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Agriculture and Natural Resources

Prune Notes

Cooperative Extension Butte County

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In this issue:

Submitted by:

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2015 Field Evaluation of Prune Rootstocks

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Roots are the unsung heroes of orchard plantings. They operate out of sight and are relatively difficult to examine and characterize. So what do roots do? Roots:

- Anchor trees to the soil
- Take up water and essential mineral elements for use by the entire tree
- Store carbohydrates and synthesize materials

Rootstocks:

- Influence scion vigor, growth and performance
- Have varying tolerance to different soil types and conditions
- Have varying resistance to soil borne diseases/nematodes
- Must be graft compatible with the scion variety

The root system is a branching system of main roots, lateral roots, feeder roots, and root hairs. The root hairs are the primary uptake structures. Healthy roots require aeration which is why over irrigation is detrimental to root performance. Low oxygen and high carbon dioxide reduce or stop root growth. Low soil moisture and temperature will also stop root growth.

The California prune industry has primarily utilized five rootstocks: Myrobalan Seedling, Myrobalan 29C, Marianna 2624, Lovell Peach and Marianna 40. The characteristics of these rootstocks are listed in the rootstock chapter of the Prune Production Manual (ANR #3507). Many more potential rootstocks for prune are being investigated. Three prune rootstock experiments evaluating 29 rootstocks are planted in Northern California. One experiment was planted at the UC Davis Wolfskill Experimental Orchards on 1/19/2011(Yolo loam), a second experiment was planted in Yuba County on 6/3/2011 (Kilaga clay loam over hardpan) and a third experiment in Butte County was planted on 4/28/2011 (Farwell clay adobe alternated with Nord loam). All trees were nursery grafted to the 'Improved

French' variety. Fowler Nursery donated most of the trees, with Viking and Atlas rootstock donations from Dave Wilson Nursery and HBOK 50 from Duarte Nursery. The first commercial harvest took place in 2015.

Figures 1-2 summarize the anchorage and suckering for the Butte Co. and Yuba Co. plots. Results from the Wolfskill site have not been given because it is a non-replicated 'first look' trial with many unusual rootstocks. Results on yield and size are not presented here because interpretation is complicated by different rootstocks having different numbers of replants at different sites. As trees fill in, yield and size will be reported in the future. The complete report can be found at the UC Davis Fruit and Nut Research and Information Center website (http://ucanr.edu/repositoryfiles/2015-37-160083.pdf).

Although all of these results are preliminary, we will be closely watching to see if trends begin to develop. One possible trend to watch for is the similarity of anchorage and suckering rankings between the Butte and Yuba rootstock sites. Krymsk 86 and Viking had amongst the best anchorage and suckering scores (least deflection and lowest suckering, respectively) at both sites. Krymsk 1 and M58 which were amongst the highest yielding at both sites (data not shown) also had the worst anchorage. We will continue to report on these trials as the trees mature.

