UNIVERSITY OF CALIFORNIA • COOPERATIVE EXTENSION • GLENN COUNTY
P.O. Box 697 (821 E. South St.), Orland, CA 95963 • (530)865-1107 • FAX (530)865-1109

ORCHARD FACTS

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Bill Krueger
Farm Advisor

Sacramento Valley Prune Newsletter

Maximizing Grower Profit in Tough Times

Franz Niederholzer, UC Farm Advisor, Sutter/Yuba Co
Bill Krueger, UC Farm Advisor, Glenn Co.
Carolyn DeBuse, UC Farm Advisor, Solano/Yolo Co.

Profit = income – cost. To maximize profit, prune growers must maximize yield of high-value prunes while keeping costs as low as possible. There's a challenge! Is there an easy, one-size-fits-all answer? No. Every orchard and farming operation is different. Each grower must make his/her decisions on an orchard by orchard basis. The purpose of this article is to review research-based prune growing practices that may be helpful in planning orchard practices. A table, drawn from the 2008 UC Prune Production Cost Study, showing common prune growing practices and relative costs is included below.

Significant savings comes from significant cuts in production costs. What are the significant production costs in prunes? No surprise, here. Hand pruning, bloom sprays, irrigation, nitrogen + potassium fertilizer, and preemergent weed control costs can total over two-thirds of the prune production costs (Table 1). The following are ideas to consider when considering cost cutting options in prune growing. Since a full program best covers risk, significant cost savings may also present significant risk to grower income, so any cost cuts must be carefully considered on an orchard by orchard, year by year basis. However, when you can't pay for a Cadillac, consider test driving a Chevy….

<u>Pruning</u>: A pruning trial (2006-2009) in Glenn County reduced pruning costs by 50% without harming grower returns (http://ucce.ucdavis.edu/files/repositoryfiles/2009-54.pdf-79204.pdf). In the reduced cost treatments, pruning was limited to mechanical topping/hedging plus pole-saw or lopper cuts from the ground. Fruit numbers per tree were counted every year. Shaker thinning was done in 2 of the 4 years. Reduced pruning without thinning may produce the worst possible situation – a large crop of small, low value fruit. Is reduced pruning a solid, long-term option for prune growers? Probably not, but, but when combined with other crop control options, it may be a viable short term answer to a tough cash-flow situation.

Bloom sprays: In dry springs, a single bloom spray at roughly 30-50 percent full bloom gives good brown rot and russet scab control. This every-row spray should contain an excellent brown rot fungicide (Vangard, Tilt, Scala, etc.) plus material for prune scab control (captan or chlorothanil). This program was developed by Dr. Jim Adaskaveg, UC Professor of Plant Pathology.

When rain occurs at bloom, the full two spray program is recommended. Full bloom is the most important timing for both scab and brown rot control. Fruit are susceptible to scab damage until they are "through the jackets".

Irrigation: Irrigating dry trees in spring and early summer = fruit end-cracking. However, excessive irrigation is wasteful. Research has shown that prunes can tolerate moderate water stress in July and August. Track orchard water status using one or more methods including soil moisture monitoring, ET estimates, and/or plant moisture monitoring with the pressure bomb. Two different methods, for example soil moisture by Watermark® sensor and plant moisture by pressure bomb give you the most complete "picture" of orchard water status.

Nitrogen (N) fertilizer: Prunes need nitrogen fertilizer, preferably in at least two applications per year. Successful growers commonly use about 125 pounds of N/year split into equal spring and summer applications. When injecting liquid N fertilizer into an irrigation system target the middle third of the irrigation set timing (for example, hours 8-16 of a 24 hour set) for best N distribution in the root system. Allowing prune trees to become N deficient risks reduced yield and increased susceptibility to bacterial canker infection. Use a July leaf analysis to adjust subsequent year fertilizer programs.

