Applied Advancements for Improving Yield and Quality of Treefruit and Nut Crops.

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Introduction

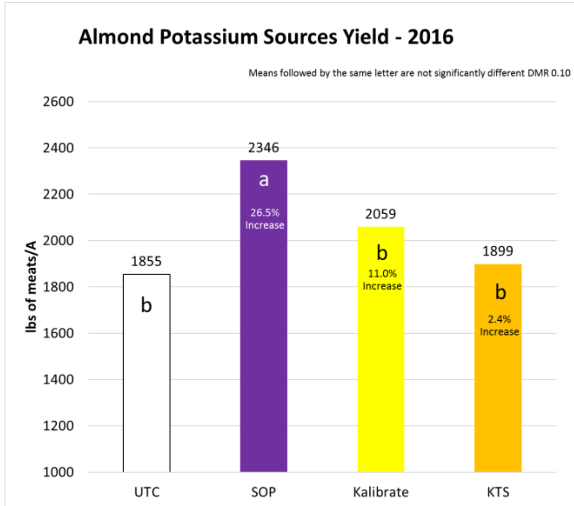
Three topics will be discussed during this Applied Crop Management Tools session. They will include “Managing Soil Applied Potassium on Low CEC Sandy Soils”, “The Impact of Early Bee Removal on Pollination and Yield of Almond”, and “The Impacts of Sprays Applied During Bloom”.

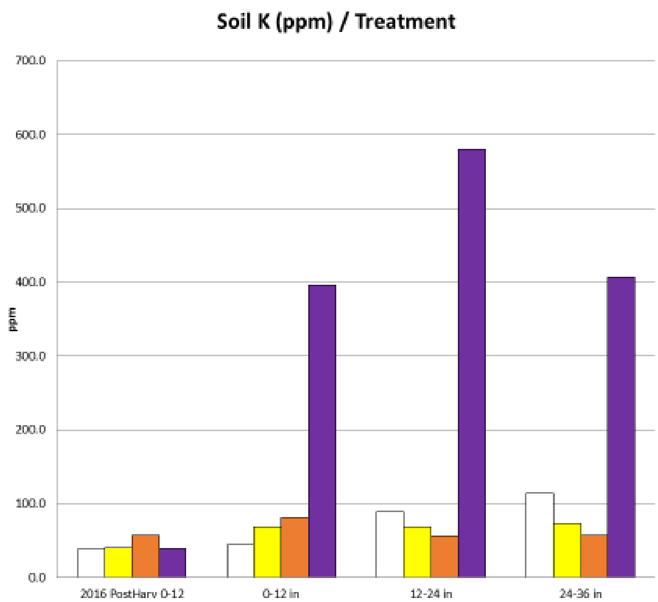
Managing Soil Applied Potassium on Low CEC Soils

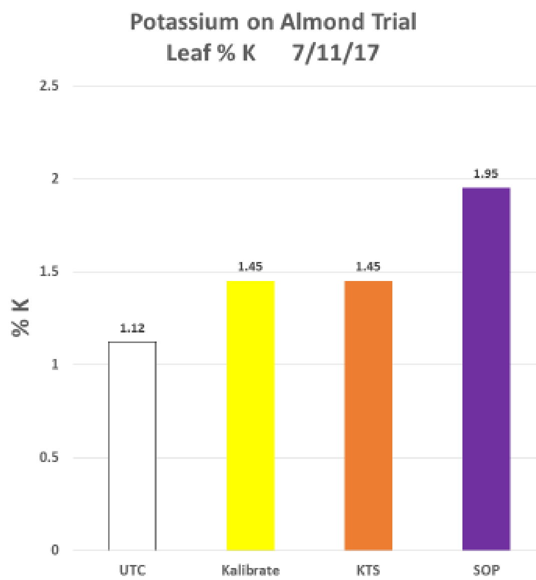
Soil applied potassium sulfate has historically been applied to orchard crops in concentrated bands, parallel to the tree rows and approximately 3 to 4 feet away from the trunks. Quantities would typically be in the 1000 to 1500 pound per acre rate. The rationale for this methodology was that potassium needed to be applied in large dose concentrated bands to prevent soil fixation and immobilization of the K+ ions. While there is some truth to this statement, certain factors depending on the locale and the soil texture can alter these results. In high CEC soils with significant clay content and/or high organic matter, K+ can become fixed and sparingly available to the roots.

Many orchards in California are grown in very sandy soils with low CEC’s in the 2 to 3 milliequivalent range. Under these conditions, potassium can move down very readily with the water phase. An added factor when microsprinklers or drip irrigation is used is a very shallow and dense root mass that can be less than an inch below the soil surface. The combination of very mobile K+ and this accessible root network allows for lower rate per acre applications and even broadcasting the material if directed into the weed strip area. Many growers have been able to sustain K levels in the trees with low doses of dry potash or fertigated applications of liquid formulations such as KTS or potassium carbonate under these conditions.

Independent research trials (Wes Asai Pomology Consulting) in the northern San Joaquin Valley have demonstrated that annual broadcast applications of potassium sulfate at 400 lbs./A can sustain almond yields and spread a growers’ cost over several years versus the major single year expense incurred during large dose applications. The data also indicated that in these low CEC soils, potential leaching losses similar to nitrogen was possible at those larger doses.