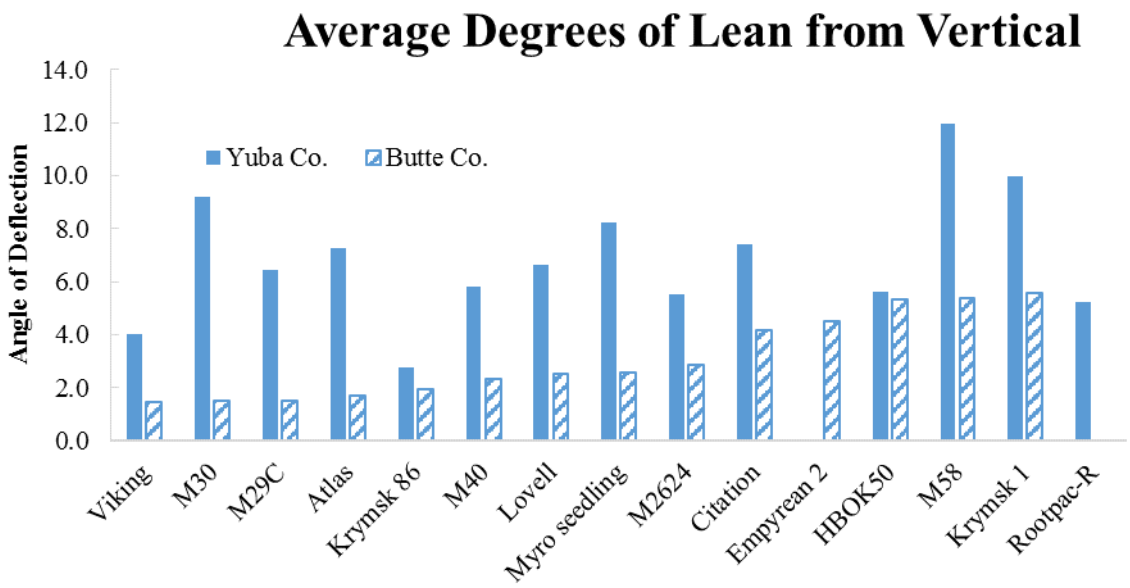

Figure 1. Leaning measurements for the Butte and Yuba County rootstock experiments. Measurements recorded degrees of deflection from vertical when pushing on the tree trunk. Higher numbers mean greater lean or poorer anchorage. Yuba County was measured shortly after irrigation and may be higher as a result.

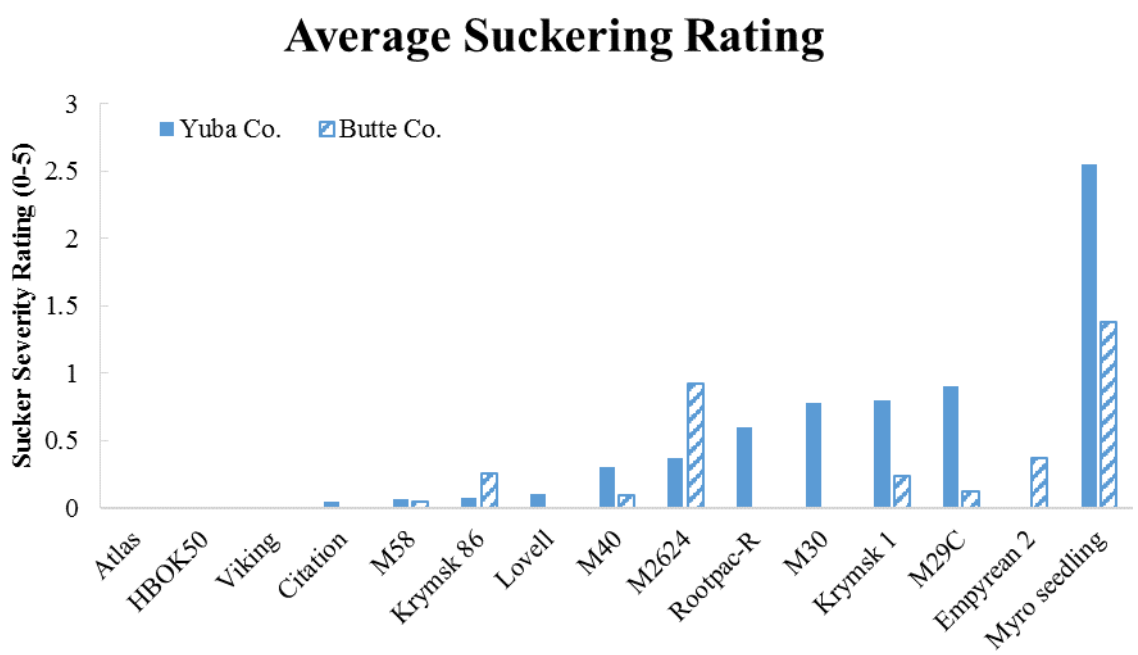

Figure 2. Comparison of average sucker rating per rootstock for the Butte and Yuba County experiments. Suckers were rated 0 to 5, with 5 as most severe.

Fungicide Efficacy

The following tables provide information on fungicide efficacy, FRAC group, and treatment timing for controlling prune diseases. Additional information on general properties of fungicides, antibiotics, biologicals, oils, salts, and natural products registered on deciduous tree fruits and their chemical classes can be found at the UC IPM website: http://www.ipm.ucdavis.edu/PDF/PMG/fungicideefficacytiming.pdf

PRUNE (DRIED PLUM): TREATMENT TIMING

Note: Timings listed are effective but not all may be required for disease control. Timings used will depend upon orchard history of disease, length of bloom, and weather conditions each year.

Disease	Green bud	White bud	Full bloom	May	June	July
Brown rot[1]	+++	+++	+++	----	+	++
Russet scab[2]	----	----	+++	----	----	----
Rust[3]	----	----	----	+	++	+++

Rating: +++ = most effective, ++ = moderately effective, + = least effective, and ---- = ineffective

[1] Flowers are susceptible beginning with the emergence of the sepals (green bud) until the petals fall but are most susceptible when open.
[2] A physiological disorder; no pathogens involved.
[3] More severe when late spring rains occur.

