correlated with grape tissue maturity. Ontogenic resistance in maturing leaves and berries decreases the rate of new infections, and studies of ontogenic resistance pinpoint flowering through fruit set as the most vulnerable period for *E. necator* infection (Ficke et al 2003; Peros et al 2006; Calonnec et al 2008). This confirms the importance of early season sprays based on phenology for preventing powdery mildew. Using both temperature-driven risk indices (e.g., PMI), and phenological risk assessment allows fungicide sprays to be directed to early season growth and may provide better protection with fewer total sprays than use of either approach alone.

Exposure to sublethal high temperatures and other environmental conditions on consecutive days or multiple days is expected to reduce *E. necator* growth and decrease efficiency of germination and sporulation, perhaps at lower temperature/duration combinations than observed in the laboratory. Insights from our work can be used to experimentally adjust the PMI to lengthen treatment intervals after high temperature events that are predicted to decrease disease pressure. This could allow for fewer fungicide applications without jeopardizing disease control. For California, source of *E. necator* isolate does not seem to be important, but exposure time appears to be as important as temperature in defining high temperature maxima, and in predicting pathogen response to sublethal and lethal conditions.



## Comparing multiple approaches for controlling gophers in vineyards.

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### Introduction

Pocket gophers cause extensive damage to many crops including grapes. Many tools are available for controlling gophers including trapping, fumigation with aluminum phosphide, poison baits, and the use of a gas explosive device. Trapping gophers has been a common method for controlling gophers for many years. However, a new trap called the Gophinator (Trapline Products, Menlo Park, CA) is now available that may increase efficiency of trapping. Additionally, combining aluminum phosphide fumigation with trapping may increase effectiveness, as gophers will occasionally spring traps without getting captured. In these situations, gophers often become trap shy and are much more difficult to capture. Treating these tunnel systems with aluminum phosphide shortly after trapping could remove these individuals from the population thereby increasing gopher control in vineyards. Poison baiting with strychnine, zinc phosphide, and anticoagulant baits (e.g., chlorophacinone and diphacinone) has often been used to control gophers. Efficacy of these treatments has varied widely, although strychnine baits reportedly are most effective. Gas explosive devices have been used to control a number of burrowing animals, although no scientific studies on gophers have been reported. These devices combust a mixture of propane and oxygen within tunnel systems, thereby killing gophers through concussive force while also destroying the burrow system. All of these methods are currently allowable techniques for controlling gophers in California, although the efficacy and efficiency of these approaches, particularly in comparison to one another, remain unclear. Therefore, I established a replicated trial at Laguna Ranch, Sebastopol, CA, from 6 April – 8 May, 2009, to estimate the efficacy and efficiency of these approaches to provide more effective methods for controlling gophers in vineyards.

## Methods

Three study blocks were established ranging from 21–31 acres in size. Plots of all three treatment types and a control were established within each block. To assess the impact of treatments on gophers, populations first were indexed. For this, 14–20 index plots (30 × 30 ft) were established within each treatment and control area. All gopher sign (mounds and feeder holes) was then cleared within each index plot. New sign was recorded in each index plot three days later. This provided both an absolute (presence or absence) and relative (number of mounds and feeder holes) index of activity. Following initial indexing, all treatments were applied. For trapping + baiting, plots were first trapped using Gophinator traps. If a gopher triggered or plugged a trap without getting captured, this tunnel system was flagged. The next day, these flagged tunnel systems were treated with aluminum phosphide (Phostoxin, D & D Holdings, Inc., Weyers Cave, VA). Baiting treatments involved the use of a self-dispensing probe and 1.8% strychnine-treated milo baits (Gopher Getter Restricted Use Bait, Wilco Distributors, Inc., Lompoc, CA). The label directed rate of bait was applied twice per burrow system. The Rodenator® (Meyer Industries, Midvale, ID) was used to treat all gas explosive plots. Following all treatments, index plots were cleared and new gopher activity was again assessed. This provided an index of gopher control. A second round of treatments was then applied in the same manner as the first round of treatments. A final index of gopher activity was recorded following these final treatments.

In addition to efficacy, I was also interested in assessing how much time and cost was required for each treatment method. Therefore, I recorded average time to apply each treatment, as well as the amount of labor required for each treatment block. The amount of labor was then combined with material costs to estimate the cost of each treatment type. These costs were compared to efficacy to determine which treatment type appeared to be most reasonable for controlling gophers in a vineyard setting.



