto Valenciano de Investigaciones Agrarias (IVIA) reported a graft-transmissible disease that caused a bud-union incompatibility between 'Nagami' kumquat and 'Troyer' citrange (Navarro et al, 1984). The 'Nagami' in question (SRA-153) had been introduced from the Station des Recherches Agrumicoles in San Giuliano, Corsica. In addition to the incompatibility, the presumptive virus caused vein-clearing in sweet orange and some other indicators and stem pitting in citron. After shoot-tip grafting, some of the plants produced were compatible with 'Troyer' and did not cause vein-clearing but did pit the citrons, suggesting that there was more than one virus involved.

A later report (Galipienso et al, 2000) demonstrated that this virus caused bud-union creasing with 'Nules' clementine and 'Eureka' lemon on 'Troyer', whereas the same was not observed with 'Pineapple' sweet and 'Marsh' grapefruit on 'Troyer'. The bud-union problems were similar to those caused by Citrus tatterleaf virus. However, the pathogen did not act like CTLV in symptom expression in indicators or in mechanical transmissibility in herbaceous hosts. This report further strengthened the evidence that more than one virus was involved. All sources of the virus used in the reported experiments produced a chlorotic blotching in 'Dweet' tangor and stem pitting in citron. However, the bud union crease and vein-clearing in 'Pineapple' sweet orange were not observed in some shoot-tip grafted plants or from 'Marsh' grapefruit or 'Pineapple' sweet orange pre-inoculated with tissue from SRA-153 'Nagami'.

The same group partially purified and characterized the apparent causal agent, and gave it the candidate name Citrus leaf blotch virus (Galipienso et al, 2001; Vives et al, 2001, 2002). These papers also indicated that CLBV was detected in trees in Spain and introductions from Japan and Florida. They also reported the development of probes usable for RT-PCR as well as other molecular detection methodologies (Galipienso et al, 2004).

Luís Navarro of IVIA, in conversation with one of the authors (RRK) and Chet Roistacher in 2001, revealed that CLBV might be similar to Dweet mottle virus, based upon the symptom expression in ‘Dweet’. Consequently, we sent him tissue of the Dweet mottle positives maintained at the CCPP. This allowed the Spanish group to compare DMV and CLBV. They recently reported that the symptom expression of the two putative viruses is somewhat different: CLBV from SRA-153 induced bud-union crease of ‘Nules’ on ‘Troyer’, vein-clearing in ‘Pineapple’ sweet, chlorotic blotching in ‘Dweet’, and stem-pitting in ‘Etrog’, whereas DMV induced only the chlorotic blotching in ‘Dweet’ and stem-pitting in ‘Etrog’. Furthermore, they reported that the nucleotide identity between CLBV and the two California sources of DMV was over 96 %. They interpret these results as indicating that at the least DMV and CLBV are closely related. Dweet mottle may be caused by CLBV, with another virus being present in SRA-153 ‘Nagami’ causing the bud-union crease and vein-clearing (Vives et al, 2004).

The overall status of CLBV in California is unknown at this time. The recent report of seed transmission of CLBV (Guerri et al, 2004) makes it a concern for the citrus nursery industry. It is possible that more attention will need to be paid to the phytosanitary status of seed source trees than in the past. It should be noted that recently Citrus Variegated Chlorosis was also reported to be seed-transmitted (Li et al, 2003). In addition, there are anecdotal indications that certain individuals in Spain have alleged that CLBV was introduced into Spain in C-35 seeds from California. Furthermore, the recently reported bud-union problems between ‘Fukumoto’ and ‘Beck’ navels and certain citrange rootstocks resemble the bud-union problem associated with CLBV (as well as CTLV).

Consequently, we have recently assayed all rootstock varieties, kumquats, and ‘Fukumoto’ navels in the CCPP Foundation Block at Lindcove Research and Extension Center utilizing RT-PCR (Galipienso et al, 2004) with our local DMV positives and a CLBV positive from Florida DPI (received via RF Lee) used as positive controls. Whereas the positives consistently produced a positive result from the RT-PCR, none of the FB trees did so. We have also tested all trees maintained in the Repository Protected Collection (the other source of clean citrus propagative material in California) in the same manner and to this point have detected no positives. If any positives are detected either at CCPP or NCGRCD, they will be re-sanitized.

The fact that all C-35 in California is derived from trees in the FB means that, given that the FB trees are apparently free of CLBV, other C-35 seed source trees should also be free of CLBV. However, ‘Troyer’ was introduced to California before indexing began, and it is possible that there are some seed-source ‘Troyer’ that do not derive from the FB trees. Therefore, clean FB ‘Troyer’ would not necessarily mean that all commercial ‘Troyer’ are also clean. A similar situation exists with the navels of interest. All ‘Fukumoto’ in California derive from the FB trees and freedom of these trees from CLBV would also mean that other trees are also free. However, ‘Beck’ navels have never passed through the CCPP and are not maintained in the FB, so nothing can be conjectured about ‘Beck’ at this point.

The close identity of CLBV and DMV has probably prevented CLBV from becoming introduced to California. All introductions of new citrus germplasm are indexed into ‘Dweet’ tangor (among other indicators). This would detect CLBV, which gives a reaction in ‘Dweet’ tangor, even if the actual identity of the virus was not known at the time of the index. Any apparent positives of this sort, even if misidentified, would have been eliminated by thermal therapy or shoot-tip grafting before release. Thus, probably CLBV and/or DMV are probably not present in California or, if present, have very low incidence.

