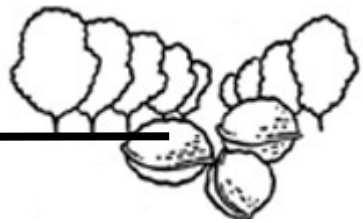
University of California Cooperative Extension Butte County

Volume 39 ▪ March 22, 2010

Walnut Notes



Joseph H. Connell
UC Farm Advisor

In this issue:

Walnut Research Reports are Available On-line

Joe Grant, UC Farm Advisor, San Joaquin County

Each year, many walnut research projects are conducted with support from the California Walnut Board, using some of the assessment funds paid to CWB by walnut handlers. Researchers prepare written reports on the outcomes of these projects, and these reports are submitted to CWB in late December.

If you wish to keep up with the latest results of CWB-funded research, and we don't happen to cover a project or topic of interest at our regular walnut meetings, you can access research reports on-line to keep abreast of the latest developments. Late each winter, the UC Davis Fruit and Nut Research & Information Center posts walnut research reports from the previous year to a database on its web site, http://fruitsandnuts.ucdavis.edu/ . From the FNRIC home page, click on "Fruit & Nut Information", then "Fruits & Nuts", then "Walnut". The Walnut Research Report database is listed under "General Sources", and can be searched by title, author, or year of the report.

One word of advice as you read these and other research reports. Many CWB-funded projects run for multiple years, and each report normally covers only the previous season's work. Unless you happen to be reading the report on a project in its final year, keep in mind that 1) previous reports on the project may contain background or important findings not necessarily detailed in the current report and 2) research-in-progress is just that: results of future work may well modify or refine the results obtained in any given year. Reports submitted while a project is on-going may not necessarily contain the "final word" on a project or problem. As much as possible, we try in our meetings and newsletters to bring the "full story" to you as final project results and conclusions become available. Still, with this in mind, there is much good and interesting information to be found in the annual reports.

New Cost Study on Hulling and Drying Walnuts and Dehydrator Workshop

Janine Hasey, UC Farm Advisor, Sutter and Yuba Counties

A "hot off the press" sample costs to hull and dry walnuts is available at the UC Davis Agricultural and Resource Economics Department's website at http://coststudies.ucdavis.edu. Click on "current cost and return studies", and then enter "walnut" under commodity. Hard copies are also available from the farm advisor office. There are comparisons between facilities with and without electronic sorters. We appreciate all the dehydrator operators who answered our survey form.

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chance to participate this June. **A workshop on** **Center. Mark your calendar!** The agenda and all

enrollment form will be coming in your next walnut newsletter.

Comparing Retain® and Hold™ for Reducing PFA and Increasing Yield in 'Serr' Walnuts

Janine Hasey, UC Farm Advisor, Sutter and Yuba Counties, Joe Grant, UC Farm Advisor, San Joaquin County

Over many years of testing, ReTain® (Valent BioSciences Corp.) has been shown to effectively reduce pistillate flower abscission(PFA) and increase nut set and yield in 'Serr' and other walnut varieties in the San Joaquin Valley. Local ReTain® trials attempted in 2006 and 2008 experienced rain and frost respectively that precluded a fair assessment. More recently, studies of bloom treatments using HOLD™ (StollerUSA) which is a combination of two nutrient supplements ReZist™ and Calcium 5S had shown promise in increasing walnut set and yield in some trials. Although less expensive than ReTain®, the efficacy of HOLD™ had not been well documented, especially in "side-by-side" comparisons with ReTain®. Trials were conducted in 2009 to further evaluate HOLD™ for its ability to improve set and yield in 'Serr' walnuts when compared directly to ReTain® in both the Sacramento and San Joaquin Valleys.

Trials were conducted in mature 'Serr' orchards, one in San Joaquin County and one in Sutter County. Experimental design, spray applications, and data gathering methods varied slightly between the two sites (Table 1) but the three treatments were the same:

1. ReTain®, 1 pouch (333 grams) per acre
2. HOLD™ (ReZist™, 2 qt/a plus Calcium 5S, 2 qt/a, packaged separately)
3. Untreated

We measured nut set by tagging 20 to 30 mid-canopy receptive double-flowered spurs on each of two trees in treated and untreated blocks. Tagging was done within one or two days before or after spray applications at each site. The number of nutlets per tagged spur was determined three to four weeks after treatment to assess PFA and again eight to nine weeks after treatment to assess nut drop from non-pollination and other post-PFA causes. Sub-samples of field harvested nuts were collected, hulled and dehydrated to determine yield on a dry in-shell weight basis from field harvest weights.