Potassium (K) fertilizer: Mature, bearing prune trees need as much or more K than N. The crop is the biggest K "user", so crop load determines the annual orchard fertilizer K needs. Thinned orchards need less K than heavily cropped, unthinned orchards. A standard maintenance K fertilizer rate for a mature orchard bearing a good to excellent crop is 300-500 pounds of soil applied K fertilizer. The actual rate depends on fertilizer material (potassium sulfate or potassium chloride), application method (under drip irrigation, fertigation is more efficient than banding on the soil) and current leaf analysis results. For example, a flood irrigated orchard with leaf K values of 1.4% in 2010 might consider a higher maintenance rate of 400 pounds/acre of potassium chloride or 500 pounds/acre of potassium sulfate, while a drip irrigated orchard with leaf K levels of 1.7% in 2010 might use the lower maintenance rate of 300 pounds of potassium sulfate through the irrigation system. As an alternative to soil applied K fertilizer, foliar feeding with potassium nitrate (total of 100# of material/acre/year) is effective. While this practice is more expensive than banding dry, soil applied K n the fall, it allows growers to check crop load before making K fertilizer decisions. Foliar feeding is also an effective means of supplementing soil applied K fertilizer if orchard conditions show a need.

Preemergent weed control: The expense of pre-emergent weed control has pushed many growers into low-cost glyphosate (e.g. Roundup) only programs that promote glyphosate resistance in many weeds. Expensive pre-emergent programs are a tool to manage glyphosate resistant ryegrass, marestail, etc. Use of below label rates of pre-emergence herbicides risks control failure. Consult an experienced PCA when planning cost-effective weed control.

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Table 1. Estimates of costs and percent of total cash costs to produce prunes, 2008. Figures based on current cost and return study by UC Ag Economics pub ID: PU-SV-O8, available on-line (http://coststudies.ucdavis.edu/current.php) or from your local UC Farm Advisor.

Production Practice	$/acre cost	% of total
Hand pruning	351	26.10
Bloom spray (2x)	155	11.52
irrigation (labor included)	151	11.23
300 # potassium sulfate (fertigated)	120	8.92
150 units N as UN32	113	8.40
Dormant weed spray	113	8.40
dormant spray (every other year)	42	3.12
Mowing row centers (5x)	42	3.12
ATV	41	3.05
mite spray (every other year)	38	2.83
Thin fruit (every other year)	33	2.45
Pickup	30	2.23
Rust spray	25	1.86
Scouting/consulting	25	1.86
Summer glyphosate strip spray	23	1.71
topping	15	1.12
Fall spray (every other year)	15	1.12
Hives	13	0.97
Fruit brown rot spray (1/5 years)	9	0.67
shred brush	9	0.67
gopher + squirrel baiting	7	0.52
Leaf sampling	2	0.15

Sutter/Yuba Prune Day

March 1, 2011

Co-sponsored by University of California & Sutter and
Yuba County Ag Commissioner's Offices

Veterans Memorial Community Building, 1425 Veterans Circle Dr., Yuba City

2.0 hrs of CE credit for PCA & PAs (0.5 hr. Laws & Regs + 1.5 hrs "other")

Refreshments courtesy of Growers Ag Service, Inc. Thank you!

8:00 **Sign-in and refreshments**

8:15 **Managing aphids and mites in prunes**
Franz Niederholzer, UC Farm Advisor, Sutter/Yuba Co.

8:45 **Grower update on permit conditions**
Jan Kendal, Sutter Co. Ag Commissioners Office
Todd Quist, Yuba Co. Ag Commissioners Office

9:15 **Supply and demand outlook for prunes, 2011**
Greg Thompson, General Manager, Prune Bargaining Association

9:30 **Weed control options for herbicide resistant weeds in the orchard**
Brad Hansen, UC Extension Specialist, UC Davis

10:00 Break

10:15 **Prune Disease management**
Jim Adaskaveg, Professor, UCCE Riverside

10:45 **Mechanical Topping of Prunes**
Elizabeth Fichtner, UC Farm Advisor, Tulare Co.

