Attachment, internalization, and dissemination of human norovirus in leafy greens

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Introduction

Human norovirus is the leading cause of nonbacterial gastroenteritis worldwide. Fresh produce is at a high risk for contamination by norovirus because it normally undergoes little or no processing and can be contaminated at any step from preharvest to postharvest. Increasing outbreaks of viruses in fresh vegetables and fruits give high urgency to our plan to understand the ecology and biology of enteric viruses in vegetables and fruits in order to develop effective preventive measures.

Objectives

The objectives of this study is to determine whether human norovirus and its surrogates (murine norovirus and Tulane virus) can be internalized and disseminated in growing lettuce; and whether extreme weather, such as drought and flood conditions, affect human norovirus internalization and dissemination in lettuce.

Hypothesis

We hypothesize that human norovirus and its surrogates can be internalized and disseminated in growing lettuce and that the absorption of virus can be enhanced or inhibited by extreme weather conditions.

Methods

Growing lettuce will be inoculated with human norovirus and its surrogates. The plants will be harvested and homogenized on Day 0 (before inoculation), Day 1, Day 3, Day 7, and Day 14 after inoculation. The amount of internalized and disseminated viruses in the plants will be determined by plaque assay and real time RT-PCR. The effect of extreme weather conditions on virus internalization will be observed by growing the plants in drought and flood conditions.

Initial observation

We have demonstrated that human norovirus, murine norovirus and Tulane virus attached tightly to roots, became internalized, and efficiently disseminated to the shoots and leaves of the plants using hydroponically growing Romaine lettuce as a model. Furthermore, extreme weather conditions affect viral internalization and dissemination. The results fill a major gap in our understanding of the virus-fresh produce interaction that would lead us to develop novel interventions to minimize enteric viruses in vegetables.