Prune Newsletter

Cooperative Extension Butte County

University of California
Agriculture and Natural Resources

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In this issue:

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Spring & Early Summer Orchard Considerations

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Late April

- ✓ **Got a crop?** We had an early bloom and expected we would have an early reference date. However, it has been generally cool for a month after full bloom, and we are seeing and hearing reports of very slow fruit development. Fruit set in many counties is uneven from orchard to orchard. Continue monitoring crop development, and be ready to check cropload and shaker thin where needed. Typically reference date is 7-10 days after pit tip hardening. Thin early for best size results.
  - The exact definition of reference date is when 8 or 9 out of 10 sampled fruit have a visible endosperm, which you can see a photo of at: sacvalleyorchards.com/prunes/horticulture-prunes/thinning-prunes/.
  - A prune thinning calculator is available at: sacvalleyorchards.com/prunes/horticulture-prunes/prune-thinning-calculator/
- ✓ **Irrigation:** We have had several small storms in late winter/early spring, however have they significantly contributed to your soil moisture? Special attention to orchard water status and irrigation is needed.
  - Monitor a combination of net ETc (ETc – effective rainfall), soil moisture sensors and pressure chamber readings to track orchard moisture status and time irrigations. The most direct measure of water status is the pressure chamber, read more at: sacvalleyorchards.com/manuals/stem-water-potential. ET reports are also published weekly: sacvalleyorchards.com/et-reports/2020-et-reports
- ✓ **Fertilization program starts:** Consider a nitrogen (N) application before the end of April if there is a good crop set. If considering foliar potassium nitrate applications as your potassium (K) program or to supplement soil applied K, begin spraying in late April and make additional applications every 2-3 weeks. More details at: apps1.cdfa.ca.gov/FertilizerResearch/docs/Prune_Plum.html
- ✓ **Aphid:** Monitor for leaf curl plum aphid and mealy plum aphid since colonies can grow soon after bloom. Monitoring details at: ipm.ucanr.edu/PMG/r606900211.html. Oil sprays anytime from petal fall to May 15 can

reduce mealy plum aphid to acceptable levels with good to excellent coverage. Oil is not effective against leaf curl aphid during this period as the spray can't reach inside the curled leaves where the aphids are feeding. Other pesticides are effective in controlling aphids during the spring, but be careful to avoid flaring mites with pyrethroids (Asana®, Warrior®, etc). or neonics (Actara®, Provado®, etc.). Movento® and BeLeaf® can provide excellent aphid control when monitoring shows a need.

More information on leaf curl plum aphid at: ipm.ucanr.edu/PMG/r611301811.html

More information on mealy plum aphid at: ipm.ucanr.edu/PMG/r611301711.html

May

- ✓ **Rust:** Monitoring commences with the start of the month, surveying 40 trees every 1-2 weeks. Pay close attention to non-bearing replants, exceptionally vigorous trees, and previous hot spots. Consider treating when the first leaf with rust is found. For more on rust see: ipm.ucanr.edu/PMG/r606100611.html

- ✓ **Peach twig borer (PTB) and Oblique-banded leaf roller (OBLR):** These worms feed on the fruit surface later in the season, "opening the door" for fruit brown rot infection as sugar increases in the fruit. Don't assume earlier sprays worked to control these pests. Inspect fruit at 400 degree days after the first PTB biofix. In the orchard, look for larval entry points on the fruit (ideally 15 fruit from 80 trees), especially where fruits contact each other or touch leaves. Treat if 2% or more (24+ of 1,200) of the fruit have damage. For OBLR, begin fruit inspections at 930 degree days after biofix for that pest, following the same sampling protocol and treatment threshold. More on PTB at: ipm.ucanr.edu/PMG/r606300211.html and on OBLR at: ipm.ucanr.edu/PMG/r611300511.html

- ✓ **Aphids:** While monitoring for leaf curl plum aphid comes to an end in mid-May, continue monitoring for mealy plum aphid until mid-July.

- ✓ **Irrigation:** Continue monitoring pressure chamber, soil moisture and/or tracking ETc to manage irrigation. May and June are the most critical months for end-cracking, which occurs when dry orchards are irrigated. Stay on top of orchard water status since irrigation is critical during the spring.

