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San Joaquin Valley Navel Orange Trees Experience a Strong Early Fruit Drop

For the second year in a row small fruit are shedding unusually freely from navel orange trees in the southern San Joaquin Valley of California. Early-maturing varieties appear to be leading the way in adjusting their fruit load to the unusually warm May weather.

Varieties of citrus like navel oranges and satsuma mandarins have the ability to set fruit parthenocarpically, which, with respect to these two varieties, means without cross-fertilization. Not only is cross-fertilization unnecessary for navel orange and satsuma mandarin fruit production, but also it is virtually nonexistent as the pollen is not viable and mother cells normally degenerate even if fertilized by pollen from other citrus varieties. This kind of parthenocarpy is valuable from a marketing standpoint since little or no pollination means no or few seeds. The disadvantage of parthenocarpy for navel orange growers is that fruit produced parthenocarpically tends to drop from the tree more easily than fruit produced through cross-pollination. Apparently trees hang onto fruit that contain cross-pollinated seed with greater tenacity than fruit without seeds. Rapid transitions in temperature from relatively cool to hot often trigger a cascade of young fruit from navel orange trees in May or June.

Young fruit dropping from the tree is not necessarily a bad thing. Growers selling fruit in the early navel orange market in October and November frequently receive a premium for larger-sized fruit. Often a crop of fewer, but bigger fruit is more economically rewarding than one containing many, small fruit. Last season many growers experienced an unusually heavy spring fruit drop, which resulted in lower than average yields by weight of navel oranges. However, even though yields were down, fruit sizes were larger than average, which helped boost financial returns for many growers. With the lower average yields last season, the yield this season was expected to be up and individual fruit size down. The unusually warm weather, though, appears to again be limiting yields again this season, hopefully in the range where fruit size is improved without undo loss of fruit numbers.

Baby fruit dropping from the tree is not necessarily a good thing either. There is a limit at which point a few, very large fruit are worth much less than a normal yield of average sized fruit. Last season a few growers experienced excessive drop of young fruit and yields were too low to provide a sufficient economic return. Some growers' yields were down enough to qualify them for weather-related insurance losses. Water-stressed navel orange trees experiencing very hot, windy conditions during the fruit-setting period will drop fruit excessively. The south sides of trees are especially affected. To help protect the trees from excessive fruit drop, irrigation should be scheduled to keep pace with increased water usage in hot weather.

The season is young and it's dangerous to make predictions about fruit size and yields in May. There is always more fruit on the tree early in the season than what the eye can see. Enough young fruit has fallen though, to suggest the yield of early-maturing navels will probably be closer to the size of last season's crop than to a new record or near-record harvest.

Problems with the Citrus Vascular System or Root Health Show Up in Hot Weather

The sudden collapse of citrus trees is a common occurrence with the onset of hot weather. This collapse is typically the result of a damaged vascular system or poor root health. The vascular system is made up of the bark, which contains the phloem; the xylem, which is the white wood under the bark; and the cambium layer, which lies between the bark and the wood. The cambium's job is to make new phloem and xylem as the trunk, roots and scaffolds grow. The phloem transports carbohydrates made in the leaves to the trunk and roots while the xylem transports water and minerals absorbed by the roots to the leaves.

If only the outer bark of the trunk or crown is damaged around its entire circumference, the tree usually goes into a slow decline as the roots slowly starve. Seldom will the tree collapse suddenly with the fruit still attached. However, for deeper girdles that go through the cambium and into the xylem, the collapse of the tree can occur relatively quickly since the tree canopy will no longer be able to obtain water from the soil. A mature citrus tree can use up to 60 gallons or more water per day during periods of hot temperatures. Anything that prevents this water from getting to the canopy can result in a fast collapse.

The two most common diseases of citrus that occur in Kern County and that hot weather will help uncover are dry root rot, caused by *Fusarium* spp. including *F. solani*, and foot rot, caused by *Phytophthora citrophthora*. In tree-killing cases of dry root rot, which usually attacks the rootstock, most of the xylem will be killed. The entire cross-sectional cut through an affected rootstock will show a brown, wavy discoloration. Usually the collapse of the tree is so sudden that leaves and fruit will remain attached to the tree. Generally, dry root rot cannot infect a healthy tree unless the tree is damaged in some way to allow infection. Although the tree collapses suddenly, dry rot fungi may grow very slowly, taking years to kill a tree. In Kern County, dry root rot is seen most commonly in trees that were one or two years old during the freeze of 1990. Dry root rots increase under conditions of poor root aeration and excessive irrigation. There are no effective chemical treatments for dry root rot.

