2020

ESTABLISHING EFFECTIVE PARTNERSHIPS TO CONTROL BMSB

DEVELOPED BY CULTIVATING NEW FRONTIERS IN AGRICULTURE (CNFA) AND TRÉCÉ INC.

CNFA
Cultivating New Frontiers in Agriculture

TRÉCÉ INCORPORATED

Hazelnut orchard Georgia, 2018)

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BACKGROUND

Since 2016, the Republic of Georgia's hazelnut sector has been under attack by an infestation of brown marmorated stinkbugs (BMSB). Other key field and orchard crops in the country—including grapes, corn, peaches, apples, and vegetables—are also under threat of infestation.

To combat this pest, the U.S. Agency for International Development (USAID) launched an international team that worked to identify challenges and constraints faced by farmers in fighting the BMSB during the 2017 growing season through its Restoring Efficiency to Agriculture Program (REAP), implemented by Cultivating New Frontiers in Agriculture (CNFA), an international agricultural development non-profit organization, and Trécé Inc., a leading American

manufacturer of pheromone-based insect monitoring and control systems. Selected by USAID's REAP in 2017 and USAID Georgia in 2018, Trécé Inc. provided two shipments of its PHEROCON® insect kits (lures and traps) to protect Georgia's hazelnut sector and other key agricultural products.

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2017-2018

BMSB control efforts ramped up in March 2018, when USAID's REAP and Trécé initiated and conducted a one-week scientific mission that brought U.S. scientists to Georgia to examine the challenges and constraints that farmers faced in fighting the pest during the 2017 growing season.

Four distinguished U.S.-based entomologists were joined by the USAID REAP team in Tbilisi in order to study the infestation and provide recommendations.

Scientists from the U.S. included Dr. Kim Hoelmer (the U.S. Department of Agriculture (USDA) Agricultural Research Service, Dr. Phil Mulder (Oklahoma State University), Dr. Chris Bergh (Virginia Tech), Mr. Bill Lingren (Trécé), and Dr. Greg Krawczyk (Penn State University). Dr. Tracy Leskey (USDA) was not in attendance but provided important technical support to the mission development.

Over the course of five days, the scientists:

- Participated in listening and debriefing sessions with Georgia's Ministry of Environmental Protection and Agriculture (MEPA) and National Food Agency (NFA), USAID REAP, and the USAID Mission in Georgia
- Visited an agricultural product sales outlet and a commercial apple orchard in eastern Georgia
- Visited hazelnut producers and a citrus producer in western Georgia
- Participated in a multinational BMSB technical conference that included members of the Georgian scientific community as well as specialists from the relevant Food Safety Agencies of Armenia, Azerbaijan and Turkey

Subsequent to the mission, the scientists released a summary report containing their findings, recommendations and other information aimed at aiding Georgia to manage the pest.

Findings:

Surveillance:

It is highly likely that overwintering adult BMSB will move to other agricultural regions in the country via vehicles and cargo, and that the pest will become more widely established, including in eastern Georgia, where vulnerable cash crops (e.g. apples, peaches, and pears) are grown commercially. Ongoing surveillance outside western Georgia using pheromone lures and sticky traps will be necessary to track its spread.

Managing BMSB injury to hazelnut and other affected cash crops in Georgia will require an intensive, coordinated, and sustained effort between all parties.

Monitoring:

The scientists commended the deployment of a network of BMSB monitoring traps in western Georgia. Given that the pest was established in much of that region, including in areas where hazelnuts and other at-risk crops are grown, the use of standard monitoring lures with traps will provide an indication of the first presence of adult BMSB in the spring, the first presence of nymphs, and changes in the abundance of adults and nymphs during the season.

Management:

Managing BMSB injury to hazelnut and other affected cash crops in Georgia will require an intensive, coordinated, and sustained effort between all parties. In the short term, eliminating the impact of BMSB on the hazelnut crop may prove to be very difficult, but some reductions are achievable as resources and strategies are applied and refined. Over the long term, insecticides alone or in combination with monitoring data will not resolve the issue because BMSBs occurs throughout the landscape and are highly mobile. Possible management approaches include:

Threshold-based management: This tactic uses data from the capture of adult BMSBs in pheromone traps to trigger insecticide applications.

