Combined Proceedings IPPS 72:298-302. 2022.

New Research Determines Successful and Secure Disposal Method for Greenhouse Waste Infected with ToBRFV

Keith Osborne

Gro-Bark Ltd, 816 Mayfield Road, Caledon, Ontario, L7C 0Y6 Canada

kosborne@walkerind.com

Keywords: Aerated composting, tomato brown rugose fruit virus, ToBRFV, greenhouse waste, stone wool substrates, compost, recycling

Summary

This research evaluated the efficacy of Walker's static aerated composting process in deactivating the tomato brown rugose fruit virus (ToBRFV) in spent stone wool substrates and infected vines in order to create a circular economy for greenhouse waste. It was concluded that Walker's standard 6-week GORE® composting process is 100% effective at deactivating ToBRFV when the cell maintains an internal temperature of over 75°C for 47% of the composting life cycle duration.

INTRODUCTION

Walker Industries (Walker) and the Ontario Greenhouse Vegetable Growers (OGVG) have recently completed a three year-long study as a part of a grant through the Greenhouse Competitive Innovation Initiative (GCII). The study evaluated the efficacy of Walker's static aerated composting process in deactivating the tomato brown rugose fruit virus (ToBRFV) in spent stone wool substrates and infected vines in order to create a circular economy for greenhouse waste.

In Ontario, stone wool slabs are one of the main substrates used in greenhouse vegetable production, however limited processes currently exist to manage the spent slabs in an environmentally friendly manner. Walker, Canada's largest fully-integrated resource recovery company, has developed a method in which to process and recycle spent stone wool slabs by separating the stone wool from the plastic encasement and grinding it to a size that can facilitate its re-use. The primary re-use preference is to add the ground stone wool as a bulking agent in compost, which would then be used to create soil blends, effectively diverting the material from a landfill.

With the discovery and spread of ToBRFV in southern Ontario, the secure disposal of end-of-crop-cycle waste has been critical to reduce further contamination of crops. Walker and OGVG subsequently entered into a coordinated partnership to determine the survival rate of ToBRFV in spend stone wool substrates and infected vines when incorporated with source separated organic (SSO) waste and processed in Walker's existing GORE® composting system (**Fig. 1**).

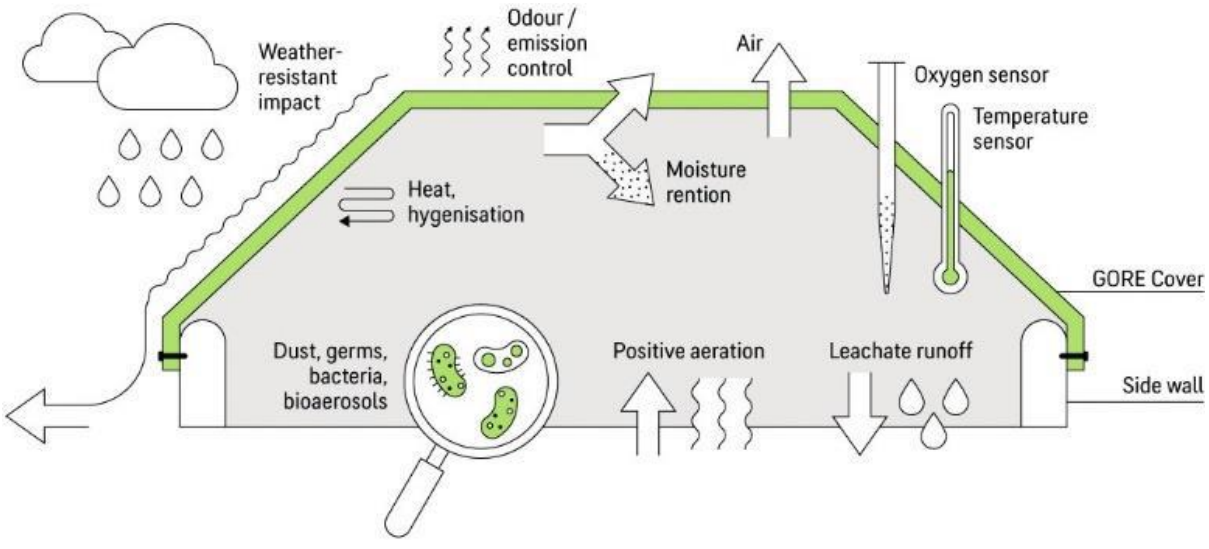

Figure 1. Summary of GORE® system dynamics (www.gore.com).