At both sites, there was considerable overlap between Serr pistillate bloom and pollen shedding; thus the potential for a heavy pollen load and PFA was great.

ReTain® significantly reduced PFA at both sites (a four fold decrease at the Sutter County site), as measured by four-week post-treatment set counts (Figure 1). HOLD™ treatments did not significantly increase nut set at either site. There was very little nut drop between the first and second set counts at both sites. This later drop is assumed to be due to non-pollination or other causes indicating that most of the drop at both sites was caused by PFA. ReTain® also significantly increased yield at both sites (yield doubled at the Sutter County site). HOLD™ treatment yields did not significantly differ from the untreated trees.

At the Sutter County site, nut quality grading by Diamond Foods, Inc. showed no significant differences in nut size or internal quality among treatments. This same nut quality result was found comparing these three treatments in the 2008 trial on 'Tulare' in Yuba County.

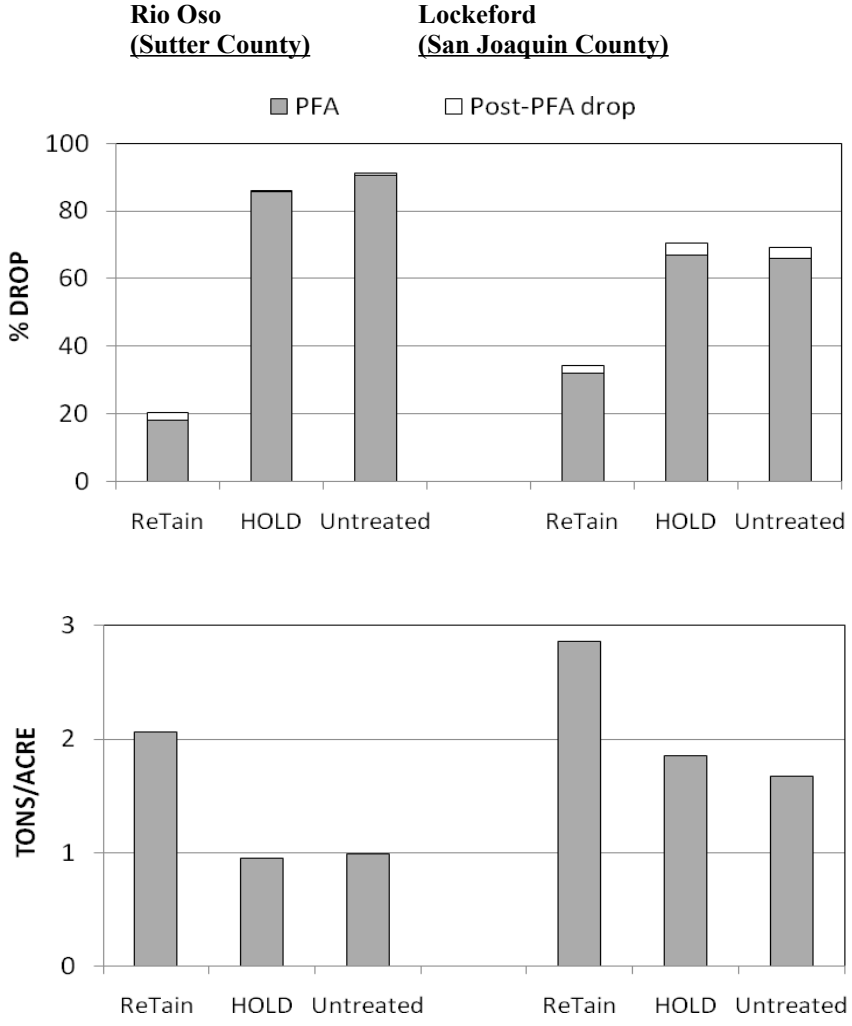
The economic value of ReTain® applications is entirely dependent upon flower density, the PFA level within the orchard, and the percent orchard acreage affected by PFA. ReTain® is not a cure-all for poor orchard performance associated with other factors that reduce flower number (the critical component for high yields), such as poor water management or excessive shade. Each grower has to determine if it's economical for them to use ReTain® in a given year.