11:15 **Growing a profitable prune crop on a tight budget: Can it be done?**
Franz Niederholzer, UC Farm Advisor, Sutter/Yuba Co.
Carolyn DeBuse, UC Farm Advisor, Solano/Yolo Co.

12:00 **International Prune Marketing Situation**
Rich Peterson, California Dried Plum Board

Encouraging Prune Size and Quality

Richard P. Buchner UC Farm Advisor, Tehama County

The primary horticultural practices that influence prune size and quality are: pruning, cropload, nutrition, irrigation management and fruit thinning. Harvest bar sizing is often included in fruit size discussions but represents a mechanical approach to removing undersize prunes. Ideally all fruit would be large eliminating the need for harvest sizing. The best strategy would be to not invest tree energy in growing prunes with no economic value. This article discusses cultural practices that can be done now to favor large fruit size and good fruit quality. Future articles will cover fruit size options as they occur throughout the growing season.

Pruning is an excellent technique to manage over cropping and improve fruit quality because it removes fruit wood, encourages light penetration into the canopy and favors shoot growth to renew flower buds. Crop load has a huge impact on fruit size and quality. Balancing crop load with tree fruit sizing potential results in good fruit size and quality, adequate sugar production through photosynthesis for good dry ratio and reduced negative impacts on the tree such as depleting carbohydrate reserves, supporting healthy foliage to prevent sunburn and branch damage from Cytospora canker plus minimizing limb breakage. Deciding how much to prune trees is an orchard by orchard decision mostly based upon experience. A history of under sized fruit would suggest heavier pruning to balance crop load particularly if mechanical thinning is not an option. It is still not too late to walk orchards and potentially adjust pruning. Will additional pruning improve fruit size and quality enough to equal or exceed additional pruning costs?

Adequate Potassium nutrition is crucial to growing large high quality prunes. Potassium (K) is essential for photosynthesis, translocation of sugars, opening and closing of stomata, root growth and K directly affects fruit size, sugar, dry ratio and yield. Three dry tons of prunes export about 80 pounds of K. At three dry tons per acre, that's 80 pounds of K leaving the orchard in that crop year. The issue with K fertilization is that most orchard soils fix K making it unavailable for root uptake and tree nutrition. Soil applications are typically done in the fall allowing winter rainfall to move K into the root zone for uptake in the spring and summer. Applications are usually banded and applied to previously treated bands to concentrate K and force it deeper into the root zone. Drip irrigation is an efficient way to apply K during the growing season. Soluble K can be injected or dry material can be placed directly under emitters .K is considered deficient if leaf analysis drop below 1.3%. That value is probably accurate however the goal is to have every tree in the orchard above that critical level. A 100 leaf sample represents an average. So a composite leaf sample at 1.3% could have a significant number of trees in the deficient range. Shooting for a leaf sample in the 2.0% range is a more realistic goal. If K levels are marginal consider an application ASAP. Since K applications are expensive, retired Butte County Farm Advisor Bill Olson worked out a maintenance program using annual application of 400 to 500 pounds of potassium fertilizer (K_2SO_4) banded in the fall. Foliar applications are useful for managing K and will be discussed in detail in the May/June Prune newsletter.

Irrigation affects all physiological processes within the tree so good irrigation management is essential for prune size and quality. Cover crops or resident vegetation compete aggressively for soil moisture. Warm spring weather combined with little rainfall results in trees going into the growing season with reduced soil moisture reserves. Monitor soil moisture prior to leafing and adjust first irrigation timing to avoid early season moisture stress and save soil moisture reserves for later in the season.

For more detailed information on pruning, K nutrition, irrigation and prune research, check out the Prune Research Reports available at http://ucanr.org/sites/driedplum.

Frost Protection

Joe Connell, UC Farm Advisor, Butte County

Mild, **radiation frosts** occur on still, clear nights, often with the development of a strong inversion. Under these conditions frost protection can be provided by running water. **Advection frosts** are more severe and usually result in more damage. They occur with wind present as cold air moves into a field from areas outside the orchard. Cold air accumulates in low spots or in areas where air drainage is blocked.