- ✓ **Fertility:** Continue with nitrogen and potassium fertilization program if a good crop is set. More than 50% of annual N budget should be applied before June 1st.

June

- ✓ Continue monitoring for **aphids** and **rust**.

- ✓ **Spider mites:** Begin scouting by checking two different sections of the orchard each week. Spend about five minutes in each section checking 2-3 leaves (some inside and outside of the canopy) on 10 trees. Look for spider mites and predators (predaceous mites and sixspotted thrips). Treatment decisions should be based on population levels of both mites and predators. If more than 20% of leaves have mites, but less than 50% of the leaves have predators, treat for mites. If more than 60% of leaves have mites, treat even if most leaves have predators. For more on mites, see ipm.ucanr.edu/PMG/r606400411.html

July

- ✓ **Aphids, rust, and spider mites:** Continue monitoring for late summer (preharvest) outbreaks of rust and/or spider mites. Infestations of these pests can cause leaf drop at harvest, slowing conveyor and elevator belts at harvest in order to better blow out the leaves and keep the bins clean.

- ✓ **Brown rot**: Consider preharvest treatments for brown rot according to UC IPM guidelines: ipm.ucanr.edu/PMG/r606100911.html. See timings and material efficacy at: ipm.ucanr.edu/PDF/PMG/fungicideefficacytiming.pdf

- ✓ **Monitoring Fruit Maturity:** When color just begins to show along the suture, fruit should be mature in

roughly 30 days. Begin measuring fruit internal pressure once fruit shows color. Warmer weather slows fruit maturity; cooler weather = faster fruit maturity. Fruit lose 1 to 2 lbs fruit pressure per week and are mature at 3 - 4 lbs internal pressure.

- ✓ **Timing Irrigation Cut off**: Track fruit pressure to plan harvest timing and irrigation cut off. For example, if shake target is 3 lb fruit pressure and you want 2 weeks between last irrigation and harvest, then water shut off should be getting close when fruit hits 6 lbs pressure – assuming pressure drops 1.5 lb/week.

- ✓ **July leaf samples:** To help evaluate your nutrient program this year, collect leaves from non-fruiting spurs from representative trees and submit to a lab for analysis. Leaf sampling details at: sacvalleyorchards.com/prunes/horticulture-prunes/july-leaf-sampling-a-critical-task-in-prune-production/

- ✓ **PTB, OBLR, San Jose Scale**, and **brown rot**: Sampling for damaged fruit just ahead of harvest will give you an indication of the efficacy of your IPM program. Randomly examine 1000 fruit (40 from 25 trees) looking for larvae, worm damage, and halo spots caused by San Jose scale. More information is available at: ipm.ucanr.edu/PMG/r606900711.html

- ✓ **Clean up orchard ahead of harvest:** Cut out broken limbs and dead branches and remove them from the orchard ahead of harvest. This will reduce the risk to the harvest crew from flying dead wood during shaking and chances of canvas tears and other glitches that can slow harvest.

Thinning Prunes

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In the 2020 season, large prunes (A and B screen) have value, medium to small fruit has much less, if any value. To avoid growing medium to small fruit, even if you pruned, it is critical that growers 1) check cropload from 2-3 trees per orchard to decide if thinning is needed and 2) THIN if needed. Thinning should occur roughly around the time of 'reference date', when 80 to 90% of the fruit have a visible endosperm. The endosperm, a clear gel-like glob, the beginning of the developing seed, will be found in the seed cavity on the blossom end of the prune (Figure 1) and is solid enough to be removed with a knife point. Typically, the reference date occurs in late April or early May, approximately one week after the pit tip begins to harden. This year, with an early bloom and cool weather after bloom, check frequently to make sure you don't miss pit hardening. The earlier thinning is done, the better the fruit size boost. However, if you thin too early and shake trees too hard , you may damage the trees without removing the desired number of fruit.

