Managing *E. coli* in Leafy Greens Wash Water: On-Farm Research

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Fresh produce food safety: some ‘control points’

**GROWING**
- manure, compost
- irrigation water
- wildlife
- livestock
- workers & equipment

**HANDLING**
- harvest
- washing
- packing, storing
- shipping

**OFF FARM**
- consumer
- retailer
- distributor
Managing generic *E. coli* levels in vegetable wash water reduces the risk of cross-contamination.
Generic *E. coli* indicates fecal contamination from warm-blooded animals.

However, only a few *E. coli* strains are pathogenic. *E. coli* is used as a proxy for other potential pathogens.

Sources: [http://www.safeproduce.eu/WaterTesting.htm](http://www.safeproduce.eu/WaterTesting.htm)
Should you be concerned about generic *E. coli* in your vegetable wash water?
Generic *E. coli* in Vegetable Wash Water, 7/08

VT Dept. Health analysis max was 200 MPN/100 ml

VT recreational water standard 77 MPN/100 ml

16 Vermont farms, various crops, various wash systems
Lynn Blevins and I conducted on-farm research from 2012-14, focused on leafy greens wash systems: low growing crop, consumed raw, high value.

One challenge: many different types of wash systems.
single plastic tub with ‘bubbler’
double steel sinks
triple stainless sinks
triple tubs with net system for transfer
hydrocooler with re-cycling water
In 2011 I did a quick trial to see how well an ‘organic’ sanitizer worked, compared to single or multiple rinses.

- Hydrogen Peroxide 23%; Peracetic Acid 5.3%
- Labeled for vegetable wash water, to reduce ‘spoilage organisms, not for human pathogen reduction
- OMRI-approved
- ~$165 for 2.5 gallons

full rate we used = 5 fluid oz. / 100 gal. water

The most recent label for this product lists rates of 6 to 20 fluid oz. / 100 gal. of vegetable wash water.

This information is provided for educational purposes and is not a product endorsement nor does it suggest that other products are not equally effective. Always follow the label.
result of samples August 2011
24 heads lettuce in 10 gal. water

First rinse  
>200 MPN E. coli  

Second rinse  
25  

Third rinse  
2  

First rinse + 0.5 oz. Sanidate  
0
We sampled leafy greens wash water from 3 farms bi-weekly in 2012 and 4 farms weekly in 2013.
Samples were analyzed for generic *E. coli* by the VT Dept. Health Lab, using the $15 ‘AG’ test kit, with dilutions when necessary.
E. coli in leafy greens wash water after 1, 2 or 3 rinses

Results from 1 farm, 24 lettuce heads washed in 10 gal water per rinse
Reduction of *E. coli* in leafy greens wash water compared with a single rinse, average of farms, 2012-13
Reduction of *E. coli* in wash water compared with a single rinse, average of farms, 2012-2013

One rinse with full rate *Sanidate*  

Two rinses with half rate *Sanidate* in 2\textsuperscript{nd} rinse

\~100\%  

99\%
In 2014 we offered free wash water test kits to growers so they could collect and send in their own samples.

43 farms submitted 80 pairs of ‘before and after’ wash water samples from June-October.

These farms wash more than 446,000 lb* or ~$2 million of leafy greens annually.

* This total from the 34 farms that provided estimates of greens washed in 2014
E. coli in the **First** Rinse - 80 samples from 43 farms

OMG
E. coli in the **First** and **Final** Rinse
### Percent reduction in generic E. coli by wash system

Excludes sample pairs with incoming loads MPN < 50, or loads greater than the limit of detection of the test.

<table>
<thead>
<tr>
<th>Wash system (n=43)</th>
<th>% reduction (mean)</th>
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</thead>
<tbody>
<tr>
<td>Hydrocooler + sanitizer (1)</td>
<td>100</td>
</tr>
<tr>
<td>Single rinse + sanitizer + bubbler (2)</td>
<td>100</td>
</tr>
<tr>
<td>Single rinse + sanitizer (3)</td>
<td>100</td>
</tr>
<tr>
<td>Double rinse + bubbler (1)</td>
<td>99.6</td>
</tr>
<tr>
<td>Double rinse (3)</td>
<td>63.4</td>
</tr>
<tr>
<td>Double rinse + sanitizer in 2nd rinse (4)</td>
<td>87.3</td>
</tr>
<tr>
<td>Triple rinse (21)</td>
<td>92.1</td>
</tr>
<tr>
<td>Triple rinse + sanitizer in 2nd rinse (5)</td>
<td>96.2</td>
</tr>
<tr>
<td>Triple rinse + sanitizer in 3rd rinse (3)</td>
<td>100</td>
</tr>
</tbody>
</table>

*Amount of product washed, amount of water used, and sanitizer rate varied across farms*
Conclusions

• Vegetable wash water sometimes has high levels of generic *E. coli* for reasons unknown

• E. coli levels trend higher in summer than in the fall

• Multiple rinses and/or use of Sanidate reduce *E. coli* levels and risk of cross contamination

• Care must be taken when using Sanidate, it is a caustic material; dispensers are available
What changes have you made to your leafy greens wash system and how is it working?