Soil and Groundcover Condition

Groundcover condition affects orchard minimums with any cover taller than 4 inches in height generally being colder. Soil heat storage is reduced because sunlight is reflected and water is evaporated. Keeping groundcovers cut short to 2 inches or less during frost season allows sunlight to reach the soil surface, and increases soil heat storage resulting in a warmer orchard through the night.

Bare, moist soil is warmest, but this is true only when the surface is moist. If pre-frost conditions are dry and windy and a dry crust forms on the surface, then, bare soil can be colder than a surface with a short (less than 2 inch) groundcover that tends to keep the surface moist with dew from the grasses and weeds. The ground surface must be moist for bare ground to be warmest.

Dry or recently cultivated soil has many air spaces, lower heat storage capacity, and low heat conductivity resulting in colder minimum temperatures. Moist soil stores more heat due to water content, has higher conductivity, and will have higher minimum temperatures. Irrigation should ideally wet the top foot over the entire orchard surface, soil moisture should be near field capacity, and these conditions should be achieved in advance to gain the most advantage. A light irrigation to moisten the soil before a frost will help obtain the greatest heat storage.

Frost Sensitivity

If water is used for frost protection, critical temperatures for frost damage help us know when to turn irrigation systems on or off. At first white, buds are more resistant to cold compared to full bloom stage, which is more resistant than small fruits.

Critical Temperatures[1] for Frost Damage

To Prune Buds, Flowers, or Fruit.

First White	26ºF
First Bloom	27ºF
Full Bloom	28ºF
Post Bloom	30ºF

[1] Temperature endured for 30 minutes or less.

Sprinklers and Micro-sprinklers

Under tree sprinklers provide protection because heat contained in water is released into the orchard system. As water cools and freezes, it releases a great deal of latent heat. This sensible heat is **radiated or convected** into the trees, thus providing protection. Sprinklers can be safely turned off when the wet bulb temperature upwind of the protected orchard is above the critical crop damage temperature or when all the ice melts.

In some orchards, frost protection is limited by the amount of water or available pipe. To learn more about moveable pipe placement we ran an experiment comparing protection with sprinkler lines in every middle, every other middle or every fourth middle. Air temperature in all sprinkled areas was 1 to 2 ºF warmer than the unsprinkled control and there were no differences between these spacings. Soil surface temperatures were colder the further from the sprinklers with the dry centers between the lines in every fourth middle as cold as the unsprinkled control. Line spacing directly affects soil surface temperature but air movement evens out the benefits. Without air movement, protection may fail between widely spaced lines.

In our experiments with **micro-sprinklers** applying 15, 25, and 40 gallons per minute per acre resulted in little difference in observed air temperatures. However, exposed temperatures were 1 to 2 ºF warmer at the higher water rates. Exposed temperature is what the buds themselves experience. The fact that the low water application gave a lower exposed temperature indicates that protection with under tree micro-sprinklers is coming mostly from direct radiation from the warmer wet spots under the trees rather than through convection of warmer air. We found a greater separation in exposed temperatures between the low and medium/high rates on the colder nights. Thus, micro-sprinkler application rate had little effect on air temperature but did affect temperature of exposed buds and flowers. The low application rate gave less protection than the higher rates and the higher soil surface temperatures from higher application rates led to more radiation heating. Under windy advective conditions this may be even more important since convection heating is negatively affected by wind but radiation is unaffected.

Drip irrigating in advance of a frost can help keep the orchard warmer by increasing soil heat storage particularly if the soil surface is dry. Running the system during a frost may provide slight benefits due to radiation heating from the wetted area beneath the trees. **Flood irrigation** for frost protection works in a similar fashion but due to larger water volumes it will provide more protection.

High Temperatures at Bloom Reduces Fruit Set

Carolyn DeBuse, UC Farm Advisor, Solano/Yolo Counties and Franz Niederholzer, UC Farm Advisor, Sutter/Yuba Counties

In the last seven years it has become well known that high temperatures during bloom can negatively affect the fruit set of Improved French prune. Economic loss was seen in three of those years (2004, 2005, and 2007) due to reduction of fruit set when temperatures soared over 80°F. We know it can happen, but we still have questions about the threshold temperatures and if growers can do anything during bloom to increase fruit set.