MATERIALS AND METHODS

Taking place from October 2021 to October 2022, Walker obtained infected Rockwool® substrate and tomato vine waste from Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) to be inserted in mesh bags and incorporated near the center of a GORE® cell at the time of loading. This occurred over seven cell repetitions in which the GORE® cell underwent standard operating procedures for either a 6-week or 8-week composting life cycle. After the composting life cycle was complete, the bags of Rockwool® substrate and tomato vine waste was removed and used to create an inoculum for a plant bioassay study at Walker's Arthur Compost Facility greenhouse.

The plant bioassay procedure consisted of tomato plants infected with several treatment inoculums (**Table 1**) then grown for a 2-week incubation period after which point plant biomass was harvested and sent to a third-party laboratory for ToBRFV detection using one-step conventional reverse transcription polymerase chain reaction (RT-PCR).

Table 1. Composting and bioassay treatment compositions.

Treatment	Components
Composted Rockwool®	- 20% infected Rockwool® - 80% SSO waste
Composted Vine	- 20% infected tomato vine waste - 80% SSO waste
Composted Control	- 100% SSO waste
Positive Rockwool® Control	- 100% infected Rockwool®
Positive Vine Control	- 100% infected tomato vine waste
Negative Control	- 100% phosphate buffer

RESULTS AND DISCUSSION

The initial repetitions of both 6-week and 8-week composting cycles (Rep 1 – 6WK and Rep 2 – 8WK) demonstrated average cell temperatures below 65°C (**Fig. 2**) resulting in only partial deactivation of ToBRFV (**Fig. 3**). However, increased average cell temperatures demonstrated significantly greater ToBRFV deactivation. All subsequent 6- and 8-week composting cycle repetitions of the study resulted in full ToBRFV deactivation due to consistent cell temperatures over 75°C (**Fig. 4**). It was concluded that Walker's standard 6-week GORE® composting process is 100% effective at deactivating ToBRFV when the cell maintains an internal temperature of over 75°C for 47% of the composting life cycle duration (**Fig. 5**).

Due to the success of the GORE® efficacy trial, Walker will further investigate end uses for composted stone wool and explore capital investments to expand Walker's infrastructure for end-of-crop-cycle waste collection and processing in the Windsor-Essex area to offer sustainable alternatives to landfilling and incineration.

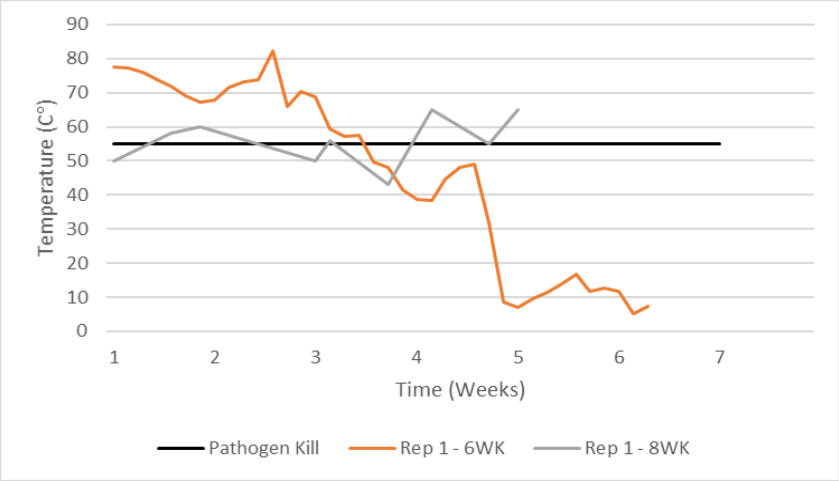

Figure 2. Temperature profiles of material in GORE® cells of the first composting cycle repetitions over time.