Phytophthora citrophthora is most active under cooler winter conditions. Frequently there are no outward symptoms of the disease. The disease usually attacks the roots of citrus, especially the feeder roots. The outer covering of the root becomes soft, water soaked and discolored. The fibrous roots may lose their outer covering exposing the white, threadlike inner vascular tissue. The tree continues to lose roots throughout the winter and the ability of the tree to absorb water decreases. The first hot temperatures of spring in combination with the stress of setting a new crop in fruit, frequently results in trees with this disease demonstrating an unthrifty appearance with the most obvious symptom being excessive yellowing and dropping of leaves. The tree usually shows excessive flowering but poor fruit retention. Usually this disease is most severe on heavy soils with poor drainage. Some rootstocks such as the trifoliates are very tolerant of *Phytophthora*. Several chemical treatments are available but are most effective when water management and drainage problems are corrected before chemical treatments occur. Chemical treatments for *P. citrophthora* are most effective when applied in December or March. Warm summer temperatures greatly reduce the damaging activity of *P. citrophthora* and root samples taken in the summer may show it absent from the orchard.

Applying Insecticidal Narrow-Range Oils Maybe Hazardous During First Spring High Temperatures

Every season, several reports usually come to this office of excessive leaf drop following applications of oil or tank mixes of oil and insecticides. These reports usually coincide with the first hot temperatures of the year. Our first hot daytime temperatures in May and early June are usually associated with cool nights and thus, relatively cool daytime soil temperatures. The ability of roots to absorb water is related to soil temperature. The increased evaporative demand of the atmosphere, tender and poorly acclimated new leaves, and cooler soil temperatures that limit the flow of water from the soil to the canopy, all conspired to produce a water-stressed tree. Applying oil to a stressed tree may cause excessive leaf drop and, eventually, sheep nosed, sunburned fruit with reduced yield. The hot temperatures also appeared to increase leaf drop in trees suffering from other forms of stress, like excessive citrus red mite feeding and late-stage bud union incompatibility caused by overgrowth of the scion by the rootstock.

Southern Fire Ants and New Citrus Plantings

Southern fire ant must be controlled in new citrus plantings. These ants damage leaves and bark. Typically, the damage occurs under the frost-protection wraps, so looking for ants should include opening and looking into wraps. The trunk of an ant-damaged tree has a honeycombed appearance with sap and dirt present. A yellowing tree with dropping leaves is a tip off that ants may have been present in the orchard for some time. As is the case with dry root rot, hot temperatures will cause the rapid collapse of tree girdled or partially girdled by ants earlier in the year. Often, many trees are damaged before the grower knows there is a problem. Ants can attack trees randomly throughout the orchard or only in one corner so any ant monitoring protocol should be thorough. Avoid looking for ants midday when temperatures are extremely hot during the summer. Ants are inactive in the heat, but are usually present earlier in the morning.

Chlorpyrophos (Lorsban ®) provides a fast acting knockdown of badly infested trees and ant baits containing abamectin (Clinch ®) or the recently citrus-registered pyroproxifen (Esteem Ant Bait ®) are all effective in controlling southern fire ant populations.

Citrus Peelminers Becoming More Of A Pest In The Southern San Joaquin Valley

Citrus Peelminer, a fairly recent import into Kern County, is becoming a pest of concern. The citrus peelminer is a moth in the genus *Marmar*. Based on reports from growers and PCA's and data from the Citrus Research Board's IPM demonstration project in Kern County in the Edison and Arvin area, citrus peelminer infested 1 to 6 percent of navels in many groves in Kern County during the 2000 harvest. Peelminer-damaged fruit usually does not make the packout, especially so if the fruit is gassed for color. Several parasitoid wasps parasitize citrus peelminer but these parasites do not appear to be widely distributed in orchards in the San Joaquin Valley. Historically and for still mostly unknown reasons in Arizona and the Coachella Valley, infestations of citrus peelminer show wide fluctuations in intensity. Damage in some grapefruit

orchards in the Coachella Valley was greater than 80% in 1995.