## Results

Based on absolute indices, Rodenator® control ranged from 0–55%, baiting control ranged from 30–56%, and trapping + fumigation ranged from 74–90%. For Rodenator® and baiting treatments, two plots had a significant reduction in gopher populations, while one was not significant. All plots for trapping + fumigation treatments indicated a significant reduction in population size. Relative index values mirrored absolute indices, with reductions in gopher sign significant for all trapping + fumigation plots (range = 91–96%), but only significant for 2 of 3 baiting (range = 22–81%) and Rodenator® (range = 0–86%) plots. Index values did not differ for control plots for either absolute or relative indices. Therefore, observed differences within and across treatments appear to be real.

The time required to apply each treatment was relatively similar between baiting, trapping, and Rodenator® treatments (90–106 seconds); fumigation treatments were substantially longer (260 seconds). Total costs for each treatment were $7,568, $6,338, and $4,532 for baiting, Rodenator®, and trapping + fumigation, respectively.

## Discussion

To be effective, control measures need to result in a minimum of a 70% reduction in plots with gopher activity; values of 80–90% are preferable. Trapping + fumigation met this minimum criterion in all three plots, and met the more rigorous criterion in 2 of 3 plots. Even the one plot that fell short of an 80% reduction in plots with gopher activity yielded a 92% reduction in overall gopher activity. In addition to being more efficacious, trapping + fumigation was also more cost effective. Therefore, trapping + fumigation appears to be an effective method for controlling gophers. Baiting and Rodenator® treatments did significantly reduce gopher activity in 2 of 3 plots, but these values fell below the minimum threshold for effectiveness (70%). As such, growers may realize short-term benefits from control, but will have to apply an equal amount of effort for control the following year. More effective control measures (80–90%) should reduce the cost of control in subsequent years.

Although absolute values were lower than desired for baiting and Rodenator® treatments, relative index values indicated a substantial reduction in gopher activity for 2 of 3 plots for both baiting and Rodenator® treatments. Therefore, an additional round or treatments could have resulted in greater absolute control values. This is of note, as both baiting and Rodenator® treatments have the potential of slowing reinvasion rates due to the destruction of gopher burrow systems by the Rodenator®, and due to residual bait remaining in vacated gopher tunnel systems. These reinvasion rates will be assessed in the near future to provide a more clear understanding on the efficacy of these control options. However, additional treatments would add additional costs to control efforts. Given that these treatment types were already more costly than trapping + fumigation, a relatively high reduction in reinvasion rates would be required to offset these costs.

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## Grape maturity affects yield, quality, and sensory properties of DOV raisins

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**Summary**
The results of several experiments suggest that dry-on-vine (DOV) raisins may have higher air-stream sorter grades than tray dried raisins when made from grapes of similar maturity. If so, then it may be possible to produce DOV raisins with acceptable airstream sorter grades from grapes having lower soluble solids than would be recommended for tray drying. Therefore, we conducted experiments to determine the effect that maturity of 'Fiesta' and 'Selma Pete' grapes may have on the yield, USDA quality grades, sensory attributes, and consumer acceptance of raisins. We found that 'Fiesta' DOV raisins should be made from grapes having at least 19 Brix, whereas 'Selma Pete' raisins should be made from grapes having at least 21 Brix. Raisins made from grapes with less sugar are more likely to fully DOV, but yield and quality will suffer. Allowing the grapes to mature beyond these minimum values before initiating the DOV process did not improve yield or airstream sorter grades, but it did affect the sensory characteristics and consumer acceptance of the raisins. Regardless of cultivar, raisins made from the more mature grapes were moister, less brown, and larger and more homogenous in size than raisins from less mature grapes. Raisins from the more mature grapes also had smaller wrinkles, and they were less gritty. Regardless of maturity, 'Fiesta' raisins were browner in color, but less homogenously colored than 'Selma Pete'. 'Fiesta' raisins also had larger wrinkles, were slightly less sweet, and were much less sour than 'Selma Pete' raisins. These sensory characteristics affected consumer preference. The population of consumers clustered into three groups of people, having distinct preferences. One group disliked raisins made from the least mature 'Fiesta' grapes, but liked the raisins made from the mature 'Fiesta' grapes and the less mature, or mature, 'Selma Pete' grapes, equally. Another