Attract-and-Kill management: Research on Attract-and-Kill used BMSB pheromone lures in combination with insecticide sprays or "long-lasting insecticide netting" (LLIN). In all studies, pheromone-baited trees were spaced at 50m intervals around the orchard perimeter, attracting and concentrating adult

Trécé Inc. PHEROCON® insect kits (lure and traps) (Georgia, 2018)

BMSB and nymphs in the canopy of the baited trees where they can be killed using insecticide sprays or LLIN.

Perimeter-based insecticide management: A tactic studied in the U.S. involves weekly sprays around the orchard perimeter, including the first full row on both borders (outer and inner sides), the outer side of the second row on both borders, and the row ends. These studies have included one or more pheromone traps in the orchard interior and the use of a threshold. When cumulative captures in any interior trap reach 10 adults, an insecticide for BMSB is applied to the entire orchard.

Reducing the overwintering population of BMSB: Large numbers of BMSB adults overwinter in many tight, dark, and dry sheltered locations associated with human activity. As has been observed in the U.S. and Georgia, many adults disperse to homes and buildings from about mid-September through October. Abandoned homes in western Georgia could be considered "traps" for these individuals, especially if their suitability can be enhanced by deploying an overwintering "habitat" such as stacks of used cardboard boxes filled with crumpled newspaper positioned against the walls of buildings. Growers, homeowners and their children would be able to find and collect large numbers of overwintering BMSB.

Biological control: While natural enemies of stink bugs (including predators, parasites and pathogens) may play an important role in regulating bug populations, research in North America and western Europe has shown that levels of mortality of BMSB from indigenous natural enemies present in these regions are generally too low to maintain BMSB populations to non-damaging levels. At this time, data on indigenous natural enemies in Georgia appears to be largely lacking, but if species are identified and their potential impact determined, opportunities to promote their populations can be devised. If natural enemy surveys fail to identify effective indigenous natural enemies in Georgia, control options—such as release of mass-reared native predators and parasites, or release

of the introduced Asian parasite *Trissolcus japonicas*, or "samurai wasp," an important natural enemy of BMSB in its native Asian range—can be employed.

The mission produced a number of research questions for Georgian researchers to pursue, and U.S. scientists offered to provide input on the design of any experiments, based on their own research. Recognizing the importance of localized research, MEPA and the NFA also allocated budget for scientific research into the biology and behavior of BMSB in Georgian habitats and for measures related to the effective management of BMSB. Within the auspice of this research initiative, about five scientific projects were funded, and firsthand data was obtained that informed Georgia's government BMSB program for the upcoming season.

2019-CURRENT

After conclusion of the REAP program, a follow-up mission to Georgia in August 2019 sponsored by Trécé Inc. and two other five-year, USAID-funded projects implemented by CNFA—the USAID Agriculture Program and the Georgia Hazelnut Improvement Project—brought leading entomologists from four U.S. universities, the USDA Agricultural Research Service, and experts from Trécé Inc. to participate in a one-week scientific mission in Georgia. Building on the earlier scientific mission, the entomologists shared additional knowledge with Georgian scientists and researchers in the Black Sea region regarding monitoring and control of the BMSB.

Over the course of the week, the participants:

- Engaged with Georgian entomologists
- Visited small and medium-size hazelnut and corn fields in western Georgia
- Exchanged knowledge with the Georgian Hazelnut Growers Association
- Attended a presentation on the NFA's BMSB monitoring system
- Met with the Minister of Environment Protection and Agriculture of Georgia and the Chairman of the Agrarian committee

The assembled scientists and officials concluded the week by attending a conference in Tbilisi that focused on international BMSB best practices and solutions. The event featured remarks from Georgia's Deputy Minister of MEPA, Giorgi Khanishvili; USAID Georgia Mission Director Peter A. Wiebler; the Head of the NFA, Zurab Chekurashvili; and others. The second scientific mission was also attended by specialists from New Zealand and Australia.

Findings:

Surveillance

Damaging BMSB populations continue to be confined mostly to portions of western Georgia, with fewer BMSB sightings in other regions. Ongoing BMSB surveillance using pheromone lures and traps in both western and eastern Georgia is warranted and strongly recommended, including traps in areas associated with crops and in wild, non-managed areas where BMSB hosts occur.