To decide whether to thin, **estimate** the number of fruit per tree needed to produce your desired crop, **determine** the number of fruit on 3 representative trees, at or just before reference date, and, using those numbers, **decide** if you need to thin. **Calculate** how much fruit needs to come off if thinning is needed. Finally, **shake** if thinning is needed. Below we walk through the math, step by step. Alternatively, skip doing the calculations by hand and use the prune thinning calculator, available at: sacvalleyorchards.com/prunes/horticulture-prunes/prune-thinning-calculator

Figure 1. Extraction of the endosperm on a developing prune.

1. **Estimate** the targeted tonnage from a given block by considering orchard history, age, etc. Let's assume a target of 3 tons/ac, and shoot for 55 dry count/lb in an orchard spaced 16' x 18' (151 trees/acre) . From there, calculate a targeted number of fruit per tree:

(Dry pounds per ac x Dry count per lb) ÷ Trees per ac = Target number fruit per tree

$$6{,}000\,\frac{lbs}{ac} \times 55\,\frac{count}{lb} \div 151\,\frac{trees}{ac} = 2{,}185\ fruit/tree\ \text{(target)}$$

2. **Determine** the actual number of fruit in a sample tree and compare that number to the target of 2,185 fruit (from step 1). Ideally, repeat this procedure on 3 representative trees to ensure accuracy. Place a tarp under the tree and mechanically shake off as much fruit as possible, then hand strip any remaining fruit. Collect all the sound fruit and weigh them (for easy math, let's assume it weighs 100 lbs). Take a 1-lb subsample of the fruit and count how many sound fruit are in a pound (assume 90 fruit/lb). Don't count fruit that looks like it wouldn't have stayed on the tree until harvest - these fruit are light green or otherwise look slightly "off" compared to the strong fruit. Then use those numbers to determine the total number of fruit per tree:

Total tree fruit weight x Number of prunes per lb = Total number of fruit per tree

$$100lbs \times 90\frac{fruit}{lb} = 9{,}000\ fruit/tree\ \text{(actual)}$$

3. **Decide** if you need to thin. Subtract the number of fruit needed at harvest from the number of fruit on the tree now (reference date). In this example, there is roughly 4 times the number of fruit on the tree than desired to hit the target of 55 dry count/lb. You don't want to simply remove all those extra fruit, because you need to account for natural fruit drop and variability in fruit per tree across the orchard. Estimates of natural fruit drop range from 10% to 40%. Selecting the appropriate drop percentage should account for orchard history, as well as your own risk threshold. Many growers prefer to leave approximately 50% more fruit on the tree after mechanical thinning than we want remaining on the tree at harvest:

Target number prunes per tree x 1.5 (= 50% fruit drop buffer) = Adjusted number fruit per tree

$$2{,}185\ x\ 1.5 = 3{,}278\ fruit/tree\ \text{(adjusted target)}$$

4. **Calculate** how many fruit to remove by subtracting the adjusted target number from the actual number of prunes on the tree:

Actual fruit per tree – Adjusted target fruit per tree = Number fruit to remove

$$9{,}000\frac{fruit}{tree} - 3{,}278\frac{fruit}{tree} = 5{,}722\ fruit/tree\ to\ remove$$

5. **Shake** (if needed). Use harvest machinery (shaker) to remove the approximately 5,700 excess fruit. Shake a tree for one second, and following the steps above, calculate how many fruit were removed. If needed, increase the shaking time until the desired numbers are removed. Typical shaking time is 2 to 4 seconds; avoid shaking for longer than 6 to 7 seconds to prevent unnecessary damage. Once you've calibrated your shaking time, go through and thin the block. If you are thinning for more than a week, check fruit per tree and green fruit per pound every few days to make sure that your shake time doesn't need to be adjusted down as fruit grow.

Update on Rootstocks for Prune Production

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Two rootstock experiments in grower orchards were planted in Northern California in 2011. One site in Butte County and a second in Yuba County. The two sites are evaluating the performance of Improved French on 14 rootstocks planted in replicated randomized trials. The sites share five standard rootstocks that already had widespread adoption in the industry, namely Myroblan 29C, Myroblan Seedling, Marianna 2624, Marianna 40, and Lovell. The sites also share eight test rootstocks, Krysmsk 86, Krysmk 1, Viking, Atlas, Citation, HBOK 50, Marianna 30, and Marianna 58. Rootpac-R is only at the Yuba location, and Empyrean 2 is only at the Butte location.

