The Crusher - Vine Vanguard
Let's crush these SLF!

Problem Statement:

Vineyard owners across New York State are affected by the rapid proliferation of Spotted Lanternflies (SLF), which lay egg masses directly on grapevines and nearby surfaces. They are trying to reduce SLF reproduction by destroying egg masses before they hatch. Each female SLF lays 30-120 eggs per year, and heavily infested vineyards can have 400 SLF per vine. This means that eggs are being laid exponentially. Current elimination methods such as crushing egg masses one-by-one is ineffective if they are not fully destroyed, and experimental ovicides kill only up to 75% of eggs (Krawczyk). Even a single surviving egg mass can enable SLF persistence, escalating plant damage and contaminated harvests.

Why it matters to the end user:

A scalable, systematic method for eliminating large quantities of SLF egg masses is necessary to meaningfully reduce infestations and prevent substantial economic losses for vineyards. Without effective, large-scale intervention, projected losses in the Lake Erie and Finger Lakes regions alone could reach approximately $8.8 million within three years (Gómez, 2025), highlighting the urgent need for proactive and reliable egg-destruction strategies.

Proposed directions:

1. **Mobile Composting Crusher**
    - A mobile crushing and composting unit designed to move through vineyard rows, collect scraped masses, crush and store remains for compost use.
    - Handles large quantities of eggs, and will be equipped with multiple contingency mechanisms to crush 100% of input masses.
    - End-of-semester proof-of-concept: A scaled prototype of the crushing and collecting mechanism, along with basic mobility to drive through vineyard rows.
2. **Egg Crusher Attachment**
    - A small, lightweight crushing attachment to integrate with other systems that crush SLF eggs, such as an autonomous drone
    - End-of-semester proof-of-concept: A prototype of a compact crushing mechanism that can be mounted onto a flat surface (or future device), and operate while inverted.

Key risks / unknowns:

- Additional operating considerations to prevent interference with harvesting equipment.
- Ensuring 100% destruction of egg masses metric is met, preventing accidental redistribution.
- Our design assumes the 'scraping' step of egg mass removal has already been completed, as we chose to focus on the crushing and disposal stage.

Our questions for the client:

- Is a solution that reincorporates crushed egg waste into the vineyard as compost appealing? This would impact potential usage of chemicals to eliminate the egg masses.
- What is your actual and ideal egg removal rate, per day and/or per acre? This would allow us to create optimal crushing speed settings.

Cited Sources:

Krawczyk, G. (n.d.). What should you do with spotted lanternfly egg masses?. Penn State Extension. https://extension.psu.edu/what-should-you-do-with-spotted-lanternfly-egg-masses

Pinto, A. F., Eshenaur, B. C., Acevedo, F. E., Calixto, A. A., Centinari, M., & Gómez, M. I. (2025). Assessing the potential economic impacts of spotted lanternfly (Hemiptera: Fulgoridae) infestations on grape production in New York State. *Journal of Integrated Pest Management*, *16*(1). https://doi.org/10.1093/jipm/pmae039