Table 1. Orchard characteristics, experimental design, spray application and data collection methods for Rio Oso and Lockeford experimental sites

	Lockeford (San Joaquin County)	Rio Oso (Sutter County)
Orchard	30' x 30' mature Serr (48.4 trees/a) ; 40'-45' canopy height; Tehama pollenizers (%	30' x 30' mature Serr (48.4 trees/a), 40'-45' canopy height; Tehama, Vina and

	unknown)	unknown pollenizers (11%)
Experimental design	RCBD, 4 replications; plots 3 rows X 8 trees (0.5 acre); 1 to 3 untreated "buffer" rows (or trees where plots in same row) between plots.	RCBD, 4 replications, plots 3 rows X 4 trees (0.25 acre); 2 or 3 untreated "buffer" rows between plots.
Spray applications	Conventional airblast sprayer, 2 mph; 200 gal/a; all spray treatments on 2 April, 2009 (30% pistillate bloom)	Conventional airblast sprayer, 2 mph; 50 gal/a; all spray treatments on 31 March, 2009 (25% pistillate bloom)
Set counts	20 receptive double-flower pistillate inflorescences/tree on center 2 trees in each plot; first set count 23 April, second count 20 May	30 receptive double-flower pistillate inflorescences/tree on center 2 trees in each plot; first set count 29 April, second count 2 June
Yield measurement	2 center middles each (3-row) plot on 29 September, 2009	2 center trees each plot on 22 September, 2009

Figure 1. Effect of ReTain® and HOLD™ treatments on nut set and yield at Sutter and San Joaquin County sites.



Managing Phytophthora in Walnuts

Bill Krueger, UCCE Glenn County and Greg Browne, USDA Research Plant Pathologist, UC Davis

Phytophthora crown and root rot is a serious cause of tree loss for most fruit and nut crops, including walnut. The disease is caused by species of *Phytophthora*, a soil-inhabiting fungus-like organism. More than 10 species of *Phytophthora* are known to attack walnut. Some of the species mainly invade the root crown or trunk base, while others mainly invade the roots. Regardless of the point of attack, the root system or crown can be compromised or destroyed, resulting in tree decline and death. Prolonged periods of soil water saturation favor reproduction, spread, and infection by

Phytophthora. All species of Phytophthora produce zoospores, which are microscopic swimming spores that can swim short distances through water-saturated soil pores to infect roots. *Phytophthora* can be spread long distances in several ways, e.g., movement of: infested soil stuck on farm equipment, infested surface irrigation water (e.g., rivers, canals), or infected nursery stock (including ornamentals).

Symptoms include small leaves, sparse foliage and lack of terminal growth. Trees appear drought stricken early in the growing season. By mid summer the leaves turn yellow and drop. Infected trees may decline for several years or die within the same growing season that the symptoms first appear. Cankers, which are dark-brown, dead areas of bark (sometimes "bleeding") measuring inches to feet across and surrounded by whitish healthy tissue, may be evident on the tree trunk or the root crown near the soil line. Cankers caused by *Phytophthora* may extend through the bark and cambium and stain the wood dark brown. Active cankers tend to have a "zonate" (i.e., banded) appearance at their edges. In contrast to Armillaria root and crown rot, also known as oak root fungus, *Phytophthora* does not produce mycelial plaques (i.e., layers of whitish, leathery fungal growth that permeates between the bark and woody tissue).

Management guidelines

- Plant walnuts on well drained soils (internal and surface) not prone to flooding, long periods of saturation, or high water tables.
- Paradox hybrid rootstock is more tolerant of several *Phytophthora* species than Northern California black rootstock. Check with your farm advisor about availability of clonal Paradox rootstock with improved resistance to *Phytophthora*.
- Plant trees on berms or mounds to avoid water saturation around the root crown
- Avoid standing water for more than 18 hours because spore production increases after this. Avoid high angle sprinklers or microsprinklers that hit the limbs or trunk. Avoid soil compaction, and improve water infiltration in soils prone to surface sealing or poor water penetration.

