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—Scientific Note—

Validating Agricultural Water Treatment for Food Safety on Farms

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Agricultural water is identified as one of the major routes for microbial contamination of fresh produce (Harris et al., 2012). Continuing outbreaks of foodborne disease associated with fresh produce in the U.S. (CDC, 2019) have resulted in market (Arizona LGMA, 2020) and regulatory pressures (FDA, 2020) that are driving growers toward treating agricultural surface water that contacts the harvestable portion of the crop. Very little information exists for growers to validate water treatment systems on their farms. The objective of this study was to validate in the field the effectiveness of agricultural water treatment methods.

Eight agricultural ponds in West Central Florida were sampled 3 times between February 2021 and June 2021. Surface water was treated with injection systems [diaphragm, aqueous chlorine (NaOCl) or peristaltic, peroxyacetic acid (PAA)] to achieve concentrations of 2–4 ppm free residual chlorine and 5–10 ppm PAA. Contact time was 31 s. Water samples were collected at 0, 1, 20, 40, and 60 min [neutralized with 0.12% w/v sodium thiosulphate (NaOCl) or sodium metabisulphite (PAA)] and evaluated for physicochemical attributes. Populations of generic *E. coli* and total coliforms were enumerated using IDEXX Quanti-Trays.

Average values for oxidation-reduction potential, pH, electrical conductivity, and chemical oxygen demand ranged from 38.50–524.55 mV, 4.26–10.70 (pH), 59.40–1116 µS/cm, and 7.50–804.50 ppm, respectively. Average water temperature, turbidity, total dissolved solids, and total suspended solids ranged from 19.10–33.85 °C, 8.50–167.50 FAU, 29.50–804.50 ppm, and 0.0005–0.6257 ppm, respectively. These wide ranges for the physicochemical attributes of the water indicated a high variability of water being treated within and among the ponds, an indication that adequate monitoring is critical for effective treatment. The average (± standard deviation) coliform concentration in the untreated water samples for NaOCl and PAA were 4.28 ± 0.57 and 4.32 ± 0.54 log MPN/100 mL, respectively. The initial *E. coli* concentrations for NaOCl were 1.22 ± 1.03 and for PAA were 1.21 ± 1.02 log MPN/100 mL (n = 120). Measured free residual NaOCl and PAA ranged from 1–5 ppm and 3.5–15 ppm, respectively. The average coliform concentration in the treated water samples for NaOCl and PAA were 1.30 ± 0.86 and 1.38 ± 1.42 log MPN/100 mL, respectively, while *E. coli* concentrations were 0.12 ± 0.37 for NaOCl and 0.44 ± 0.78 log MPN/100 mL (n = 96) for PAA. The average coliform log reduction achieved during NaOCl and PAA treatments were 2.96 ± 0.78 and 2.95 ± 1.46 log MPN/100 mL, respectively. The average *E. coli* log reduction achieved during NaOCl and PAA treatment was 1.17 ± 0.93 and 0.90 ± 0.69 log MPN/100 mL, respectively. Analysis of variance comparing coliform and *E. coli* concentrations before and after treatment indicate that both NaOCl and PAA treatments were effective in inactivating microbial indicators in agricultural water. NaOCl and PAA significantly ($P < 0.05$) reduced the concentrations of total coliforms and *E. coli* after treatment regardless of sampling event, pond, or sampling time. Both treatment methods have the potential to effectively reduce microbial populations in surface waters and can be used to help mitigate food safety risks associated with agricultural water used during produce production.

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