It should be noted that our experience with CLBV is just beginning. Conversations with L Navarro and J Guerri of IVIA during the recent 2004 meeting of the International Organization of Citrus Virologists suggest that detection of CLBV is not always straightforward. The Spanish researchers told us that CLBV appears to be distributed irregularly in the trees. Detection is variable even in small greenhouse trees, and sometimes leaves from the same tree give variable results. We are thus continuing to assess the reliability of the RT-PCR test under our conditions. We are also currently observing the reaction of our DMV positives in indicators other than ‘Dweet’ in order to assess whether the reaction under our conditions is the same as that reported from Spain. If any growers or extension personnel have questions or concerns regarding DMV or CLBV, we invite them to contact us.

(Robert Krueger is the Curator at the USDA-ARS Citrus Germplasm Repository, Riverside; John Bash is a Staff Research Associate at U.C. Riverside; Richard Lee is the

Director of the USDA-ARS Germplasm Repository, Riverside)

LITERATURE CITED

Galipienso, L, L Navarro, JF Ballester-Olmos, JA Pina, P Moreno and J Guerri. 2000. Host range and symptomology of a graft-transmissible pathogen causing bud union crease of citrus on trifoliate rootstocks. Plant Pathol, 49:308-314.

Galipienso, L, MC Vives, P Moreno, RG Milne, L Navarro, and J Guerri. 2001. Partial characterization of citrus leaf blotch virus, a new virus from Nagami kumquat. Arch Virol, 146:357-368.

Galipienso, L, MC Vives, L Navarro, P Moreno, and J Guerri. 2004. Detection of citrus leaf blotch virus using digoxigenin-labeled cDANprobes and RT-PCR. Euro J Plant Pathol, 110:175-181.

Guerri, J, JA Pina, MC Vives, L Navarro, and P Moreno. 2004. Seed transmission of Citrus leaf both virus: implications in quarantine and certification programs. Plant Dis, 88:906.

Li, WB, WD Pria, PM Lacava, X Qin, and JS Hartung. 2003. Presence of Xylella fastidiosa in sweet orange fruit and seeds and its transmission to seedlings. Phytopathol, 93:953-958.

Navarro, L, JA Pina, JF Ballester, P Moreno, and M Cambra. 1984. A new graft transmissible disease found in Nagami kumquat. Pro, 9th Conf In Org Citrus Virologists, 234-240.

Roistacher, CN, and RL Blue. 1968. A psorosis-like virus causing symptoms only on Dweet tangor. Proc, 4th Conf Int Org Citrus Virologists, 13-18.

Vives, MC, L Galipienso, L Navarro, P Moreno, and J Guerri. 2001. The nucleotide sequence and genomic organization of citrus leaf blotch virus: candidate type species for a new virus genus. Virol, 287:225-233.

Vives, MC, L Galipienso, L Navarro, P Moreno, and J Guerri. 2002. Characterization of two kinds of subgenomic RNAs caused by citrus leaf blotch virus. Virol, 295:328-336.

Vives, MC, JA Pina, J Juárez, L Navarro, P Moreno, and J Guerri. 2004. Dweet mottle disease is probably caused by citrus leaf blotch virus. Abstracts, 16th Conf Int Soc Citrus Virologists, 98.

Farm Advisors

Gary Bender – *Subtropical Horticulture, San Diego*
Phone: (858) 694-2856
Email to: gsbender@ucdavis.edu
Website: http://cesandiego.ucdavis.edu

Mary Bianchi – *Horticulture/Water Management, San Luis Obispo*
Phone: (805) 781-5949
Email to: mlbianchi@ucdavis.edu
Website: http://cesanluisobispo.ucdavis.edu

Ben Faber – *Subtropical Horticulture, Ventura/Santa Barbara*
Phone: (805) 645-1462
Email to: bafaber@ucdavis.edu
Website: http://cesantabarbara.ucdavis.edu

Mark Freeman – *Citrus and Nut Crops, Fresno/Madera*
Phone: (559) 456-7265 email to: mwfreeman@ucdavis.edu
Website: http://cefresno.ucdavis.edu/newsletter.htm

Craig Kallsen - *Subtropical Horticulture and Pistachios, Kern*
Phone: (661) 868-6221
Email to: cekallsen@ucdavis.edu
Website: http://cekern.ucdavis.edu

Peggy Mauk – *Subtropical Horticulture, Riverside/San Bernardino*
Phone: (951) 683-6491 Ext. 221
Email to: pamauk@ucdavis.edu
Website: http://cesanbernardino.ucdavis.edu

Neil O'Connell – *Citrus/Avocado, Tulare*
Phone: (559) 685-3309 ext 212
Email to: nvoconnell@ucdavis.edu
Website: http://cetulare.ucdavis.edu

Eta Takele – *Area Ag Economics Advisor*
Phone: (951) 683-6491 ext. 243
Email to: ettakele@ucdavis.edu
Website: http://ceriverside.ucdavis.edu

This newsletter is also available online at
http://cesandiego.ucdavis.edu
Or any of the CE office websites as listed above

UC CE University of California Cooperative Extension