Agricultural Water

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Monitoring the microbial quality of water used in agriculture is important to reduce the likelihood of produce contamination and possible future foodborne outbreaks. The U.S. Food and Drug Administration has established the Produce Safety Rule as part of the Food Safety Modernization Act to improve the safety of produce that is normally consumed raw during growing, harvesting, packing and holding activities. In order to comply with the rule, growers need to follow some standards for the microbial quality of water that is used on the produce field, however, more information on the water microbial profile is necessary in order to improve the accuracy of the testing.

Keywords: Agricultural water ; E. coli ; Regulation

1. Definition

FSMA defines “agricultural water” as water that is likely to contact the edible portion of produce that is covered by the rule, as well as water that may be used on food-contact surfaces; irrigation water accounts for the majority of pre-harvest water used on produce fields.

2. Regulations, Guidelines, and Microbial Quality Standards

In order to monitor the quality of water contacting fresh produce, systematic microbial water sampling schedules are critical. These programs should be based on current guidelines (good agricultural practices, quality assurance standards), third-party or buyer requirements, and current regulations, including the PSR[1]. To minimize the impact of foodborne outbreaks, the FDA established the PSR to improve the safety of fruits and vegetables that are normally consumed raw during growing, harvesting, packing and holding activities. A primary goal of the FSMA was to shift the regulatory framework from a system that reacted and responded to foodborne outbreaks to a system focused on prevention and protection[2]. The PSR describes standards for good agricultural practices to which produce growers must adhere, including requirements for agricultural water used during pre- and post-harvest activities. The rule mandates testing schedules for the establishment of microbial water quality profiles (MWQP) for all water sources contacting the harvestable portion of the crop prior to harvest. To establish the MWQP, the surface water source is sampled for generic *E. coli* per 100 mL for 20 times over a 2 to 4-year period, throughout the growing season including as close to harvest as practicable. In subsequent years, 5 additional samples are rolled into the MWQP. To comply with the PSR, the geometric mean for the MWQP must be ≤126 CFU/100 mL generic *E. coli* with a statistical threshold value of ≤410 CFU/100 mL generic *E. coli*[3]. In March 2019, the FDA extended the compliance dates for these agricultural water provisions by 4 years to give growers additional time to establish MWQPs for their water sources[4]. However, because timing of sample collection is left to the growers’ discretion, some individuals may manipulate their MWQP by testing water sources at advantageous times, such as during periods of drought or late in the day when the water surface has been exposed to solar radiation for several hours, leading to results that may not be the most representative of the microbial water quality.

Certain produce types, such as leafy greens[5], appear to be more susceptible than other types to contamination and many enteric pathogens tend to preferentially attach to specific commodities. *Salmonella*, which has been implicated in multiple tomatoes and pepper-associated outbreaks[6][7][8], has resulted in no major U.S. outbreaks related to leafy green consumption[9]. Conversely, leafy greens are frequently associated with pathogenic *E. coli* outbreaks[10][11][12][13][14][15][16], but *E. coli* is seldom the causative agent during outbreaks of enteric disease linked to tomatoes[6]. Pathogen attachment strength also varies among varieties within similar produce types; attachment of five *S. enterica* serovars was greater on Romaine lettuce than on Iceberg lettuce or cabbage[17]. Another study examining *Salmonella* attachment to produce germinated and grown in soil irrigated with an eight-serovar suspension found that incidence of *Salmonella* contamination was significantly lower on lettuce (51.1% contamination incidence) and spinach (56.8%) than other examined Asteraceae

including radicchio (86.6%) and endive (79.6%). The authors also examined differences in contamination among tomato cultivars and found that contamination incidences ranged from 61.1% for the Brandywine cultivar, which was significantly higher than contamination incidence on the cultivars Nyarous (11.1%) and Yellow Pear (6.3%)[9].

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