

REPORT OF THE TECHNICAL WORKING GROUP
FOR THE
EUROPEAN GRAPEVINE MOTH PROGRAM
September 27, 2013

A subset of the Technical Working Group (TWG) for the European grape vine moth, *Lobesia botrana* (EGVM), program in California met through a combination of travel and teleconference on September 27, 2013. TWG members attending: R. Cardé, M. Cooper, D. Lance, A. Lucchi, V. Mastro (TWG Chair), G. Simmons, R. Steinhauer, and L. Varela. The following members were not in attendance: B. Bagnoli, G. Barrios, L. Sazo, R. Sforza, and G. Wegner-Kiss. C. Ioriatti also was unable to attend but provided an update on ongoing research and valuable input and comments for this report.

In the morning of the meeting (PDT), program personnel from federal, state, and county levels provided the TWG members in attendance with a summary of activities and results from the previous season. Following that, the TWG met separately to formulate responses to a series of questions from the program and draft recommendations on guidelines for deregulating areas as the program progresses. The format did not allow for a preliminary oral report to the program during the course of the meeting. In addition, delivery of this written report was delayed by a 16-d federal furlough starting on October 1, 2013.

Overview

At this point, the TWG believes that a wide variety of program goals, including eventual eradication of EGVM from California, remain technically feasible. Following its April 2010 meeting, the TWG provided three conditions for the continued feasibility of eradication. To reiterate:

1. The population is not (and does not become) substantially more widespread than it is known to be at present,
2. The grape industry remains behind the effort, and
3. Control methods that are available at the present time remain available for use by the program.

All three are still applicable. At this time, all previously infested areas of California beyond Napa have been deregulated, with the exception of portions of Sonoma and Solano Counties that are within 3 miles of earlier captures in Napa County. None of the chemical or behavioral (mating disruption) control tools have been lost or become ineffective. In addition, the grape industries have remained solidly behind, and involved with, the program. The TWG commends their efforts and recognizes that they have collectively borne the brunt of treatment costs and, along with growers of other affected crops, the burden of regulatory measures. Program officials at the federal, state, and county levels have continued their very good job of coordinating with program activities.

Numbers of EGVM captured in the core infested area (Napa County) have been reduced each year of the program from over 100,000 moths in 2010 to 77 in 2012. The decline continued this year, with only 40 moths captured. The actual reduction in number of moths from 2012 to 2013 was almost certainly greater than what is suggested by comparing total annual captures, as the number of traps in the Napa area was several-fold higher in 2013 while the area under mating disruption treatment was much smaller than in 2012. Because of these differences, the trapping system almost certainly caught a higher proportion of the EGVM in Napa County in 2013 than in 2012; the ability to detect small pockets of infestation in the area was also enhanced in 2013. With that said, however, the pattern of captures in 2013 is a reason for some concern. In 2012, the vast majority of captures were associated with a small, private vineyard in the Olive Hill area with a few additional finds scattered among 4 sites at the periphery of the county's wine-growing areas. In 2013, there was again a "hot spot" (Greenfield area of St. Helena, N of Lake Hennessey), but the scattered finds were more numerous than in 2012 and occurred not only in peripheral areas but also in central portions of Napa Valley (St. Helena/Rutherford/Oakville). In addition, moths were captured in the second flight this year, which did not happen in 2012. All of this suggests that the

small residual pockets of the EGVM population may be more numerous and broadly distributed than what was indicated by the 2012 captures.