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It remains important to remember that BMSB moves predominantly among deciduous host plants bearing fruit or seed structures. Appropriate monitoring practices and protocols, as guided by Dr. Krawczyk and re- emphasized in the 2018 mission report, appear to have been implemented and followed very well. This includes regular monitoring of traps and maintaining BMSB capture data from each trap at each sample interval, which is expected to be highly valuable for comparisons between years as management strategies are implemented and sustained, and potentially, as biological control agents begin impacting BMSB populations.

Second USAID-sponsored study tour (Georgia, 2019)
Featured: CNFA and Trécé teams

Management

These impressive efforts on behalf of the NFA as well as the level of organization, coordination, and communication led to the implementation of what can only be described as a resounding success in managing the threat from BMSB to hazelnuts in western Georgia in 2019. The inclusion of stakeholders at all levels, from the Ministry of Agriculture to growers, was particularly impressive. The village-specific responses to BMSB exemplify a practical "areawide" approach. The efforts and success at responding so quickly and effectively to the BMSB threat can be considered an important case-study to other countries that experience similar invasive pest emergencies.

The efforts and success at responding so quickly and effectively to the BMSB threat can be considered an important case-study of great significance to other countries that experience similar invasive pest emergencies.

This important first step will need to be sustained, and there are a number of factors to be considered as plans for the 2020 season and beyond are developed including: assessing management impacts, considering sustainable management, utilizing trap threshold-based management, utilizing Attract-and-Kill traps, and risking re-invasion of cropland. Because BMSB occurs widely in the landscape, biological control is considered to be the ultimate mechanism by which population regulation on a large geographic scale can be achieved.

Biological control: The initial stages of biocontrol programs in Georgia have begun, but much work remains to address the relevant aspects of BMSB biocontrol. A key initial aspect of this effort will be to identify the predator and parasitoid taxa that attack various BMSB life stages, including those native to Georgia and adventive species that may be present now or that may arrive subsequently. Surveys for BMSB natural enemies may well be most profitable in areas of Georgia where large BMSB populations have been confirmed and where insecticides have not been used for BMSB management.

Parasitoid ID workshop: For the past several years, an annual BMSB Parasitoid ID workshop in the U.S. has been offered to researchers, students and extension workers. The workshops have taught them how to collect and identify specimens obtained in their research. It is highly recommended that a parasitoid ID workshop be organized in Georgia to train Georgian specialists in methods to collect and

identify potential parasitic wasps affecting BMSB. The workshop could also be open to interested clientele from neighboring countries.

CONCLUSION

There are tangible successes in 2019 that start with higher volumes of hazelnut harvest compared to the 2017-2018 growing seasons, and most importantly the quality of hazelnut that had a huge impact on thousands of farmer livelihoods in western parts of Georgia. Despite these successes there should be significant and coordinated efforts focused on the 2020 growing season to achieve positive results while fighting BMSB sustainably. Recommendations related to BMSB activities going forward are as follows:

- Accelerate the implementation of BMSB biocontrol research, including but not limited to natural enemy surveys
- Consider biological control to be the ultimate goal of all BMSB management activities, as biocontrol in non-managed habitats, including those adjacent to agricultural crops, will likely have the greatest impact on suppressing BMSB populations areawide
- Establish laboratory colonies of BMSB to be used for research and acquisition of egg masses needed for parasitoid detection; and when initiating colonies, follow the protocol for eliminating *Nosema* infections
- Continue and, if feasible, expand the BMSB monitoring and surveillance program near managed crops and in non-managed areas suitable for BMSB development
- When and where feasible, replace broad applications of insecticides against BMSB with targeted applications and/or placement of Attract-and-Kill stations
- Conduct experiments to validate, and if necessary, refine the *trap-based* threshold for BMSB under Georgian conditions
- Conduct experiments to validate, and if necessary, refine and improve the effectiveness of *Attract-and-Kill* under Georgian conditions

The 2019 mission, together with the 2018 mission, fostered new connections, strengthened existing relationships and laid the foundation for stronger integrated pest management in Georgia.

- Establish the baseline susceptibility of BMSB to commonly used insecticides (e.g. bifenthrin and deltamethrin) via dose-response bioassays using adults from two or three different populations

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Georgian hazelnut farmer (Georgia, 2019)

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