The Butte site was previously planted to almonds on Lovell rootstock, while the Yuba site is prune following prune. The Butte site is a Farwell clay adobe alternating with a lighter textured Nord loam, while the Yuba site is Kilga clay loam. The Butte site received no pre-plant fumigation, while the Yuba site had Telone fumigation. Following late planting

during a wet spring, there were extensive replants in 2012 at both sites. At the Butte site, replants benefited from spot fumigation with 0.5 pounds of chloropicrin. The Butte and Yuba sites are irrigated with drip and micro-sprinkler, respectively. Finally, the Butte site is 12.5 feet in-row and 17 feet between rows (205 trees/acre), and Yuba is 16 feet in-row and 18 feet between rows (151 trees/acre). We previously reported in this newsletter on the results from this trial in 2016 and 2018 issues.

Rootstock survival:

Although the vigor imparted by the rootstock is an important consideration, survival in adverse conditions is the most valuable benefit a rootstock can impart (Table 1). Percent tree survival was assessed at both sites in 2019 and survival ranged from 10% (Empyrean 2) to 97% (Atlas) at the Butte site, and 37% (HBOK 50) to 100% (Viking and Lovell) at the Yuba site (table 2). There are notable differences and similarities in survival between the two sites. Myrobalan 29C, Myrobalan seedling and HBOK 50 have all had higher numerical survival rates at the Butte site than at the Yuba location where bacterial canker created significant tree losses, potentially due to bacterial canker susceptibility at the Yuba location (Photo 1). It is unclear why Lovell, Krymsk 86, Citation, and Krymsk 1 have had numerically higher survival at the Yuba location. At both sites Atlas and Viking, which were planted a year later and in the case of the Butte site received spot fumigation before planting have had excellent survival (97-100%). Marianna 40 and Marianna 2624 have also had good survival (80-87%). Marianna 58 has had intermediate survival performance at both sites (73% and 77%). Finally, Marianna 30 has had very low survival at both sites (43% and 37%)

% Tree Survival, 2019					
Rootstock	Butte		Rootstock	Yuba	
Atlas	97%	a	**Viking**	100%	a
Viking	93%	a	**Lovell**	100%	a
Myro.	93%	a	**Atlas**	97%	a
M29C	90%	ab	**K86**	97%	a
M40	86%	ab	**Root.-R**	93%	a
M2624	80%	ab	**M40**	87%	a
K86	77%	ab	**M2624**	83%	a
HBOK50	77%	ab	**Citation**	80%	a
M58	73%	ab	**K1**	80%	a
Lovell	70%	ab	**M58**	77%	ab
Citation	53%	abc	**Myro.**	73%	ab
M30	43%	bc	**M29C**	63%	ab
K1	43%	bc	**M30**	37%	b
Emp. 2	10%	c	**HBOK50**	37%	b
Average	**70%**		**Average**	**79%**	

Table 1. Percent tree survival at the Butte (7 September) and Yuba (12 June) sites in 2019. Values followed by the same letters are not significantly different at 95% using Tukey's HSD.