PRUNE (DRIED PLUM): FUNGICIDE EFFICACY

Fungicide	Resistance risk (FRAC#)[1]	Brown rot		Russet scab	Rust
		Blossom	Fruit[2]		
Adament**	medium (3/11)	++++	++++	----	+++
Bumper/Tilt[2]	high (3)	++++	++++	----	+++
Distinguish**	medium (9/11)	++++	++	----	++
Elite**/Tebucon/Teb/Toledo[2,7]	high (3)	++++	++++	----	+++
Indar[2]	high (3)	++++	++++	----	+++
Inspire Super	high (3/9)	++++	++++	----	+++
Luna Sensation*[2]	medium (7/11)[4]	++++	++++	ND	ND
Merivon	medium (7/11)[4]	++++	++++	ND	ND
Pristine[2]	medium (7/11)[4]	++++	++++	ND	ND
Quash [2]	high (3)	++++	++++	----	+++
Luna Experience*	medium (3/7)[4]	++++	++++	ND	++++
Quadris Top[2]	medium (3/11)[4]	++++	++++	ND	++++
Quilt Xcel[2]	medium (3/11)[4]	++++	++++	ND	++++
Rovral[5] + oil	low (2)	++++	NR	----	NR
Scala[6]	high (9)[3,4]	++++	+++[6]	----	ND
Topsin-M /T-Methyl/Incognito+ oil[2,4]	high (1)[4]	++++	++++	----	----
Vangard[6]	high (9)[3,4]	++++	+++[6]	----	ND
Fontelis	high (3)	++++	+++	----	+++
Elevate[2,7]	high (17)[4]	+++	+++	ND	----
Rovral[5]/Iprodione /Nevado	low (2)	+++	NR	----	NR
Topsin-M/T-Methyl/Incognito [2,3]	high (1)[4]	+++	+/-	----	----
Abound	high (11)[4]	++	+	----	+++
Oso/Tavano**	high (19)	++	++	----	ND
Botran	medium (14)	++	++	ND	ND
Bravo/Chlorothalonil/Echo/Equus[8,9,10]	low (M5)	++	++	++	----[9]
Captan[7,8,10]	low (M4)	++	++	+++	----
Gem[7]	high (11)[4]	++	+	----	+++
Rally[2]	high (3)	++	++	----	----
Sulfur[10]	low (M2)	+/-	+/-	----	++

Rating: ++++= excellent and consistent, +++= good and reliable, ++= moderate and variable, += limited and erratic, +/- = often ineffective, ---- = ineffective, ? = insufficient data or unknown, NR=not registered after bloom, and ND=no data

*** Registration pending in California.**

**** Not registered, label withdrawn or inactive in California.**

[1] Group numbers are assigned by the Fungicide Resistance Action Committee (FRAC) according to different modes of actions (for more information, see http://www.frac.info/). Fungicides with a different group number are suitable to alternate in a resistance management program. In California, make no more than one application of fungicides with mode-of-action Group numbers 1, 4, 9, 11, or 17 before rotating to a fungicide with a different mode-of-action Group number; for fungicides with other Group numbers, make no more than two consecutive applications before rotating to fungicide with a different mode-of-action Group number.

[2] Fruit brown rot treatments for fungicides in FRAC Groups 1,2, 3, 17, 7/11 are improved with the addition of 2% light summer oil. The oil is "light" summer oil (1-2% vol/vol). If applied in summer, fruit will loose their waxy bloom and look red. They will dry to normal color.

[3] Strains of *Monilinia fructicola* and *M. laxa* resistant to Topsin-M and T-Methyl have been reported in some California prune orchards. No more than two applications of Topsin-M or T-Methyl should be made each year. Resistant strains of the jacket rot fungus, *Botrytis cinerea*, and powdery mildew fungi have been reported in California on crops other than almond and stone fruits and may have the potential to develop in prune with overuse of fungicides with similar chemistry. Subpopulations of both *Monilinia* spp. have been shown to be resistant to AP (FRAC 9) fungicides on prune in CA.

[4] To reduce the risk of resistance development, start treatments with a fungicide with a multi-site mode of action; rotate or mix fungicides with different mode-of-action FRAC numbers for subsequent applications, use labeled rates (preferably the upper range), and limit the total number of applications/season.

[5] Blossom blight only; not registered for use after petal fall.

[6] High summer temperatures and relative humidity reduce efficacy.