Almond Potassium Sources Yield - 2016
Means followed by the same letter are not significantly different DMR 0.10
lbs of meats/A
2600
2400
2200
2000
1800
1600
1400
1200
1000
1855
b
2346
a
26.5% Increase
2059
b
11.0% Increase
1899
b
2.4% Increase
UTC
SOP
Kalibrate
KTS


Soil K (ppm) / Treatment
ppm
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
2016 PostHarv 0-12
0-12 in
12-24 in
24-36 in


Potassium on Almond Trial
Leaf % K 7/11/17
% K
2.5
2
1.5
1
0.5
0
1.12
1.45
1.45
1.95
UTC
Kalibrate
KTS
SOP

The Impact of Early Bee Removal on Pollination and Yield of Almond

During the period of late-January through early-March, honeybee colonies are placed in almond orchards for pollination. This is generally a safe environment for the bees, however in some cases due to the use of sprays in the orchards or on surrounding crops, hives are removed from the orchards before the almond bloom is completed. The general belief is that the last 10% of the blossoms represents an insignificant amount of yield (Almond Board of California Best Management Practices), thus hive removal for bee safety will not impact the crop. Many growers will debate this and request that bees be left in the orchards until bloom is completed, justifying their $175 to $200/hive cost to rent the bees.

Pesticides can kill bees in pollinating crops (Hooven et al., 2006), (Chesick et al., 2015), (Johansen & Mayer, 1990) or negatively affect the brood (Fine et al., 2017). Due to these concerns, beekeepers are anxious to move hives from orchards as soon as possible, even if the almond grower is not the one doing the spraying.

To evaluate the potential effect on crop set with early hive removal, two separate studies (Wes Asai Pomology Consulting, 2010, 2017) were conducted to measure the contribution to crop load of the last 10% of the blossoms to open on the last varieities to bloom. The studies were done on the Butte and Padre varieties in 2010 and on the Padre in 2017. In the 2010 study, limbs on 15 Butte and 15 Padre trees where unopened blossoms represented the last 10% of the bloom were counted. In 2017, 23 Padre trees had limbs with unopened blossoms counted that represented the last 10% of the bloom. Percent set counts were made in May. In 2010, the Butte set 56.4% of the flowers and the Padre 64.1%. Based on average kernel weights, this would extrapolate to approximately 411 lbs./A. In the 2017 study, the Padre set 23.7% of the flowers. This would extrapolate to 163 lbs./A. One can use their own prices per pound to project potential revenue.

The Impacts on Pollination of Sprays Applied During Bloom

There are many factors that can affect the decision whether to apply sprays during the bloom period. These may include a concern for the bees, management of diseases, nutritional requirements and effects on pollination. The previous topic discussed the potential negative effects of insecticides on bees. Of additional concern are other sprays that may include products such as fungicides, adjuvants or combinations of both. There is evidence that these materials can have negative effects on bees (Pilling and Jepson, 1993) (Fine et al., 2017). Also, the Almond Board of California Best Management Practices brochure suggests not applying fungicide sprays during bee activity. This creates a dilemma since inclement weather during bloom may necessitate the need for fungicides, and a review of the University of California Pest Management Guidelines (Adaskaveg, 2017) suggests the optimum timing for the majority of bloom diseases is during the full-bloom period.

An added factor is the inclusion of foliar nutrients during these sprays. Certain materials are potentially phytotoxic to the stigma of the flower (USDA AG Handbook 496), where others pose a threat to the entire flowers, developing crop and foliage. Some materials such as zinc or boron can be directly toxic in sufficient concentrations. Others, such as non-buffered phosphites can have pH levels below 2 and cause direct injury or indirect injury by increasing the solubility of free metal ions.

There are synergistic phytotoxicities such as oils near captan, sulfur or chlorothalonil applications.

There are also specific varietal incompatibilities. Sulfur on apricots, azoxystrobin on apples or malathion on certain varieties of cherries.

Then there is the tank mix which simply has "too much stuff" with unknown compatibilities. Spray tanks that may contain an insecticide, fungicide, buffer, adjuvant, nutrients, phosphites, humic acid and seaweed extracts all combined are more common than one might think. To know all potential incompatibilities of all products is an insurmountable task.

Literature Cited

Adaskaveg, J., Gubler, D., Michaildes, T. 2017. Fungicides, Bactericides, and Biologicals for Deciduous Tree Fruit, Nut, Strawberry and Vine Crops 2017. UC Statewide IPM Program

Chesick, C., Stiles, P., Savesra, R., Williams, D. 2015. Pesticides Kill More Bees than Pests. Asheville Alternatives to Pesticide Coalition, Lenoir-Rhyne University.

Fine, J., Cox-Foster, D., Mulin, C. 2017. An Inert Pesticide Adjuvant Synergizes Viral Pathogenicity and Mortality in Honeybee Larvae. Scientific Reports 40499.

Gottwald, T., Graham, J., Riley, T. 1997. The Influence of Spray Adjuvants on Exacerbation of Citrus Bacterial Spot. Plant Disease 81 1305-1310

Hooven, L., Sagili, R., Johansen, E. 2013. How to Reduce Bee Poisoning from pesticides. Pacific Northwest Extension Pub 591

Hopeting, C., Beer, S. 2013. Role of Adjuvants in Bacterial Diseases of Onions. NY State Onion Research & Development Program.

Johansen, C., Mayer, D., 1990. Pollinator Protection

Pilling, E., Jepson, P., 1993. Synergism between EBI Fungicides and a Pyrethroid Insecticide in the Honeybee. Pesticide Science 39, 293-297

Zidak, N., Backman, P., Shaw, J. 1992. Promotion of bacterial infection of leaves by an organosilicone surfactant: Implications for biological weed control. Biological Control Vol. 2, Issue 2, 111-117