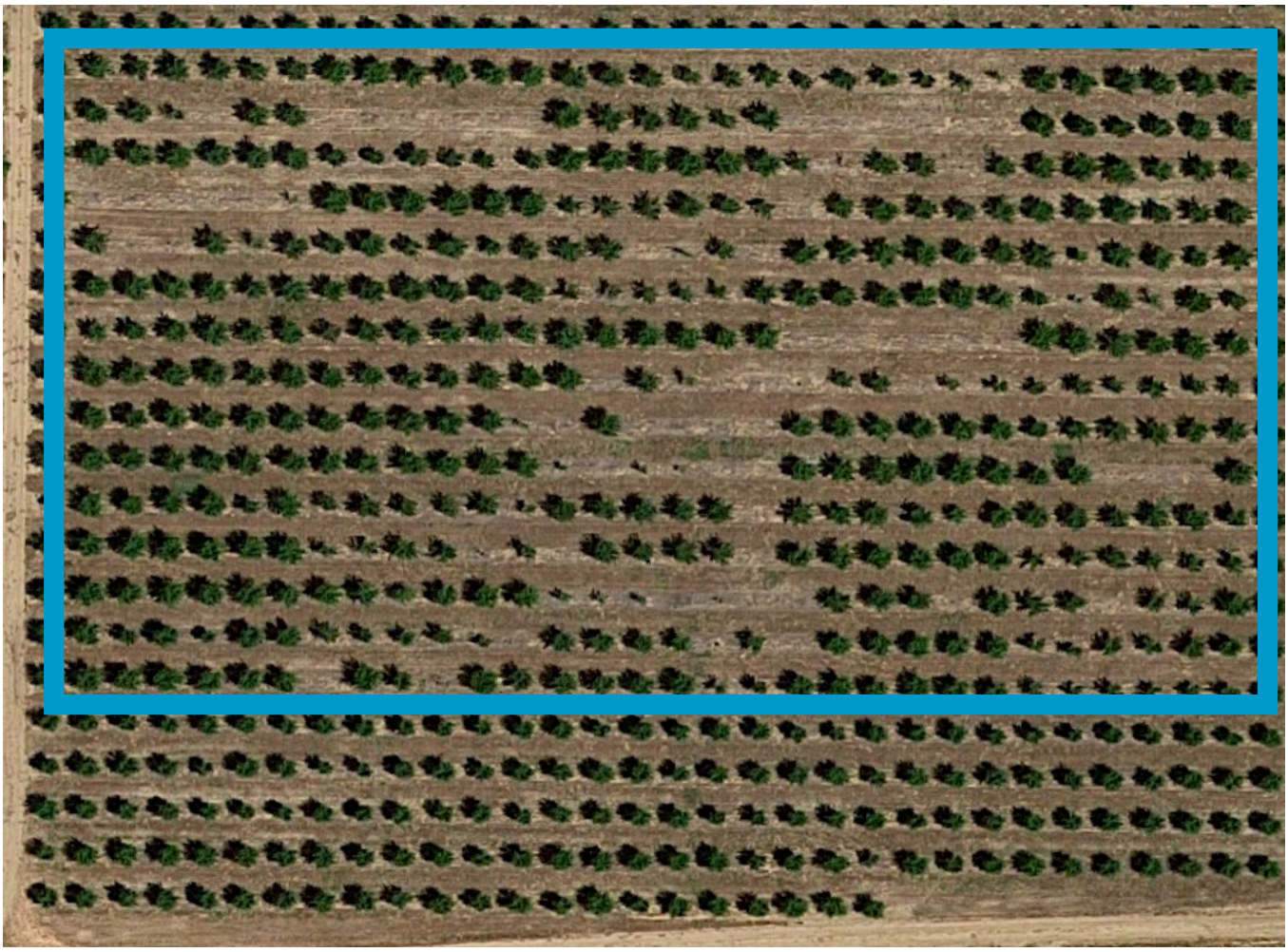

Photo 1. Satellite image of the UCCE prune rootstock plot (inside the blue line) in Yuba County showing differences in tree size and survival between different rootstocks. Although tree loss was likely from multiple causes, bacterial canker was a significant player. Each rootstock is planted in six tree groups down the rows running E-W. Note gaps of six trees show where a particular rootstock failed, adjacent to large, healthy canopies where a different rootstock is thriving. The grower's trees, outside the blue line are all on M40. (Google©, Imagery Maxar Technologies ©2019, and U.S. Geological Survey map data ©2019).

Rootstock vigor:

The 2018 article includes discussion of relative vigor, potential nematode and crown/root rot susceptibility, as well as early assessments of rootstock bloom timing at Butte, canker and tree loss at Yuba, and the 2017 trunk size and yield results. You can find the full discussion of these preliminary findings at: sacvalleyorchards.com/blog/prunes-blog/preliminary-observations-for-new-prune-rootstocks.

