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Reduction of *E. coli* as a Surrogate for *Salmonella* Species on the Surface of Grapefruit During Various Packing Line Processes

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The Produce Safety Rule of the Food Safety Modernization Act (FSMA) allows for use of agricultural water that does not meet its microbial standards if corrective measures, including commercial washing to remove microorganisms, are employed. Regarding fresh grapefruit, there is still a need to validate different postharvest treatments for reducing microbial loads on fruit surfaces to update previous work that was conducted on oranges. The current research evaluated the removal of *Escherichia coli* (a surrogate for *Salmonella*) from red-fleshed grapefruit during five separate experiments on each of two pilot packing lines (one located at the Institute of Food and Agricultural Sciences (UF/IFAS), Citrus Research and Education Center, Lake Alfred, FL, and the other located at the UF/IFAS Indian River Research and Education Center, Ft. Pierce, FL) over two harvest seasons (2015–16, and 2016–17). This report summarizes the overall results of both the 2015–16 and 2016–17 seasons.

During the 2015–16 season, *Escherichia coli* strains used in the tests were first validated as an acceptable surrogate for *Salmonella* (Zhang et al., 2016). During each of the 10 experiments (five on each packing line), whole grapefruit were inoculated on the equator with 100 µL of an *E. coli* suspension (10^8 CFU/mL). The *E. coli* strains used were the same as those used by Pao and Brown (1998). Inoculated fruit were dried under ambient temperature for 2 h before conducting various packing line processes and treatments. Control fruit were inoculated but not treated or treated but not inoculated. Each treatment had three replicates containing 10 grapefruit each. Individual processes evaluated on the pilot packing lines included fruit wetting, brush washing, pre-wax drying, waxing (shellac and carnauba ± morpholine) plus drying, and fruit sanitizers [chlorine, peracetic acid (PAA), and sodium-o-phenylphenate (SOPP)]. A combination of processes representing a complete packing line process were also evaluated on each packing line.

After packing line treatment, fruit were placed in sterile bags containing D/E neutralizing broth (10 mL/fruit), and shaken for 0.5 min, rubbed for 1 min, and shaken for another 0.5 min by hand. The solutions were diluted at suitable levels and plated with the selective media, TSA-R (tryptic soy agar amended with rifampicin at 80 µg/mL) and MAC-R (MacConkey agar containing rifampicin at 80 µg/mL), and the non-selective medium TSA (tryptic soy agar), respectively. Inoculated *E. coli* CFU on TSA-R and MAC-R, and background bacterial CFU on TSA were directly counted after plate incubations at 35 °C for 24 h. *E. coli* and background bacterial populations were expressed in log CFU/grapefruit. The log reductions of bacterial populations by different treatments were calculated based on the bacterial population levels of the respective controls.

Overall results of the tests during the 2015–16 and 2016–17 seasons showed that the mean reductions of *E. coli* populations by individual processes/treatments were 3.01 to > 5.10 log CFU/grapefruit, and that the average reductions of background bacterial populations were 1.28 to 2.76 log CFU/grapefruit, depending on the detecting media, the individual processes, chemical treatments and packing line. Running fruit over the complete packing line processes at both packing lines reduced *E. coli* populations below the detection limit (< 1 log CFU/grapefruit).

Results were fairly consistent over the 10 repeated experiments split between the two different packing lines and over two seasons. The results demonstrate a large reduction of *E. coli* (a surrogate for *Salmonella*) populations on fresh grapefruit surface using the processes and treatments typically found in commercial fresh citrus packing houses in Florida.

Literature Cited

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