Phosphonate treatments have been shown to reduce the severity of canker development in walnut trees inoculated with *Phytophthora citricola* (a highly aggressive species on walnut) (http://walnutresearch.ucdavis.edu/2007/2007_219.pdf). Whether inorganic (i.e. mono- and di-potassium phosphonates) or alkyl (i.e. fosetyl-Al- Alliette) formulations of phosphonate are used, the active ingredient is phosphonic acid. Evidence suggests that phosphonic acid disrupts growth of *Phytophthora* and intensifies host defenses against the pathogen. Phosphonate treatments are not known to affect other diseases of walnut.

Phosphonate treatments for walnut have been most effective when applied as a foliar spray. When appropriately applied, phosphonates become systemic in the tree, providing weeks to months of protection. Results of almond research suggested that an early fall foliar spray, applied before the leaves begin to senesce and while the trees are actively transporting food from the leaves to the roots, was optimal. If a foliar treatment with phosphonate is applied in the spring, it is advisable to wait until the leaves have fully emerged and expanded. Check the product label for rates and restrictions.

Winter Freeze Damage and Spring Recovery

Joe Connell, Carolyn DeBuse, Janine Hasey, Farm Advisors, Butte, Yolo-Solano, and Sutter-Yuba Counties

Cold temperatures from November 13 to December 6, 2009 should have been sufficient to harden off most walnut trees. Winter kill on young dormant walnuts usually occurs following extremely low temperatures when trees are water stressed or if vigorous trees are not fully hardened off. The low temperature on December 8, 2009 was close to 20°F (plus or minus a couple of degrees) in many locations.

Symptoms of damage include darkening bark and streaks of grey on the inner wood. Young walnut orchards, especially those with low soil moisture, should be examined for freeze damaged cambium tissue that is discolored and dry (Figure 1). This spring, buds may be slow to

break or may fail to break altogether. In cases where branches or the young trunk dies, winter kill acts as severe pruning and vigorous shoots grow from below the damaged area. Sunburn often accompanies the cold damage increasing the amount of injury. Sunburn can occur during the winter months on damaged tissue especially on the southwest side on unpainted trunks or limbs (Figure 2). Additional winter kill photos can be accessed at http://cesutter.ucdavis.edu/Orchard_Crops/Walnut_damage_from_winter_kill_or_autumn_frosts.htm .

If you suspect cold damage, do NOT prune out the damaged limbs. Buds may be slow in opening or buds from deep in the bark may grow to rejuvenate the limb. In the late summer, prune out dead wood that did not revive. New scaffolds that grew can be trained to replace the damaged wood. Reduce or delay spring fertilizer applications where cold damage is evident.

Figure 1. Walnut freeze damaged wood is discolored and dry.
Photo, 4/94 by J. Hasey.

Figure 2. 1-year old Chandler painted white after December 1990 freeze. Damage (no upper shoots) on southwest side of tree.
Photo, 5/91 by J. Hasey.

Spring Frost?

Joe Connell, Janine Hasey, Farm Advisors, Butte and Sutter-Yuba Counties

Radiation frosts occur when skies are clear, winds are calm, and humidity is low. As heat is radiated to the sky the existing air mass cools and shoots, leaves, and nutlets radiate (lose heat) to the cold night sky. Exposed tissues are the most likely to be damaged during a frost night. Shoots, leaves, and nutlets on the top sides of limbs may be injured while tissues underneath a limb or protected by dense foliage may escape injury.

Walnut flowers and small nutlets can be frozen when exposed to temperatures of 30°F for only 30 minutes. Shoots, flowers, or small nutlets can be cut and examined to determine if the tissues appear watersoaked or blackened to varying degrees. In contrast, healthy tissues will appear moist and bright green inside when examined.

The probabilities of frosts are greater with early leafing varieties like Serr and Ashley. As later leafing varieties such as Howard and Chandler begin growth the probability of frost continually declines. During the April 20, 2008 radiation frost, the earliest leafing varieties had the least injury since they had more leaf tissue providing protection when the frost occurred. Remain vigilant! To gauge the frost potential, check the dew point temperature before retiring for the night. When the dew point is above 45° F, frost is rarely a problem.