Data from grapefruit groves in Maricopa County in Arizona show a relatively small peak of citrus peelminer activity in June-July, and major population increases during the time period from Mid-August through October. There is no commercially available pheromone to lure peelminers to a trap. Colored traps are not attractive nor are black lights. Looking for mined fruit appears to be the major current option for determining levels of infestation. The first mines of the season seem to appear in May, with substantial levels of mined peels showing up in mid June and July. This insect may have six or more generations a year, so attempting to break the life cycle with pesticides is probably going to be problematic. Obviously, with infestations reaching 6% in Kern County, some growers are not going to be satisfied with natural levels of predation and parasitism, especially if these growers are currently under a chemical control program that may reduce predation and parasitism. Maurer et al. in Arizona suggest that treatments for this pest should be applied when 5-10% of grapefruits are infested with mines measuring ½ inch or less in length. Maurer states that both chlorpyrifos and spinosad have been effective against the peelminer, but the former should be avoided to minimize disruption of parasitoids. I do not believe either of these materials is specifically registered for this pest in California. Read and follow label directions carefully.

Grapefruit, of course, usually hang on the tree much longer than do our early navels, and, with any luck; we may never see navel infestation levels higher than 10%. Most mines appear on fruit in the lower third of the tree and in interior fruit so monitoring for peelminer infestations is backbreaking work. Stems of water sprouts are also mined. Leaves are not mined.

A handout is available at this office that has color pictures of the citrus peelminer and the citrus leafminer (the latter insect which has not yet made it to Kern County but it is in the Imperial Valley.)

Glassy-winged Sharpshooter Update

A major effort is underway in the General Beale Road area to reduce populations of glassy-winged sharpshooters (GWSS), which spread Pierce's Disease of grapes. Because citrus appears to be a preferred overwintering host of this insect, most of the control activity has been focused on citrus. The foliar and the systemic treatments have reduced populations considerably compared to areas to the north where a less systematic approach to control is occurring. Pierce's Disease is present in grapes at low levels in the General Beale Road Pilot Project Area. How effective these insecticidal treatments of GWSS will be on the spread of Pierce's Disease is unknown but will continue for at least another year based on the not unreasonable supposition that greatly reducing the number of GWSS in an area with low levels of Pierce's Disease will slow the spread of the disease. Work is also progressing on finding and rearing new parasites that will be released to help control GWSS. Several important questions remain regarding the relationship of the Pierce's Disease bacterium and citrus. Citrus appears to be a host to the Pierce's Disease bacterium. Whether or not and how readily GWSS can spread the bacterium to grapes is not known. Neither is the degree that citrus is infected with the bacterium.

As some of you know, I have been acting as "communicator" between grape and citrus growers in the citrus growing area to the south of the General Beale Project Area loosely referred to as the "Rancho-David-Herring Roads Area." I greatly appreciate the cooperation that I have received so far from all involved. So far, populations of GWSS have remained very low in this area, but we are still a few months away from when we saw populations peak last season in the General Beale Road area. Why populations of GWSS are very high in one area and

extremely low in adjacent areas that appear almost identical with respect to topography, environment, and cropping patterns remains puzzling.

A California Citrus Industry Guide to the glassy-winged sharpshooter produced by the Citrus Research Board in cooperation with a wide array of citrus industry and University of California members is available from this office. It is probably too early to tell how far GWSS will spread this upcoming season. But unless the situation changes drastically, the regulations regarding the shipping of fruit from southern Kern County to northern Kern County and Tulare County will probably be as strict or possibly stricter than last season. Packinghouses on the coast are gearing-up to handle navels from the Edison, Arvin and Maricopa areas for growers wishing to avoid the threat and economic losses associated with having north-bounds loads of fruit turned back at the packinghouses.

Clementine Mandarins Coming Into Bearing

The new bearing mandarin (i.e. tangerine) acreage numbers for Kern County , mostly composed of clementine and W. Murcott varieties, will likely take a big step upward this fall as many plantings reach their fourth birthday.

