Mass Trapping of Japanese Beetles in Massachusetts Grapes and Blueberries

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The Japanese beetle (JB) (*Popillia japonica*) continues to pose a significant threat to agriculture, particularly in North America, where it has become an invasive pest. Known for its distinctive metallic-green hue and coppery wings, this voracious beetle inflicts substantial damage to crops, including fruits, vegetables, and ornamental plants. Adult beetles feed on leaves, skeletonizing plants, while their larvae, known as grubs, feed on grassroots. The economic impact of JB infestations underscores the urgency of effective pest management strategies in affected regions.

Insecticide-based control of JB is largely used to manage populations of adults and larvae. Although adults are the cause of defoliation and the source of reproduction of future offspring, controlling larvae before they emerge can prevent the rapid rise of adult populations in the summer. In organic settings, insecticidal options are more limited and include microbial and plant-derived insecticides, such as pyrethrins. However, most organic insecticides are either ineffective, or too expensive (e.g., spinosad). Thus, organic growers struggle to effectively control JB.

Mass trapping systems influence insect behavior through the sense of smell. Insect pests are attracted and killed in the mass trapping devices. A 6-year study conducted in Missouri provided the foundation for the use of mass trapping systems as an alternative to spraying and a cheaper option compared to the current ineffective and expensive organic management practices for JB. The Missouri study tested the efficacy of a dual-lure mass trapping system as a management option which would replace the need for spraying insecticides. The design for a mass trapping system used in Missouri consisted of a large mesh cylindrical sock attached to the yellow trap top with tape and hung nearby the crops. Another effective mass-trapping system used in Missouri was a trash bin system. The results from those studies can be found HERE.

Figure 1. Above *left*, sock trap design used in MO. Above *right*, failed in-ground trap for automatic Japanese beetle composting.

The goal of the present study was to evaluate the efficacy of the Missouri mass trapping system in Massachusetts in two crops: grape and blueberry. We wondered if the system used previously in blueberry in Missouri would hold up to different environmental conditions and perform as effectively on other crops such as grapes.

Materials and Methods

Study Site. This study was conducted at the University of Massachusetts Cold Spring Orchard (CSO) in Belchertown, MA, during July and August of 2023. We used one block of Frontenac grapes and one block of blueberries (mixed cultivars). Each block measured about 2000 square meters.

Traps. Pest pressure in Massachusetts is not nearly as strong as in Missouri as reported by Piñero and Dudenhoeffer (2018). Therefore, large traps made of 32-gallon trash bins were not deemed necessary. Instead, we initially tested two designs (Fig. 1): a new in-ground trap designed to auto-compost JB which was unsuccessful, and the sock trap design, which in Missouri was effective at controlling the pest and easy to implement due to its portability, size, and low cost.

We followed the protocol established by Piñero and Dudenhoeffer (2018) to manufacture mass trapping socks. Briefly, we used rectangular 0.75-meter x 0.5-meter cuts of fiberglass anti-mosquito screen, which was folded and stapled onto itself on the side and bottom to create a cylindrical shape. Then this mesh cylinder, or "sock", was securely taped to a plastic trap funnel acquired from Trécé (Trécé Inc., Adair, OK), which consists of a one-piece molded vane of yellow panels that intersect at 90∘ with a funnel underneath ending in a wide rim. Beetles hitting the vane fall through the funnel into the collecting device (sock).

All traps were baited with a double lure system comprised of a floral-based lure and the JB sex pheromone. Each dual lure was inserted inside vane slots. Yellow tops and lures were purchased from Great Lakes IPM (Vestaburg, MI).

Monitoring JB emergence. Early-season JB monitoring was necessary to determine when to implement trapping systems to effectively intercept the beetles emerging from the orchard's soil. To that end, we implemented a monitoring system using the same pheromone lure and a commercial trap (available at Great Lakes IPM). The monitoring system was hung from vegetation in the perimeter on June 12th and the first JB was captured on June 26th, 2023.