Dr. Rick Snyder, Cooperative Extension Biometeorologist makes the following observations on frost protection:

- For weather forecasts, go to the National Weather Service Forecast Office website at http://www.wrh.noaa.gov/sto , click on "Forecast Weather Stations" on left, set the interval in hours and the duration in days, and enter your zip code or location. These forecasts are very helpful for predicting autumn frosts, winter freeze and spring frost events.
- If the soil is dry, it should be wetted at least 3-5 days ahead of a freeze. If there is water on the soil surface before a freeze, it will make the soil surface colder because of evaporative cooling. Water conducts and stores more heat than air spaces, so wetting the soil 3-5 days prior to a frost night will fill the air spaces and the soil will store more heat. You don't want water on the surface during the frost night unless you keep re-wetting it with sprinklers or with continuous running furrows.
- Under tree sprinklers should be turned on before the wet-bulb temperature falls to the critical damage temperature and turned off the next morning after the wet-bulb temperature goes above the damage temperature. To be really safe, turn off the sprinklers when the wet-bulb temperature exceeds 32°F. For example, from Dr. Snyder's website http://biomet.ucdavis.edu, click on "Frost Protection" and then "When to turn the sprinklers on or off for frost protection". Table 1, in that webpage article indicates that with a wet-bulb temperature of 32°F and a dew-point temperature of 25°F, the sprinklers should be turned off at an air temperature above 36°F. If sprinklers are run all night, the temperature of the wetted soil will normally stay around 32°F, which is warmer than if the sprinklers are not operated. This is true unless the application rate is really low or if the wind speed is high and the dew-point temperature is low.
- The website shows methods to measure the dew-point and to estimate the wet-bulb temperature and has guidelines for the application rates. The application rate of the sprinklers becomes important as the dew-point decreases and/or the wind speed increases because evaporation increases. The key to beneficial application is whether or not the soil surface temperature is warmer with irrigation or without irrigation. You can test that by placing minimum recording thermometers on dry and wetted ground.
- Refer to Dr. Snyder's website, for more detailed information on frost protection.

University of California Technical Bulletin

Walnut Blight Management Update - 2010 Growing Season

J. E. Adaskaveg, University of California, Riverside, R. Buchner, and J. Connell, UCCE, Tehama and Butte Co., respectively

Walnut blight is caused by the bacterium *Xanthomonas arboricola*. Copper was the sole material available for managing this devastating leaf and fruit disease since the inception of modern walnut production in California.

In the early 1990s, copper resistance developed in the pathogen populations and the disease began causing significant crop losses in many orchards in the central and northern production areas of the state. Research at the University of California (UC) showed that the disease could still be managed when copper was mixed with an ethylene bis-dithiocarbamate or EBDC fungicide such as maneb (e.g., Manex-DuPont Crop Protection). Since the early 1990s, the California Walnut Commission has successfully petitioned the United States Environmental Protection Agency (US-EPA) for an emergency registration of Manex (one of the longest standing Section 18s in the history of US agriculture). While the EPA was concurrently reviewing the registration of the entire class of EBDC pesticides, the California Walnut Board aggressively funded UC research to better understand the epidemiology of the disease and management practices including alternative treatments for Manex®.

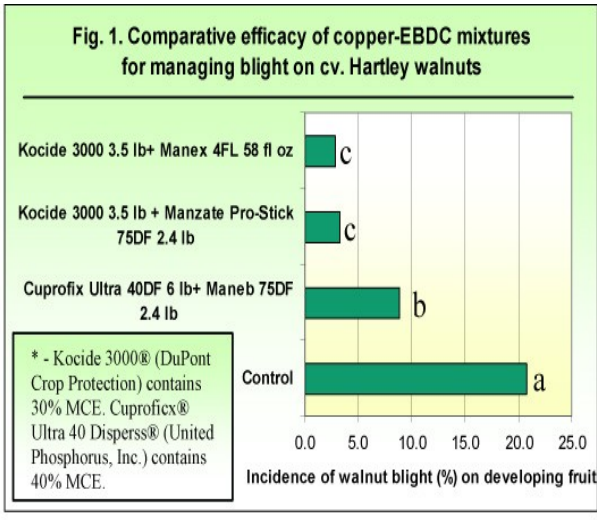
In 2009, as part of a joint decision between the US-EPA and the EBDC task force (a coalition of registrants and manufacturers of EBDC products), the United States registration of maneb, which is used to manufacture Manex, was canceled. Fortunately, UC research has identified several alternative products ranging from fungicides, an antibiotic, and organic compounds. A closely related EBDC compound, mancozeb, was identified that could be a "drop in" replacement for maneb. With over 18 years of experience with copper and EBDC materials for managing walnut blight, mancozeb was the logical choice for pursuing an emergency registration for commercially managing blight. The California walnut industry has successfully petitioned the US-EPA for an emergency registration of mancozeb and the California Department of Pesticide Regulation has issued a Section 18 Exemption on February 25, 2010 to allow applications of DuPont Manzate Flowable or Manzate Pro-Stick in combination with copper on walnut in selected California Counties. Either product must be tank mixed with a fixed copper product registered for use on walnut in California.