[7] Registered for use on fresh prunes only.

[8] Do not use in combination with or shortly before or after oil treatment.

[9] Do not use after jacket (shuck) split.

[10] Do not use sulfur, captan, or chlorothalonil in combination with or shortly before or after oil treatment.

Nitrogen Management for Prunes

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Nitrogen management boils down to one fundamental concept – matching output with input. When nitrogen input (fertilizer and other sources) exceeds output (harvested crop and tree growth), nitrogen (N) can be lost from the root zone and leached into groundwater aquifers. Two key tools to managing nitrogen -- both for tree productivity and minimizing leaching -- are nitrogen budgeting and leaf analysis. Nitrogen budgeting is used to determine how much nitrogen to apply, and when and where to apply it based on estimated tree N use. Leaf analysis is a report card for the season and a back-stop – a way to watch out for nutrient deficiencies before they decrease yield.

Nitrogen Budgeting

Three key components to nitrogen budgeting are the Rate, Time and Place of nitrogen application. When timing or amount of supply doesn't match demand, yield can be reduced compared to yield under properly fertilized conditions.

Rate

UC research led by Professor Patrick Brown found 11-13 lbs N (also commonly called units of N) in every ton of dried prunes. Approximately 30 lbs per acre (estimated) are additionally needed in tree growth in mature trees. This number would be larger with younger trees. An orchard that produces 3 tons/acre will remove 33-39 lbs N/acre from the orchard in the crop, with another 30 lbs N/acre used in tree growth. Thus, 63-69 lbs N all together is needed for growth and yield.

But, does this mean 63-69 lbs N should be applied to the trees as fertilizer? Not necessarily. First, consider that not all of the applied nitrogen will be taken up by the tree. Some fertilizer N will be absorbed by weeds or soil microbes before it can reach the tree roots, or will be lost from the root zone by leaching or volatilization. With split N applications and irrigating to match ETc, it's reasonable to expect that 70% of the amount of nitrogen applied will be taken up by the tree (the ratio of nitrogen used by the trees to nitrogen applied to the orchard is called nitrogen use efficiency, NUE). For the 3 ton orchard example, 94 lbs N would need to be applied to meet the demand of 66 lbs N/acre (assuming a70% NUE). (66 ÷ 0.7 = 94).

Also, when calculating nitrogen input, consider nitrogen from sources such as manure, compost and irrigation water, particularly groundwater. Table 1 shows how many pound of nitrogen are applied in water with nitrate, using two different styles of lab analysis results (nitrogen as either "nitrate-nitrogen" or plain "nitrate").

Table 1. Nitrogen available for plant use from irrigation water.

Reported as NO_3-Nitrogen (Nitrate Nitrogen) (ppm or mg/l)				
Acre- Inches	Pounds of Nitrogen in Water			
	1 ppm	5 ppm	10 ppm	15 ppm
1	0.2	1.1	2.3	3.4
6	1.4	6.8	13.5	20.3
12	2.7	13.5	27.0	40.5
Reported as NO_3 (Nitrate) (ppm or mg/l)				
Acre- Inches	Pounds of Nitrogen in Water			
	1 ppm	5 ppm	10 ppm	15 ppm
1	0.05	0.3	0.5	0.8
6	0.3	1.5	3.1	4.6
12	0.6	3.1	6.1	9.2

enough such that all trees are above the 2.2% critical value. For that reason, many orchard managers shoot for leaf nitrogen levels in the 2.6% to 2.8% range. Values above 3.0% N are excessive. Leaf tissue values graphically charted over several years can indicate if leaf levels are increasing, suggesting over-application, or decreasing suggesting under-application of nitrogen.

Prune Bloom Orchard Management Considerations

Katherine Pope, UC Farm Advisor Sacramento, Solano & Yolo Counties
Franz Niederholzer, UC Farm Advisor, Colusa, Sutter and Yuba Counties
Emily J. Symmes, UCCE Area IPM Advisor, Sacramento Valley
Luke Milliron, UCCE Horticulture Intern, Sutter, Yuba and San Joaquin Counties

Cultural Operations:

- Order bees in February, generally you want to install one hive per acre.
- *Heat:* Consider running water if heat is predicted at bloom. Water provides some small temperature reduction from orchard floor evaporation, usually just a degree (oF) or two. Just the orchard surface and top foot of soil needs to be wet, so deep watering is not necessary. Run water when temperatures reach 70-75oF and shut off when they drop below those temperatures.
- *Frost:* Get orchard floor ready to minimize frost risk -- a closely mowed orchard is warmer than an orchard with tall weeds/cover crop. Considering frost risk, a loose, freshly disked soil is the coldest.