One of the questions posed to the TWG this year was “Would an area-wide treatment approach provide better results in our eradication efforts?” The TWG has, since its first meeting, believed that the program should strive to function on an area-wide basis. A coherent management strategy should be deployed uniformly throughout the program area. The question may have been in relation to expanding treatment boundaries. In particular, as the population declines toward eradication, achieving coverage of suppression treatments across all areas where treatments are recommended will, if anything, become increasingly important to ensure that small, localized populations of EGVM are eliminated before they grow, show up in traps, and force an extension of the program in that area and likely in surrounding areas as well. The program coordinators have, given the situation they have been working with, done an excellent job to date of trying to achieve coverage of treatments throughout the affected areas. The TWG realizes that, due to the nature of the program, land-use patterns, and varying production models, the “area-wide” treatment is and will continue to be, by design, more like a patchwork quilt than a uniform blanket. TWG members, though, have expressed concern that gaps in insecticide treatments (holes in the quilt, so to speak) could delay or hinder eradication. According to reports the TWG received at this meeting, some such gaps are occurring already; moreover, the TWG is concerned that the situation could grow much worse if grower enthusiasm for the program flags given that treatment costs are continuing while moth populations are not apparent in many areas.

Specific recommendations

Recommendations new, emphasized, or unique to this report:

Compliance with treatments: As indicated in the discussion above, the TWG believes that compliance with recommended treatment methods and schedules will be important for program success, especially from this point onward. Program managers may wish to consider providing Program Coordinators with additional tools to help them ensure compliance, such as enhanced education and outreach, penalties for non-compliance, funding to supplement costs of treatments, or other means. How the program chooses to go about ensuring compliance is not a technical matter and as such is beyond the scope of this report. However, the need for thorough treatment coverage (i.e., a high degree of compliance) in order to ensure program success is a technical issue, and the TWG would be remiss if we did not stress that here.

Lure loading: The TWG is recommending an increase in the loading of trap lures for EGVM from 1 mg to 10 mg. Based on recent results of ongoing research in Italy and Portugal, a 10-mg lure will provide a more sensitive detection tool in general and, in particular, when trapping within areas treated for mating disruption (though 10 mg under mating disruption will still be well less sensitive than 1 mg in untreated areas). The TWG is recommending that the 10-mg lure be used for all applications; however, the program may use the 10-mg lures just in areas being treated with mating disruption until the remaining 1-mg lures are depleted.

Given current pricing for the active ingredient, the change should not cost the program more than a few cents per lure. The TWG is not recommending a change in the composition of the attractant at this time.

Mating disruption (MD) treatments: MD treatments should be applied per previous recommendations (see *Treatment recommendations/Mating disruption*, below) around sites of 2013 finds and 2014 captures that occur during the first flight. The TWG does not believe that deploying MD treatments would be warranted during 2014 in response to captures during the second (or third) flight of 2014. In addition, the program may consider not deploying MD around sites of single, isolated 2014 captures. The TWG defines a “single, isolated” capture as more than 1 kilometer from other known detections. An alternative would be to enhance trapping in the vicinity (up to, e.g., a trap per hectare) to gain an improved understanding of the local population. Note that the TWG is not suggesting that this trap density is sufficient to act as a control (mass-trapping) treatment.

Initial deregulation of portions of Napa County: Based on previous recommendations, specific areas at the southern end of the regulated area could be deregulated after the second flight of the 2014 season if no additional EGVM are captured in those areas. These include the Carneros and Wooden Valley areas. The program should set the boundaries for these deregulations based on criteria defined in the *Deregulation* section below, as well as other physical or political features. It may be helpful to follow AVA boundaries in some cases, especially in Carneros. If these areas qualify for deregulation (i.e., protocols are followed and no moths are found), a good portion of the regulated area in Sonoma County, as well as all of Solano County, would be deregulated in the process.

Trapping and, where appropriate, insecticide treatments should continue in those areas per recommendations. Traps should be maintained as in 2013 at a minimum of 100 per square mile in grape production areas, with other levels as defined below. The maps provided to the TWG prior to and during this meeting suggested that there may have been some small lapses in trap densities in these areas; e.g., cases where borders of a large vineyard were trapped but the interior was not, or portions of vineyards simply were not trapped. The TWG does realize that mapped information on areas in grape production may not always be 100% current. With that said, though, if Carneros and/or Wooden Valley are to be deregulated, extra vigilance will be needed to ensure thorough trap coverage of all areas that may harbor host plants during the first two flights of 2014.