Early Harvest Kern County Valencias Hurt by Late Navel Harvests

For many years an early market in Asia has existed for Valencia oranges picked in late February and March. However, as more and more acreage of late-maturing Australian navels have come into production in the US, the demand for these early Valencias has been decreasing. As Kern County heats up in the spring, these Valencias regreen, as Valencias do, and any possibility of sending them overseas evaporates. So what can we do to keep Valencia oranges from regreening?

Nitrogen and the Regreening of Valencia Oranges

Valencia oranges grown in the San Joaquin Valley of California are destined for the fresh table market. Probably the most important commercial quality factor for the Valencia orange, other than external fruit scars or blemishes, is the amount of green color on the peel. Like navels, Valencias turn orange during the winter. However, Valencia oranges mature and ripen more slowly than do the navels and are still hanging on the tree well into the second summer of their existence, long after the navels have been picked. As temperatures rise in the spring and early summer, the fruit frequently revert to the yellow, green or partially green color of the previous summer in a phenomenon called "regreening." Since the Valencia harvest does not begin, even at the earliest, until late February, with the majority being picked in mid-summer, with some late harvests continuing into November, regreening is often a significant marketing problem. The regreening is an exterior feature. These green oranges are ripe and ready to eat. Customers, though, associate ripeness with the orange color. Oranges that are too green at harvest require additional treatment at the packinghouse with a growth regulator to promote the required hue. This treatment often results in reduced fruit size and a reduced shipping and shelf life.

Why Valencias regreen is not fully understood. There are years in which regreening is a problem across the industry and years in which it is a minor concern. This variability strongly suggests that climate is an important governing factor. While the grower can do little to change

the climate, research has shown that nitrogen management can be used to moderate the effect of climate. The quantity of fertilizer nitrogen applied and when and how it is applied all affect regreening. Generally, the higher the nitrogen fertilization rate, the greater is the risk of regreening. An important step in managing nitrogen is to determine how much nitrogen the tree is currently storing. The total nitrogen concentration, expressed as percent of the dry-weight of fall-sampled spring flush leaves, has been shown to be indicative of the nitrogen status of the tree. Total nitrogen concentration in the leaves of less than 1.5 % have been documented in very deficient trees with values in excess of 3.4 % in leaves of trees fertilized with high rates of nitrogen. In the 1950's and early 1960's Drs. Embleton and Jones conducted nitrogen fertility trials with Valencia oranges in southern California. The results of one experiment are summarized in Table 1.

Table 1. Affect of quantity of nitrogen, type of application and timing on regreening of Valencias. After Embleton and Jones, 1973.

Nitrogen Rate lbs of N/tree	Nitrogen Form	Application Type	Timing	Leaf-N %	Green Peel %
0.67	Urea	Broadcast	Jan-Feb	2.33	16
2.00	Urea	Broadcast	Jan-0ct	2.54	24
0.67	Urea	Foliar (3 apps)	Jan-June	2.48	21
1.35	Urea	Foliar (6 apps)	Jan-Dec	2.40	20

In this experiment the statistical comparisons were made separately comparing only the two broadcast treatments together or the two foliar treatments together. There were significantly less fruit per tree (about 11% less) at the lower rate of broadcast nitrogen. None of the differences, including yield which is not shown, between the two foliar treatments were statistically significant. Although significant differences did exist is the percent of green color on the peel, all of the treatment percentages were probably high enough to warrant a trip to the degreening room.

The results of a second experiment (Jones and Embleton, 1959) can be summarized as follows:

1. Summer foliage or summer soil applications of nitrogen resulted in increased regreening.
2. Properly times urea sprays (February through May as opposed to summer sprays) resulted in less regreening than did properly timed soil applications.
3. A nitrogen applications of 2 lbs./ tree, as opposed to 1 lb./ tree or less, resulted in increased regreening.
4. Regreening or oranges did not occur in trees receiving a late winter or spring foliar spray of only 0.33 pound of nitrogen per tree for the season but yield was decreased.