Adult beetle trap counts. One single mass trapping sock was deployed at the grape block and at the blueberry block. The sock traps in blueberry and elderberry were both emptied weekly and weighed. To estimate the population of beetles caught by weight we used the formula developed by Piñero & Dudenhoeffer (2018) which uses the weight of beetles captured per trap capture to estimate the number of beetles trapped.

Assessments of adult JB on foliage. We assessed JB densities on the foliage of both the grapes and blueberries weekly. Walking down every other row of the block, the surveyor would stop once every 2 meters and record how many beetles they could see in thirty seconds at that stop. Due to the size of the fields and density of foliage, 10 stops were made in the blueberry rows while 20 were made in grape.

Results

Mass trapping JB captures. One single sock was initially deployed at each of the two blocks (grape and blueberry). Due to unacceptably high numbers of JB found on grape foliage at the peak of activity (see below), one whole-block insecticide spray was made on July 13th. On the same day we increased the number of traps from one to six at the grape block, and from one to two at the blueberry block. Figure 2 shows the total number of JB adults captured on each of five collection dates, for each crop. Trap capture data stemmed from six traps in grape and two traps in blueberry. Comparing JB between the two crops, 12,496 (61% of the total) beetles were captured in traps within the grape block and 8,022 (39%) beetles in the blueberry block (Fig. 2). The highest number of adult JB captures was recorded on July 25th and captures quickly subsided

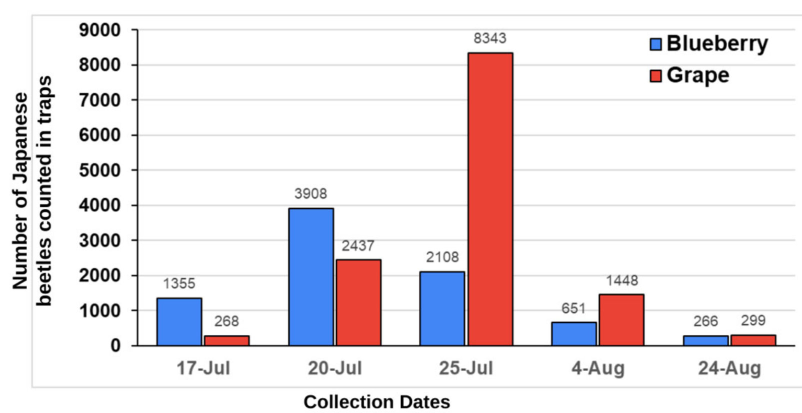

Figure 2. Weekly captures of adult Japanese beetles in mass trapping socks according to crop.

after that date. At the blueberry block, no insecticides were sprayed and little to no damage was found on plant foliage, highlighting the high efficacy of the mass trapping system for blueberries.

Beetle densities on crop foliage. Surveys were conducted to assess the population of JB on the foliage of both crops. As shown in Figure 3, the blueberry surveys consistently showed little to no pest pressure on the crop, while a high number of JB catches were recorded in the mass trapping system (see Fig. 2). In contrast, in the grape block, more JB adults were recorded on foliage and low trap catches (particularly on the July 13-17th and 20th dates), showing that a single mass trapping system was not effective in grapes when JB populations were at their peak. Once the number of mass trapping systems were increased to six, deployed around the grape block after the insecticide spray (applied on July 13th) JB densities on grape foliage dropped significantly, and they did not bounce back. In contrast, high numbers of JB were captured by the six mas trapping systems in the grape block (see July 20th captures in Fig. 2).