Trapping outside of the regulated area: The TWG is reiterating an earlier recommendation that grape production areas in California should be trapped at a minimum of 25 traps per square mile for the entire trapping season.

This is especially important for Sonoma County because of the amount of agricultural materials and equipment that move back and forth between Sonoma and Napa counties. As part of this, traps should be placed in the immediate vicinity of wineries or other facilities that receive materials or equipment from within regulated areas.

Treatment areas around finds: The TWG received questions on whether the prescribed treatment area of 500 m around finds should be extended. The TWG believes, at this point, that the 500-m radius remains appropriate as a basic guideline. The program, though, should be responsible for defining specific treatment boundaries and, at its discretion, could increase distances in cases where logical or natural boundaries exist or if the program feels that an extension will improve program effectiveness. Examples could include treating entire vineyards rather than only treating portions within 500 m of finds or extending treatments moderate distances to such features as ridges or edges of agricultural areas. Note that the TWG recommends against using similar criteria to reduce treatment areas.

General recommendations (with minor modifications from earlier TWG reports)

Quarantine buffer:

For the regulated zone, the TWG continues to recommend that the regulated area is encompassed in a 3-mile buffer around the sites of *any* EGVM finds collected during 2012, 2013, and 2014, whether they are trap catches or visual finds.

The TWG is recommending a programmatic trigger of 1 life-stage (an adult in trap or an immature) within the regulated zone in the Napa County area. That is, finding a single insect will kick off a program response in terms of trapping levels and control activities, and will reset the deregulation “clock” for areas within 3 miles of the find. The rationale is that populations have been driven low enough that transport of single moths to points outside of infested areas will be rare, so a moth find is likely an indication of local breeding population.

Quarantine triggers in unregulated areas:

The TWG is not recommending specific changes for quarantine triggers in areas that are not regulated for EGVM or have been released from EGVM quarantine. Specifically, a new quarantine area is triggered if 2 moths are trapped within 3 miles of each other within a lifecycle or if any immature stage is found.

Survey recommendations (unregulated areas):

The TWG's recommendations for survey in unregulated areas have changed little from those developed during the November 2010 meeting. Trapping recommendations for the Napa area are discussed separately in *Deregulation*, below.

1. Survey levels

- a. No fewer than 25 traps per square mile for the entire trapping season (Feb-Oct 1). The TWG would like all traps to be in place by March 7. Priority should be given to trapping the areas within 300 m of grape processing facilities (e.g., wineries), and especially those that have received grapes from regulated areas. In addition, any vineyards within that area, no matter how small, should have at least one trap.
- b. 100 traps per square mile for delimitation within 1 mile radius of new finds for a full generation.
- c. At-risk urban areas in California should be surveyed at a minimum of 5 traps per square mile.
- d. TWG strongly supports current APHIS efforts to survey nationwide for EGVM.

2. Timing of trapping.

Trapping should commence in the late winter or spring before the predicted start of the adult flight season, based on degree-day modeling (at ~150 DD Celsius, 10-30 deg base, with January 1 as the starting point for accumulating DD). Trapping should continue until at least October 1. No EGVM have been captured in California after October 15, so there is no need to trap after this date. Further, given the minimal captures in the first half of October, the TWG felt that the benefit from trapping during this period does not justify the effort, especially if traps interfere with harvest or vice versa. Note that diapause occurs in the pupal stage in EGVM and is controlled primarily by photoperiod. As a result, weather – aside from temperature effects on the duration of the pupal stage – will have relatively little influence on the calendar date when the flight season ends.

3. Trap placement.

Traps that are placed at a specified density (i.e., a proscribed number of traps per square mile) should be spaced as uniformly as possible throughout the area being trapped. For example, if 25 traps per square mile are arrayed on a “perfect” square grid, traps will be 322 m apart, and maximum distance between an insect and the nearest trap within that area (mid-point on the diagonal between traps) will be 228 m. To keep the maximum insect-to-trap distance reasonably close to 228 m, traps need to be placed within and not just at the perimeter of any vineyards that exceed ~325 m across in the shorter dimension (length or width). See Appendix I of the 2012 TWG Report for details and the rationale for this recommendation.

