Food Safety Risks at the Fresh Produce–Animal Interface: Identifying Pathogen Sources and Their Movement on Diversified Farms

SUMMARY
The primary goal of this project was to determine the potential transmission of *Salmonella*, Shiga toxin–producing *Escherichia coli* (STEC) O157:H7 and non-O157:H7 STEC from animal operations to vegetable production systems located in close proximity to an experimental research station (Objective 1) and to commercial diversified farming operations (Objective 2). Based on the outcomes of a two-year sampling program established in vegetable fields located within 400 ft of poultry or dairy operations (Objective 1), it was established that a 400-ft buffer zone distance may not be appropriate to prevent pathogen transmission. On commercial diversified farming systems located in Tennessee (n=5) and North Carolina (n=2), STEC was isolated from fresh produce, animal feces, flies, and environmental sources in TN while in NC only fecal and soil samples tested positive for these pathogens. The proximity of animal operations to produce fields seems to impact pathogen transfer to produce irrespective of farming operation.

OBJECTIVES
1. Conduct a controlled study to determine the impact of buffer zone distances, temporal factors, air and insects on the movement of indicator (fecal coliforms, *E. coli* and *Enterococcus* sp.) and pathogenic (*Salmonella*, STEC O157:H7 and non-O157:H7 STEC) organisms at the animal-produce interface on the Piedmont Agriculture Research Station reflective of a diversified farming systems.

2. Validate the outcome of the first objective by studying the movement of pathogenic microorganisms from known animal reservoirs and potential environmental sources into fresh produce fields in commercial diversified farms.

METHODS
At the Piedmont Research Station, we studied the transmission and impact of buffer zone distances, spatial/temporal factors and air on the movement of indicator (fecal coliforms, *E. coli* and *Enterococcus* sp.) and pathogenic (*Salmonella*, STEC O157:H7 and non-O157:H7 STEC) organisms at the animal (dairy and poultry) to produce interface. For our second objective, we collected produce, fecal material, flies and environmental samples from commercial sustainable farms in NC (n=2) and Tennessee (n=5). Pathogenic and indicator organisms were isolated using standard microbiological techniques. Phenotypic (serotyping) and genotypic (pulsed field gel electrophoresis typing) was done following standard practices.

RESULTS TO DATE

Objective #1: Diversified farming operations were established at two locations, one located next to a dairy unit holding 150 animals and another located next to a layer-hen house. At both locations, plots were placed downwind at 32, 200 and 400 ft away from each animal operation. *Salmonella* was not recovered from 96% of the samples, except for two poultry manure samples. Soil and produce samples consistently were positive for STEC within the 400-ft buffer zone distance.

Objective #2: *Salmonella* was isolated from multiple samples originating from commercial sustainable farms in TN but not in NC. In TN, STEC were isolated from fresh produce, fecal material, flies, soil and water while in NC only the fecal and soil samples tested positive for STEC.

Conclusion: A 400-ft buffer zone distance between animal operations and produce fields may not be appropriate to reduce pathogen transmission to produce. Current buffer zone distance guidelines need to be revised and potentially extended.

BENEFITS TO THE INDUSTRY
1. Transfer of STEC pathogens was established between animal operations located in close proximity to diversified vegetable production systems.

2. Our results strongly suggest that there needs to be a reassessment of the proposed minimum buffer zone distance between animal operations and the location of fresh produce fields. We suggest performing quantitative studies at varying buffer zone distances to determine the adequate buffer zones to prevent pathogen transmission and the establishment/assessment of other physical barriers to potentially reduce pathogen transfer.

3. The size and management of each animal operation seems to impact indicator and pathogen transfer within the diversified systems, where there was lower transfer with small and enclosed animal operations than with large and open animal operations.

4. Soils and insects were found to be positive for STEC, O157:H7 and *Salmonella*, which clearly highlights their potential for pathogen transmission to fresh produce.

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