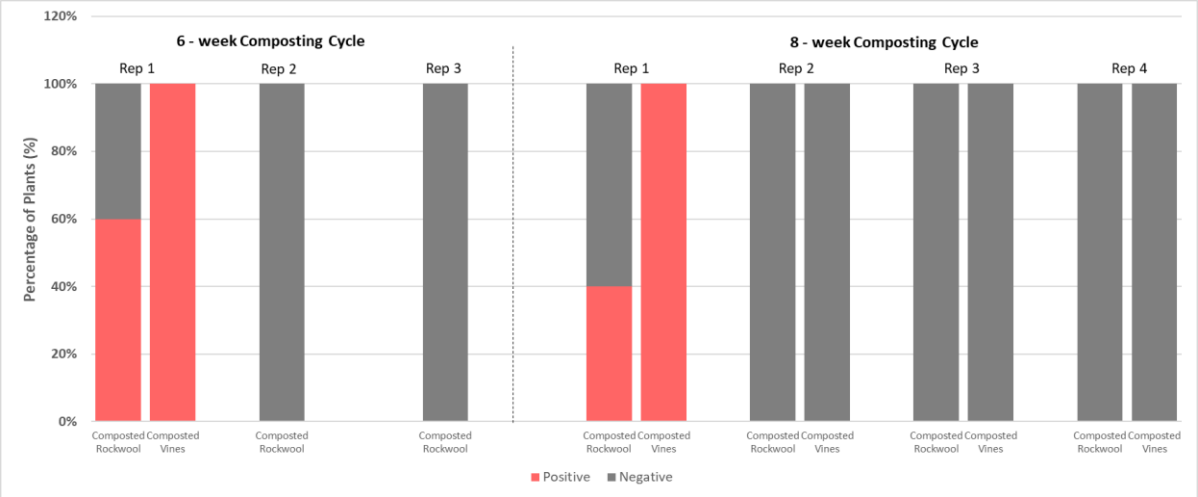

Figure 3. The percentage of plants inoculated with composted Rockwool® and composted vines that tested positive for ToBRFV following a plant bioassay.

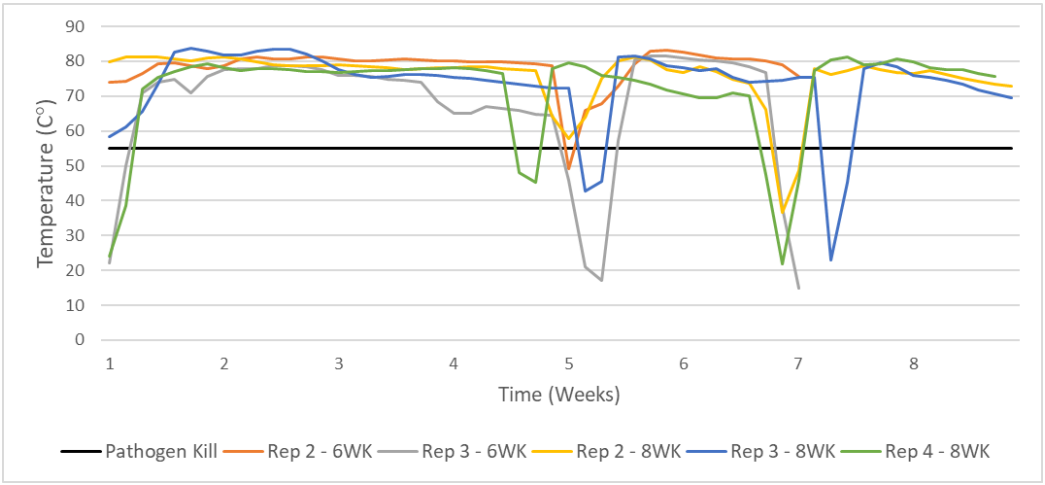

Figure 4. Temperature profiles of material in GORE® cells of composting cycle repetitions over time.

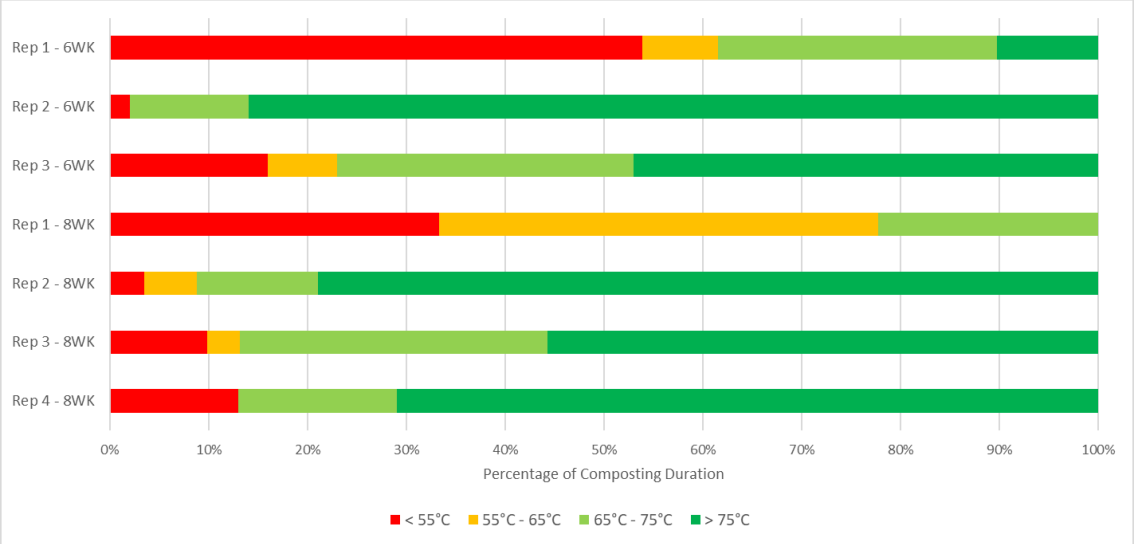

Figure 5. The percentage of treatment time spent within the defined temperature ranges of each repetition.