Within vineyards, place traps at canopy height.

4. Visual inspections.

The TWG recommends the use of visual inspections of grapes for immature EGVM, especially in areas under mating disruption treatment. These should be conducted during first generation of the year:

- Inspect 100 clusters at 25 trap sites per square mile in treated areas.
- Inspections should be made during the period from the beginning of flowering to fruit set.
- Inspections would be expected to require 15-20 minutes per 100 clusters.

5. Other considerations:

- a. Trap-check frequency. The TWG continues to recommend a 2-wk trap-servicing interval. Degradation of captured moths could occur during longer intervals, leading to misidentification or non-identification. Additionally, longer intervals could increase the time required to react to a capture. Because most management tools are life-stage sensitive, such delays could compromise the ability of the program and growers to respond effectively when moths are detected.
- b. Second-generation diapause. In areas of California, including the Napa Valley, a portion of the population appears to go into diapause following the second annual generation (i.e., they overwinter as pupae rather than emerging as adults as part of the third flight). This has also been observed in other areas where EGVM occurs. Second-generation diapause can affect our ability to detect the population via trapping during the third flight. It can also affect calculations of the overall number of generations a population passes through.
- c. The TWG was asked if, in outlying areas, stopping trapping after the second flight could potentially be used as cost-saving strategy. This is not recommended but is preferable to reducing trap density.

Treatment recommendations

Options for control treatments remain similar to those in 2011 recommendations.

1. Chemical treatments.

- a. Treat to a 500-m radius around finds (trap or larval) collected at any time during 2012-2013 or during 2014.
- b. Treat first and second generations. The TWG does not recommend attempting to treat the third-generation larvae or overwintering EGVM.
- c. Timing based on DD models and host phenology (first annual generation) and primarily DD models (second generation).
- d. The current list of available insecticides remains appropriate. Methoxyfenozide (“Intrepid”) and Chlorantraniliprole (“Altacor”) have been the most commonly used options and have been very effective, but growers (or program managers) should continue to select products based on situation and need. For organic production, Bt and spinosads (“Entrust”) are the available options. These insecticides have a short field residual and can require multiple applications per generation to be effective.

2. Mating disruption.

- a. Treat to a 500-m radius around sites of 2013 EGVM finds (trap or larval). Also, treat to 500 m around sites of any 2014 finds in the Napa area, if (and only if) those finds occur during the first flight (trap) or first generation (larvae). Also, if EGVM captures indicate the presence of a population at a remote location beyond the Napa infestation, use of mating disruption is at the

discretion of the program based on a variety of factors, including the apparent size of the population and the efficacy of the other control measures being used.

- b. Apply prior to first flight of the 2014 season (2013 sites), based on degree-day models.
 - c. Do not apply to areas surrounding 2010, 2011 or 2012 finds, unless those areas are also within 500 m of 2013 or 2014 (first-flight finds).
 - d. Efficacy of mating disruption can decrease at the edges of treated areas (the effect is presumably most pronounced along windward edges). Applying dispensers to vegetation surrounding vineyards, where feasible, can potentially alleviate this effect. Increasing dispenser density in a “border area” (i.e.; doubling-up the border) is another tactic that been shown to increase efficacy of mating disruption at the edges of the treated area.
 - e. When mating disruption is used in residential areas, cover the area surrounding the find(s) as uniformly as possible out to 500 m. Because “spot” applications of mating disruption are not effective, dispensers should be applied to foliage surrounding grapevines as well as the grapevines themselves. Specific recommendations on this subject will be forthcoming pending further discussions by the TWG.
 - f. The TWG received specific questions about effects of topography on effectiveness of mating disruption. Uneven or sloping topography can potentially reduce efficacy of mating disruption treatments, but the TWG is not aware of evidence that increasing the treatment radius would compensate for these effects. Conversely, treatment radius should not be decreased based on topographic factors.
3. Residential, urban, and natural areas. Continue to use host removal or Bt, in combination with mating disruption, when practical. The use of mating disruption continues to be strongly favored by TWG members, except in areas targeted for deregulation, as described below.