Care should be exercised in transferring the results from southern California directly to the San Joaquin Valley. The climate in the San Joaquin Valley is more extreme than that of the southern California locations were these experiments were conducted. Winter temperatures are colder and summer temperatures are warmer. The results obtained by Embleton and Jones do suggest that regardless of how nitrogen is managed, there is a possibility that the Valencias will have to make a trip through the degreening room. Some long-term on-farm experimentation is probably warranted for the serious grower determining the trade-off

between yield and tree health and possible gains in fruit quality associated with low rates of nitrogen fertilization. Data from southern San Joaquin Valley orchards suggest that maintaining leaf-tissue levels from 2.1% to 2.3 % will probably reduce regreening and still maintain an acceptable level of tree yield, health and vigor. An annual application of approximately 0.75 to 1 pound of nitrogen per tree per season over time should keep most fertigated or foliarly fertilized San Joaquin Valley Valencia trees in this range, but annual monitoring is advised. Reducing the nitrogen sufficiently to ensure an orange-colored summer Valencia (probably less than 0.5 lbs of nitrogen per tree per season over time) will eventually negatively impact yield and tree vigor. Applying the nitrogen foliarly in late winter or spring appears to be preferable to soil applications in the same time period. Fertilizer applications, whether they are broadcast, fertigated or foliar, made in late winter or the spring are preferable to summer applications. Summer nitrogen applications of any kind should be avoided if the crop is still on the tree. If a split application is planned, apply a late winter or spring application, preferable foliarly, and wait until the crop has been harvested to apply the remainder of the nitrogen. Potassium fertilization and high leaf-potassium concentrations have, also, been shown to increase regreening especially if nitrogen is high.

Summer heat, though, appears to be the major reason why Valencia oranges regreen. Even the Australian late navels held late into the spring appear to yellow with the onset of warmer temperatures. Dr. Mary Lu Arpaia, University of California Citrus Extension Specialist, has been evaluating a selection of Valencia that initial research suggests does not regreen like existing varieties. If markets for Valencia oranges continue to exist, this cultivar may be a better choice for the future.

California Citrus Clonal Protection Program Website

The California Citrus Clonal Protection Program has a website at www.ccpp.ucr.edu. This website is under development and contains or will contain information on characteristics of many new and existing varieties of citrus and how they perform at various locations across the citrus growing areas of California. Eventually, pictures of fruit from most of the varieties in the program will be available at this site as well as directions on how to obtain disease free bud wood for propagation.

Fukumoto Bark Rot Appears in Hot Weather

Fukumoto bark rot, once thought to be a caused by bacteria, is now suspected to be caused by copper deficiency. Lime and copper applications have always appeared to lessen symptoms and instead of killing what was thought to be the causal bacteria, may actually have supplied the deficient nutrient. The deficiency (or disease) normally becomes apparent in a grove with the first hot temperatures of spring or summer. The disease is most commonly seen in the Fukumoto navel orange variety and in trees that are one to two years old, although older trees may show symptoms as well. The usual tip-off to the disease is dying branches. Closer inspection of the dying branches reveals cankers with prolific gumming. In hot weather, apparently, a species of yeast uses the gum as a food source, and a light, frothy sudsing is produced, that smells somewhat like brewing beer. The gumming is not unlike that seen in Midnight Valencia and Fisher Navel orange trees grown on sandy/gravelly soils deficient in copper. Observational evidence suggests that copper may prevent the gumming entirely.

Not as Tolerant to Preemergent Herbicides

Grapefruit and grapefruit x pummelo hybrids appear to be less tolerant of some commonly used preemergent herbicides used in citrus. The problem usually manifests itself on sandy and/or gravelly soils. The problem has been seen in Kern and in some southern California citrus groves. If grapefruit are growing poorly with short, stubby branch growth and chlorosis on leaves of upper shoots the grower might experiment by reducing the rates of or eliminating simazine, diuron, or combinations of diuron and bromacyl in areas of affected orchards and comparing growth and tree health to areas receiving standard rates to determine if preemergent herbicides are the cause of the problem.

Disclaimer

Discussion of research findings necessitates using trade names. This does not constitute product endorsement, nor does it suggest products not listed would not be suitable for use. Some research results included involve use of chemicals which are not currently registered for use, or may involve use which would be considered out of label. These results are reported but are not a recommendation from the University of California for use. Consult the label and use it as the basis of all recommendations.

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