A two year study at UC Davis, Dr. Vito Polito and Matt DeCeault showed that the optimum temperatures for pollen germination and pollen tube growth are between 72-76°F. When temperatures are higher than 76°F the pollen viability and the pollen tube growth decline rapidly. A Sacramento Valley wide study followed to track temperatures at bloom and correlate fruit set. The results show that it is not only the extreme temperatures that matter but the duration of time over which the temperatures remain high. The absolute threshold temperatures and duration are still unknown but our working threshold for increased risk of crop loss is exposure to 10 hours or more of max temperatures > 80°F.

Another interesting thing we noted in 2010 is with sufficient chilling and temperatures in March being similar throughout the valley the French prune bloom occurred in all counties within days of each other. See Table 1 for a summary of the trial results in 2010. This means that the vulnerability of the prune industry is greatest when this phenomenon happens. The goal of a healthy orchard is a fruit set of 12-20%, but last year the fruit set was higher than average in all locations. Temperatures during bloom were at the optimum for pollen viability and the fruit set.

Table 1. Average prune fruit set, full bloom dates, and maximum temperatures in orchard at full bloom in Yolo, Solano, Sutter, Glenn and Tehama Counties, 2010.

County	Date of Full bloom	Maximum Temperature at 80-100% full bloom	% Fruit Set (mid-May)
Tehama	March 24-25	74-76	20-59%
Glenn	March 22-24	74-78	22-39%
Sutter	March 21	71-72	46-56%
Solano	March 21-22	77	41-46%
Yolo	March 24-26	72-75	43-60%

What can be done if temperatures increase above 80°F during bloom?

1) **<u>Cool the orchard with irrigation water.</u>** Evaporative cooling may reduce temperatures enough to help set a crop. Impact sprinklers or micro-jet irrigation systems have an advantage over flood irrigation systems for orchard cooling. There are reports of good crops in 2005 after running water, while other growers ran water with no benefit. Here are some key points to consider when using irrigation water to try to reduce temperatures in an orchard:

    a. The top one foot of soil should be moist (not saturated) when warm weather hits.

    b. If you can only irrigate part of the orchard per set, run water long enough to wet the soil and then shift flow to another part of the orchard. "Flash" irrigation water across irrigation checks and move on to others when using flood irrigation. If the soil surface dries and isn't rewet, the potential for evaporative cooling decreases significantly.

    c. Concentrate irrigation/cooling efforts on the upwind side of the orchard. Let the wind move the cooled air through the orchard.

    d. If I was a grower, I'd start running water (impact sprinklers or microjet sprinklers) when the temperature gets over 70ºF. If I only had flood irrigation to work with, I'd try to wet the soil surface in advance of predicted warm (over 70-75ºF) weather. If the warm weather stayed and the soil surface dried, I'd irrigate again.

2) **<u>Get bees in the orchard.</u>** This means renting bees, as native bee populations have weakened due to bee mites and poor food availability. Experience suggests better fruit set in 2005 and 2007 on trees close to hives, and poor fruit set away from the hives. It may be beneficial to spread hives throughout the orchard. In larger almond orchards beehives are distributed at 1/10 to ¼ mile intervals through the orchard for optimum pollination. If the orchard is smaller than 40 acres, hives can be distributed around the perimeter.

3) **<u>Leave grass long</u>** in the orchard if heat at bloom is predicted. Tall, well irrigated vegetation should be 1-2ºF cooler compared to short mowed vegetation on the orchard floor. If frost is a threat at bloom, keep the orchard ground cover as short as possible. Delay the orchard floor management decision as long possible so that a better forecast of bloom weather is available and can be included in the final decision.

University of California
Cooperative Extension
P. O. Box 697
Orland, CA 95963