Alternate and secondary hosts

The TWG does not have recommendations in this area at this time, other than to continue treating flowering olives as potential hosts. Applicable recommendations on EGVM host plants can be found in previous TWG reports and in several communications that came out following the 2011 TWG meeting.

Regulatory treatments

At this time, the TWG believes that the current regulatory requirements are sufficient (if enforced) and is not recommending any changes in regulation involving, for example, handling of winery waste, movement of grapes or grape plants, systems approaches to fresh grape certification, or handling of other grape products such as must. Some regulatory measures such as the requirement for slack-loading were relaxed over the past year (following consultation with scientific support staff) based on reduced EGVM populations in the Napa area. The TWG remains concerned about the risk of EGVM being imported on farm equipment from EGVM infested countries and suggests that the program work through channels to ensure that such risk is mitigated to the degree possible.

Deregulation

The TWG recognizes that, as the EGVM program progresses; it is desirable to keep all infested areas under regulation, but to lift regulations as quickly as possible from areas where the insect has been eradicated. There are two associated “error states” – specifically, (1) lifting regulations from an area where the pest still exists and (2) keeping an area under regulation after the pest has been eradicated. While neither of these error states is desirable, the former would be much less so, as finding a population in an area that has been declared pest-free – especially if there are multiple incidents – will tend to erode confidence of the public, the industry, and our trading partners. Declarations that areas are pest-free are based primarily on sampling, which for EGVM is done with pheromone-baited traps and in some cases by

visual examination of vines. Such sampling can never provide 100% assurance that a population of the pest isn't present, but the ability to detect a population, and especially a small population, increases with the intensity (e.g., traps per square mile) and the duration (moth generations) of the sampling effort. Determining the success of eradication efforts is further complicated with EGVM because we do not have a good understanding of the efficiency or effective sampling range of the traps. With these factors in mind, the TWG has developed strategies for deregulation that we believe will minimize the risk of type (1) errors without placing an undue burden on affected industries.

As noted previously, the TWG is recommending more stringent protocols prior to release from regulation for the Napa area than were used for the outlying counties, all of which have now been deregulated with the exception of portions of Solano and Sonoma that were within 3 miles of a Napa find. To reiterate, these conditions were (with updating as above):

1. Areas within three miles of EGVM finds (2012, 2013, and if applicable 2014) in Napa County should be regulated (no change) at this time. This includes portions of Sonoma and Solano counties.
2. General detection trapping within the entire regulated area should be increased to 100 traps per square mile for grape production areas and 25 traps per square mile in urban areas.
3. When a life stage of EGVM is detected, production areas within 500 m of the find should be:
 - a. Treated with program-recommended insecticides during the first and second generation following the detection for at least two years.
 - b. Treated with mating disruption for two *full* flights following the detection. As noted above, in the Napa area, the third flight of the year typically includes only a portion of the population and cannot be counted toward mating disruption treatments or as a flight for confirmatory trapping prior to deregulation.
 - i. If moths are trapped in an area during the second flight, mating disruption should be applied before the first flight the following spring. If moths are trapped during the first flight of a season, mating disruption treatments should be applied to the surrounding area before the second flight. In practice this will normally result in effectively treating the first three full flights after detection with mating disruption, as dispensers should be re-applied before the first flight the following spring and will remain active through the second flight.
 - ii. If only a single moth is trapped, the program may, at its discretion, continue trapping at a high level (or preferably enhance trapping in the area) rather than deploying mating disruption. Foliar insecticide treatments should still be applied per *Deregulation 3.a.*, above.
 - iii. Trapping levels may be reduced to 25 traps per square mile for areas under active mating disruption treatment.
 - c. Survey visually for EGVM larvae in vineyards treated with mating disruption per protocol above under *Survey recommendations*/Visual inspections.
4. In the second year after the detection (the year following mating disruption), increase trapping within 500 m of previous finds to either 250 or 100 traps per square mile in production areas depending on the duration of trapping (see below), 100 traps per square mile in urban and residential areas, and 25 traps per square mile in any riparian or wild areas that may be harboring wild or feral grapes. To be clear, this would apply in 2014 to areas where moths had been captured in 2012 (but not in 2013) and mating disruption had been applied in 2013 and possibly part of 2012 (per 3.b.i.).
5. If there are no additional finds in the area after four full flights of high-density trapping (and at least six full flights after the initial find), the area becomes eligible for deregulation if 100 traps per square mile were deployed in vineyards within 500 m of earlier finds. An alternative strategy (the TWG's initial 2012 recommendation for Napa) would be to deploy 250 traps per square mile in those core