Generally, larger trunks = larger, more vigorous trees with greater yield. Trunk diameter (in) for 2019 is shown for 2019 in Table 2. Myrobalan 29C and HBOK 50 had the largest diameter at the Butte and Yuba sites, respectively. The rootstocks imparting among the greatest vigor according to diameter at both locations were Myrobalan 29C, Viking, Atlas, Krysmk 86, and Lovell. Krymsk 1 had the smallest diameter at both sites. In addition to Krymsk 1; Marianna 58, Empyrean 2, Citation, and Marianna 2624 imparted the least vigor according to diameter. In general, trees were larger at the Butte site than in Yuba.

Trunk diameter (in), 2019					
Rootstock	Butte			Rootstock	Yuba
M29C	7.1	a		**HBOK50**	5.5 a
Atlas	6.5	ab		**Viking**	5.3 ab
Viking	6.3	ab		**Atlas**	5.3 ab
M30	6.1	ab		**K86**	5.0 abc
Lovell	5.9	abc		**M29C**	4.7 abcd
M40	5.4	abcd		**Lovell**	4.6 abcde
K86	5.3	abcd		**M30**	4.5 bcde
Myro.	5.2	bcd		**M40**	4.3 cde
M2624	5.0	bcde		**Root.-R**	4.0 def
Citation	4.9	bcde		**M2624**	3.8 ef
HBOK50	4.0	cde		**Myro.**	3.8 efg
Emp. 2	3.9	cde		**Citation**	3.4 fg
M58	3.8	de		**M58**	3.0 gh
K1	2.9	e		**K1**	2.3 h
Average	**5.2**			**Average**	**4.3**

Table 2. Trunk diameter (in) at the Butte and Yuba sites in 2019. Values followed by the same letters are not significantly different at 95% using Tukey's HSD, with letter order denoting highest to lowest.

Yield has been much more variable at the two sites. Together with trunk diameter, yields have been numerically higher at the Butte site. The exception of this was 2018, following potential over cropping in 2017 at the Butte site and poor return bloom density in 2018. Unlike trunk diameter, yield differences by rootstock have not been consistent at each site, year-to-year. However, Krymsk 1 has been amongst the lowest yielding rootstocks at both sites for every harvest. More harvests are needed to more clearly define yield differences between the rootstocks. Despite this variability, it has been true that generally yield increases with increasing trunk diameter (Table 1).

When interpreting yield results, it's important to consider that all rootstock trials that impose the same spacing across the plot disadvantage lower vigor rootstocks that could have been placed at a higher density. Although yield generally increases with increasing tree size, there are some rootstocks that yield particularly well or poorly for their size. In 2019 at the Butte site, for example, Marianna 2624 and Marianna 30 had the highest yield efficiency, Empyrean 2 had the lowest and all other rootstocks fell in-between. Again, more harvest data is needed to enumerate which rootstocks are over- and under-yielding for their vigor. Some growers with an interest in lower vigor inducing rootstocks are beginning to trial high density plantings.

To see the complete yield, fruit size, bloom timing and density, leaf mineral nutrition, and tree water status results for this trial you can find the 2019 report at: ucanr.edu/sites/driedplum/files/318583.docx

Rootstock suckers and anchorage:

In the 2016 article on early observation from the two rootstock sites we focused on rootstock suckers and anchorage. Rootstock suckering was evaluated on a rating of 0-4, where trees with a "0" had no suckers at all, "1" had at most only a couple of very small suckers, to "4" where suckers were both numerous and large. At both sites Myroblan seedling had the highest sucker rating. Conversely, Atlas, HBOK50, Viking, Citation, Marianna 58, Krysmk 86, Lovell, and Marianna 40 all were rated below a 0.5 at both sites. Anchorage was evaluated by measuring the degrees of lean from vertical when each tree was pushed with an equal force. There was much more lean at the Yuba site, which is on a Kilga clay loam, over hard pan where soils were wet at the time of evaluation. However, at both sites Krymsk 1, Marianna 58, HBOK 50, and Citation average above 4% lean. At both sites, Krymsk 86 and Viking averaged the least lean. In these evaluations of suckering and anchorage, Krymsk 86 and Viking had among the best performance at both sites. You can see the suckering and anchorage results at: sacvalleyorchards.com/blog/prunes-blog/prune-rootstock-trial-performance