Table 1. Comparison of Manex® and Manzate Pro-Stick™

Property	Manex®	Manzate Pro-Stick ™
Active Ingredient	Maneb	Mancozeb
Formulation	Flowable - 4 lbs/gal	75% DF
Stability	Stable and consistent	Stable and consistent
Functionality	Easy to measure, handle and mix	Easy to measure, handle and mix
Persistence	High rainfastness and residual activity	High rainfastness and residual activity
Spectrum	Broad - Many fungal and bacterial diseases	Broad - Many fungal and bacterial diseases
Bactericide Treatment	Tank-mixed with a fixed copper*	Tank-mixed with a fixed copper*
Rate (/A)**	58 fl oz	2.4 lb
Application**	Ground/Aerial	Ground/Aerial
UC Bactericide Efficacy Rating	++++	++++
Resistance Potential	Low (Multi-site MOA)	Low (Multi-site MOA)

* - Fixed coppers include copper hydroxide, copper oxide, copper oxychloride among other materials. MOA = mode of action. '++++' = excellent.
** - Proposed usage under a Section 18 emergency registration (pending).
*** -*Data courtesy of Professor J. E. Adaskaveg, Univ. of California, Riverside.*

The US EPA has not established a time limited tolerance but expects to do so in the near future. If residues are found on walnut at the time of harvest and a tolerance has not been issued, the residue levels will be considered illegal. Both Manzate formulations are very similar to Manex® however they are coordinated EBDC, i.e., a defined mixture of zinc and manganese is used in the



* - *Data courtesy of Prof. J. E. Adaskaveg, Univ. of California, Riverside.*

manufacturing of the active ingredient (Zn- and Mn-EBDC). This fungicide/bactericide has been registered in the United States for over 50 years

and provides broad-spectrum disease control. Both Manzate Pro-Stick™ and Manzate Flowable, when tank mixed with copper, are highly effective for managing bacterial plant diseases. Table 1 compares the properties of Manex and Manzate Pro Stick. Note that Manex is no longer legal to apply on California walnut.

Walnut Blight Control Experience over the Last 20 years

Richard P Buchner, UC Farm Advisor, Tehama County

1) Complete walnut blight research information is available at the UC Fruit and Nut information center http://walnutresearch.ucdavis.edu

2) Consider First blight application when 40 percent of the pistillate buds have expanded to the "prayer stage".

3) Copper tank mixed with a section 18 ethylene bis-dithiocarbamate (EBDC) product is currently the most effective spray choice. For 2010, the two available EBDC products are DuPont Manzate flowable or Manzate Pro-Stick. Be aware of application issues if a time limited tolerance is not issued by the US EPA.Tollerance information changes quickly so check with your walnut buyer before application.

4) Full coverage at full material rates is suggested. Under severe walnut blight infection pressure, excellent coverage at the correct application rate is advised.

5) Good quality copper products are all effective for controlling walnut blight. Follow label rates because metallic rates and copper availability vary depending upon the manufacturer.

In summary, Manzate Pro-Stick™ plus copper or Manzate flowable plus copper have been shown to be equivalent to Manex plus copper for managing walnut blight (Fig. 1). Over the last four years, more than 20 research trials have been conducted in Tehama, Butte, Solano and Fresno Counties evaluating Manzate Pro-Stick™, Manzate Flowable other mancozeb products, and alternative treatments.

6) Following the first application, consider damage history and weather forecasts for additional spray decisions. Sprays are thought to provide protection for 7 to 10 days.

7) Computer weather forecasts (http://www.noaa.gov/) and or Xanthocast (Irrigate.net or Agtelemetry.com) are available. Weather channels forecast weather conditions and Xanthocast developed By Dr. Jim Adaskaveg at UC Riverside can help determine disease infection events.

Prayer Stage