Implications of Wildlife in *E. coli* Outbreaks Associated with Leafy Green Produce

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ABSTRACT: Outbreaks of *E. coli* O157:H7 associated with the consumption of leafy green produce from different regions within California have initiated a series of food safety management practices regarding wildlife access to the produce production environment and potential contamination of irrigation water supplies. Recent surveys of feral swine that document fecal shedding of *E. coli* O157:H7 underscore the potential for wildlife contamination of fresh produce under appropriate environmental conditions. Collectively, these observations have motivated retailers, processors, and growers of leafy green products to develop that set of ambitious guidelines regarding buffer zones, set-back distances, and fencing requirements for restricting wildlife access to the production environment. These issues and their ramifications for food safety and environmental quality will be discussed.

KEY WORDS: California, contamination, *E. coli*, feral swine, food safety, foodborne disease agents, wildlife

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The multistate foodborne outbreak of *E. coli* O157:H7 linked to contaminated spinach grown and processed in Central Coastal California has raised numerous questions regarding the ability of resident or migratory wildlife to function as important reservoirs of this enteric pathogen. The role of wildlife as a source of foodborne microbial contamination along the farm-to-fork continuum is a long-standing concern among public health and food safety agencies. This outbreak has heightened concern about the ability of wildlife to forage within or to transit through the produce production environment, and what biosecurity measures are in place to prevent wildlife access to human foods that are minimally processed and often consumed raw.

Although the definitive source of *E. coli* O157:H7 for the 2006 outbreak was never determined, both cattle and wildlife were high on the list of species of concern during the outbreak investigation. Although the outbreak strain of *E. coli* O157:H7 was isolated from wild pigs, this does not prove that wild pigs were in fact the originating source of bacteria leading to the outbreak. This is because it is very difficult to prove the originating source of contamination in the complex preharvest environment that has numerous portals of entry for bacteria (water, vehicles, humans, animals, windborne dust, produce plugs, etc.). It is even possible that a third entity infected the pigs and also contaminated the spinach. Cattle and water samples were also found positive during the investigation, but a definitive link and the mode of transmission was not made to the lot of contaminated spinach. Nevertheless, there remains today considerable concern about the ability of wildlife to function as the biological reservoir or mode of transmission for this and other virulent human pathogens such as *Salmonella*. The primary concern is that mammalian or avian wildlife will access the produce production environment and defecate either on the beds or furrows, on the produce, on harvesting equipment, or in pre-irrigation water supplies, such as a pond.

One of the big challenges during an outbreak investigation is to capture and test a wide range of wildlife species so that an accurate assessment is made of which species can function as a source of this pathogen. If outbreak investigators do not test a specific species of animal, then that animal cannot be incriminated as the source of the outbreak. This underscores the need for competent and widespread wildlife trapping to be conducted in parallel with outbreak investigations, with wildlife control specialists working closely with outbreak investigators to more definitively identify the originating source of a foodborne pathogen.

Given this heightened concern about in-field defecation and fecal contamination of irrigation water or equipment by wildlife, the question arises: How do we prioritize wildlife species of concern in order to more effectively structure or implement our biosecurity measures? If we are to develop cost-effective biosecurity measures for safeguarding produce from these potential foodborne threats, which wildlife species should we focus on, and which can we ignore? Are we building a fence to exclude just wild pigs, or a fence that will exclude both large and small species ranging from, for example, mule deer to California ground squirrels? Are birds a legitimate food safety concern given that many species will perch directly on top of heads of lettuce or forage among the rows of produce? Is the possibility of birds defecating while perching on overhead power lines a sufficient food safety threat to justify creating a wide buffer zone of no produce both underneath and alongside power lines, a considerable expense to the grower?

Unfortunately, we do not have high quality quantitative data (cfu/g feces) or even the prevalence of fecal shedding of *E. coli* O157:H7 for many of the wildlife species that frequent or transit the produce production environment in Central Coastal California. This same dearth of data exists for all of California, with this question about the link between wildlife and food safety now extending to many agricultural commodities.

This dearth of data makes it very difficult to focus wildlife biosecurity measures and can result in widespread fencing, habitat removal, high density rodent trapping, and other such wildlife control measures that may or may not be effective. Much of the riparian corridor along the Salinas River is now fenced, with the remaining gaps in the line resulting in high concentrations of wildlife transiting the location.

The appearance of indiscriminate wildlife control efforts in the name of food safety are increasingly the focus of concern for conservation and environmental groups who have worked with agriculturalists for many years to install woody or grassland habitat in order to increase wildlife populations and their biodiversity. Long-standing conservation practices such as planting of vegetative buffers for wildlife habitat and water quality benefits, or the building of sediment basins that can result in seasonal aquatic habitat, are all coming under increased scrutiny as growers are forced to comply to strict pre-harvest food safety requirements.

Developing improved produce food safety practices that can accommodate, to the extent possible, conservation and water quality goals and either maintain or enhance wildlife habitat will be a considerable challenge for the near future. Central to the success of such an integrated effort will be a clear understanding of the role of wildlife in contaminating produce with foodborne microbial pathogens, and how produce production practices influence the likelihood of wildlife to forage within or transit through the production environment. If we are to succeed, it is essential that wildlife control specialists partner with produce food safety experts as we endeavor to consistently safeguard these important agricultural commodities that are enjoyed throughout the nation every day by millions of consumers.