Irrigation:

- Check the uniformity of your irrigation system and perform system maintenance for any sprinkler/micro-sprinkler frost control and the beginning of your irrigation season. Guidelines for irrigation maintenance can be found on pages 7-9 of cesutter.ucanr.edu/newsletters/Sacramento_Valley_Prune_News53275.pdf

Disease Management:

- Get air-blast sprayer ready to apply bloom fungicides. Check calibration and do general maintenance (check sprayer filters, replace nozzles as needed, etc.)
- *Brown rot*: Plan for disease if bloom time weather is wet. Despite the recent warm spell, rainy El Niño conditions are expected to pick up again at the end of February and through March. Flowers are susceptible beginning at green bud. Alternate fungicide classes when planning a two-spray program. Check that FRAC numbers on the label are different to ensure appropriate rotation (see FRAC numbers on tables in this newsletter.) Remove or destroy thinned fruit on the orchard floor to reduce inoculum. More on Brown rot: ipm.ucdavis.edu/PMG/r606100411.html
- *Russet scab*: The disorder develops when there is significant rainfall during and immediately after bloom. Consider spraying captan or chlorothanil (Bravo/Echo) at full bloom to reduce scab on fruit at harvest, but be careful to pay attention to honey bee safety. More on Russet scab: ipm.ucdavis.edu/PMG/r606100511.html

Pest Management:

- *San Jose scale (SJS):* If dormant treatments were not applied, not effective, and/or SJS pressure is high in the orchard, treatments targeting the late spring crawler stage can be effective. Place pheromone traps by mid- to late February. Crawler treatments should be applied 600-700 degree days after biofix (males caught on consecutive trap checks). Pheromone traps can also give an indication of SJS parasitoid activity in the orchard. Alternatively, double-sided sticky tape can be placed around limbs beginning in April to detect

crawler emergence and time spring treatments if necessary. Additional SJS management information: ipm.ucdavis.edu/PMG/r606302111.html

- *Aphids*: In the absence of aphid sprays during fall or winter, two (4 gal/acre) oil sprays at bloom can be effective against mealy plum and leaf-curl plum aphids if applied 7-10 days apart at 1.5 mph. Oil should not be applied with or shortly before/after captan, chlorothalonil or sulfur because the combination can be phytotoxic. Continue monitoring for mealy plum aphid during the season. Oil sprays anytime from petal fall to May 15 can reduce mealy plum aphid to acceptable levels. Oil is not effective against leaf curl aphid during this period.

  More Leaf curl plum aphid info: ipm.ucdavis.edu/PMG/r606301811.html

  More Mealy plum aphid info: ipm.ucdavis.edu/PMG/r606301711.html
- *Peach twig borer (PTB):* Monitor for PTB during bloom and post-bloom periods. Chewing damage on buds during bloom indicates PTB activity and may warrant treatment (see link below for material options). Begin post-bloom monitoring with pheromone traps (minimum 2 per block) no later than April 1 to determine biofix (moths caught on two consecutive trap checks). Monitor for PTB fruit feeding 400 degree days after the first biofix. Walk the orchard, visually examining the fruit (ideally 1200 fruit or 15 fruit from 80 trees) looking for larvae and/or damage (entry into fruit), paying close attention to where fruit contact each other or leaves touch the fruit. Scouting for damaged fruit at this timing (around May/pit hardening) also gives you an idea of the potential for latent brown rot infections of damaged fruit. Treat for PTB if 2% or more (24+ of 1,200) of the fruit has damage. Additional PTB management information: ipm.ucdavis.edu/PMG/r606300211.html
- *Obliquebanded leafroller (OBLR)*: Place pheromone traps (minimum 2 per block) no later than mid-April to identify biofix (moths are caught on two consecutive trap checks). Begin sampling fruit for OBLR damage 930 degree days after biofix. As with peach twig borer, walk the orchard, visually examining fruit (ideally 1,200) and treat if 2% or more of the fruit have damage.

  Additional OBLR management information: ipm.ucdavis.edu/PMG/r606300511.html

Nutrition:

- Measure crop load in mid-April BEFORE any nitrogen or potassium fertilizer applications occur. For optimal nitrogen uptake, apply multiple applications avoiding a single heavy spring application, which rains and subsequent irrigation may leach nitrate from the root zone. Please see article on nitrogen fertilization (*article in this issue*).

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