production areas and reduce the required high-density trapping period to three full flights (and at least five full flights after the initial find). Active mating disruption dispensers cannot be present in areas where high-density trapping is being used to confirm eradication (note that under these conditions, the Olive Hill area could not qualify for deregulation until after the first flight of 2015 even if trapping in the area was increased to 250 per square mile; requires 3 full flights post-mating disruption).

As discussed above, traps should be spaced as uniformly as possible throughout the area being trapped in order to keep the maximum insect-to-trap distance as small as possible. More specifically, at 100 traps per square mile, traps should be arrayed so that no point in the vineyard is more than ≈ 120 m from the nearest trap; at 250 traps per square mile, all points should be no more than ≈ 75 m from the nearest trap. This will require placing traps within, and not just at the perimeters of, larger vineyards. Guidelines and rationale for this recommendation are given in Appendix I of the 2012 TWG Report.

During the 2012 meeting, the TWG had internal discussions as to whether it would be better to suspend insecticide treatments prior to the last one or two full flights. The thought was that this would allow any residual population to grow, which would improve our odds of detecting it. The counter-argument was that any population that was small enough to require growth to ensure detection would probably be eliminated by the additional treatments. We chose the latter option because it potentially hastens deregulation and simplifies/shortens the program.

6. Since the beginning of the program, the TWG has maintained that when Napa County is deregulated, it should be done in fairly large contiguous blocks and preferably from the outside in, as opposed to, say, deregulating individual vineyards or individual square-mile areas in a patchwork fashion. Patterns of future finds are impossible to predict at this point, but the TWG is willing to provide recommendations in this area if and when they are needed to supplement Napa's deregulation protocols. The other consideration here, and one that the TWG has only limited knowledge to address, is how the movement of grapes within the Napa area might influence optimal spatial patterns for deregulation.

Appendix. Research needs, unprioritized, from 2010 report (*annotated with updates in italics*)

Monitoring:

- Determine the utility of high-load pheromone lures, light traps, food-lure traps, etc., for monitoring EGVM populations in areas under mating disruption treatments. *As discussed above, studies on high-load pheromone lures in Italy and Portugal over the past two years have resulted in a recommendation of 10X lure loading for general monitoring as well as monitoring under mating disruption. Testing of additional lure components is also underway. To date, light- and food-based lures have not been shown to be effective for program use.*
- Develop/validate sampling systems for assessing populations of immature EGVM in fields (for use in monitoring to assess risk of moving grapes out of quarantine zone for crush and for assessing mating disruption effectiveness). *Research has not been done specifically in this area, but a recommendation based on European sampling plans is included here.*
- Optimize trap design (includes looking at folding of flaps in delta traps). *This has not been pursued to date.*
- Determine sensitivity of the detection and delimitation systems (would have to be done abroad at this point). *There was a bit of release-recapture done in Italy in 2012 but studies were not specifically designed to address this.*
- Validate the degree-day model. *This work is ongoing in California and making good progress. Results are also being related to vine phenology.*

Ecology, behavior, biology, biological control:

- Continue work to determine what alternative hosts are used by EGVM in California. *There was a re-assessment of the literature that resulted in some recommendations, but this issue appears to be less urgent now that only the Napa area is being regulated.*
- Determine factors that control entry into diapause; i.e., is it possible that many EGVM in Napa go through only two generations in a growing season?
- Evaluate genetic diversity in EGVM. *This work is ongoing in California.*
- Characterize adult behavior (flight, mating, oviposition, resting).
- Evaluate possibility of using biological control agents to reduce populations. *The success of the program in moving toward eradication has reduced the potential value of pursuing this, at least in the short term.*
- Characterize population dynamics of EGVM in California, including effects of natural enemies.
- Develop a spread model.

Control and management:

- Develop enhanced systems for monitoring and evaluating an area-wide EGVM management program.
 - Use GIS/GPS to track monitoring, treatment, and related relevant programmatic data (ongoing, APHIS-PPQ)*
 - Enhance tracking and evaluation of insecticide treatment data for Napa and Sonoma program areas (ongoing, UC Extension).*
 - Develop enhanced geospatial tracking and analysis of EGVM spread, control, and program activities in California (proposed).*

- Develop/assess new mating disruption formulations for EGVM, including machine-applied. *Field trials were conducted in Europe (Italy, Portugal) in 2012 and 2013; results were presented during the TWG meetings.*
- Determine field life of mating disruption dispensers and how that affects the efficiency of pheromone-based trapping systems over time. *This was a new item for the 2012 report; there is some concern that if dispensers are left in vineyards, they could affect detection sensitivity the following year. Various types of mating disruption dispensers from the 2012 study in Italy were analyzed for attractant residue across time; results are being analyzed.*
- Continue to assess insecticides and develop lists of “best” insecticides for use in conventionally managed vineyards, organic vineyards, and sensitive areas (e.g., riparian, urban and suburban areas). Encourage registration of promising compounds and products for use against EGVM. Determine optimal timing and use patterns for products with short field life such as Bt. *Ongoing work, closely integrated with the program.*

Develop Sterile Insect Technique methodology for EGVM:

- Improved rearing technology. *This work is ongoing and has resulted in identification of a suitable diet as well as improved holding and handling methodology. Up to now, the rearing development work has been largely in support of producing insects for commodity treatment testing.*
- Radiation biology – identify dose and methods for producing fully sterile and F1-sterile male EGVM. *This work has been ongoing at the Otis lab despite a lack of specific funding, and the initial characterization is nearing completion; use of radiation as a potential phytosanitary treatment for EGVM was added as an objective.*
- Develop release technology. *We are not yet at the point where this is feasible.*
- Evaluate field competitiveness of sterile moths. *Discussions were initiated about testing survival, dispersal, and response to pheromone for sterile EGVM in Italy during the 2014 season.*

Regulatory:

- Develop and/or confirm regulatory treatments for grapes (table, wine, and raisin). *This work has been pretty well wrapped up.*
- Develop regulatory treatments for grape nursery stock; confirm efficacy of hot-water dip.
- Investigate pathways that could move EGVM to new areas. Also, how did it get to Napa? Given that Chile and Argentina continue to be infested, what measures are in place to prevent introduction from these countries through importation of machinery?
- Evaluate/develop improved methods of transporting grapes within California to reduce incidence of new EGVM finds in the vicinity of wineries that are outside of regulated areas.
- Confirm efficacy of/develop improved methods for handling, composting, or otherwise treating winery waste to minimize risk. In particular, look at mechanical treatments for green waste (shredding, grinding, etc.). *Mechanical treatments and composting methods require additional evaluation. Methods involving mixing of green waste with wet fermented pomace wastes may also be assessed.*
- Determine if EGVM life stages can survive the crush process and survive in unfermented pomace. *Work in this area has led to recommendations to treat at 2 bars or higher to minimize risk.*
- Confirm that processing grapes into raisins will kill all EGVM life stages.