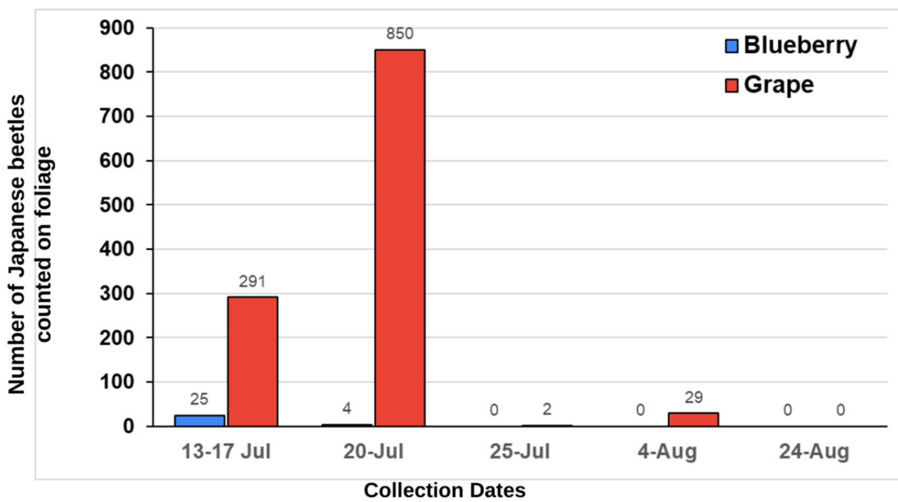

Figure 3. Weekly densities of adult Japanese beetles recorded on grape and blueberry foliage.

Conclusions

In the grape block, one drawback was that initially one mass trapping system was deployed in one location outside the grape block. This was insufficient. JB pressure on the grapes began to overwhelm the crop in early July and the farm manager sprayed an insecticide on July 13th. Shortly after the spray five additional traps were deployed along the perimeter. This six-trap perimeter system was effective in controlling the resurgence of the JB population after the July 13th spray. In the blueberry block, the performance of the single mass trapping system was excellent given that JBs were always suppressed from the crop without using any insecticides. Organic blueberry farmers in MA struggling to control JB may benefit from a mass-trapping system, which our results suggest can be an effective means of control depending on the timing and number of traps used per block.

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References

Piñero JC, Dudenhoeffer AP. 2018. Mass trapping designs for organic control of the Japanese beetle,Popillia japonica(Coleoptera: Scarabaeidae). Pest Management Science. 74(7):1687–1693. doi:https://doi.org/10.1002/ps.4862.

Piñero JC, Shivers T, Byers PL, Johnson H-Y. 2018. Insect-based compost and vermicompost production, quality and performance. Renewable Agriculture and Food Systems. 35(1):102–108.

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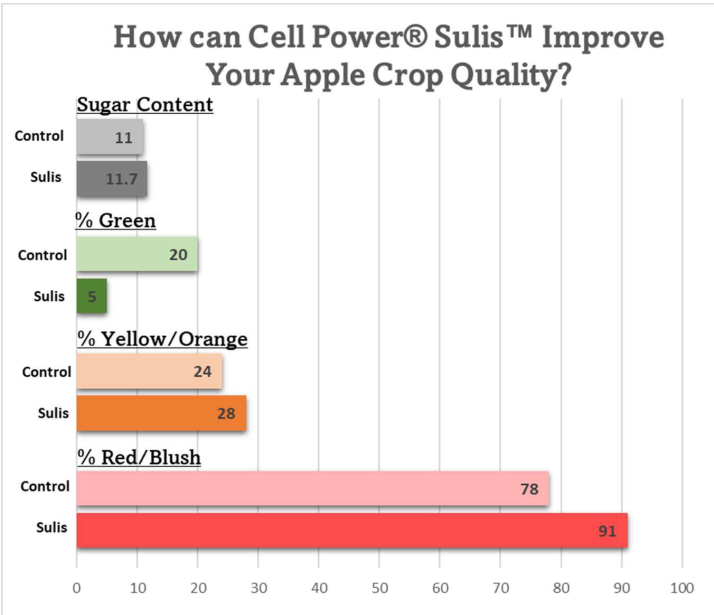

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