SEEDS

Number 41

RESEARCH UPDATE

Ohio Agricultural Research and Development Center
College of Food, Agricultural, and Environmental Sciences

Safe Salad: Keeping Dangerous *E. coli* Off and Out of Vegetables

Jeff LeJeune, Food Animal Health Research Program
Ken Lee, Department of Food Science and Technology
Sally Miller, Department of Plant Pathology

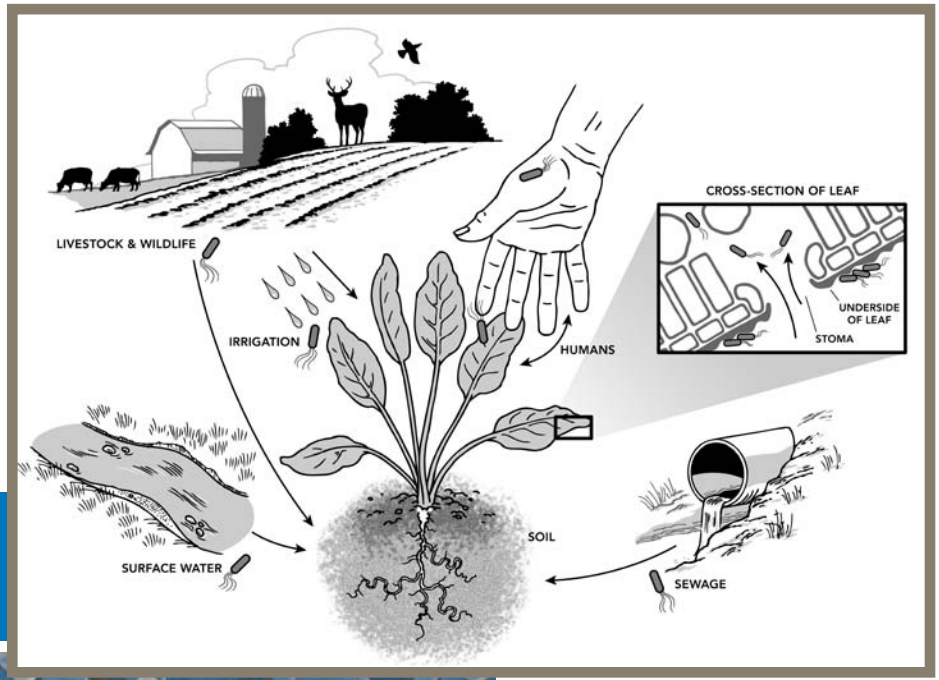
E. coli

Research suggests that *E. coli* can find a way to survive and reproduce inside plant tissues, where the pathogens are protected from disinfecting solutions.

Escherichia coli dealt a powerful blow to U.S. food security during August-September 2006, sickening almost 200 people and killing three in a national outbreak linked to a source that was rare only a few years ago — fresh vegetables, in this particular case, spinach. But as cases of foodborne-pathogen contamination in produce are on the rise, scientists' understanding of how such contamination takes place and the factors that contribute to it is lagging behind.

To help seal this knowledge gap, an interdisciplinary team of scientists with the Ohio Agricultural Research and Development Center (OARDC) and OSU Extension is conducting a new research project aimed at determining the processes that impact growth and survival of *E. coli* O157 (the strain involved in the spinach outbreak) on and in vegetables — practical knowledge that could lead to new ways to reduce bacterial contamination in the veggies people are so encouraged to eat every day.

Leading this project are Jeff LeJeune, a microbiologist with OARDC's Food Animal Health Research Program (FAHRP) and Extension specialist; Ken Lee, a food safety expert with the Department of Food Science and Technology; and Sally Miller, a vegetable pathologist with the Department of Plant Pathology and Extension state specialist.



According to the U.S. Centers for Disease Control and Prevention (CDC), *E. coli* O157:H7 causes an estimated 73,000 cases of infection and 61 deaths in the United States each year. Although most *E. coli* strains are harmless and live in the intestines of healthy humans and animals, the O157:H7 strain produces a powerful toxin and can cause severe illness, often leading to bloody diarrhea and, occasionally, to kidney failure.

Most foodborne illnesses occur from improper handling of foods at home. But contamination can happen anywhere in the farm-to-fork continuum. In the recent *E. coli* outbreak involving spinach, given the widespread distribution of illnesses, contamination most likely occurred at the time of processing or in the field, where there are a number of potential sources of contamination, including soil, fertilizer, water, or wildlife.

Objectives

Research about the interaction between human pathogens and plants is limited, so this study is expected to fill critical voids in scientists' understanding of how foodborne illnesses occur and what can be done to prevent outbreaks and save lives in the future. Specifically, the researchers are testing the following hypotheses:

- In the presence of plant-pathogenic bacteria that secrete plant tissue-degrading enzymes, *E. coli* O157 will proliferate to greater numbers and is more likely to be systematically disseminated to edible plant tissues than in the absence of plant pathogens.
- Pre-harvest contamination of edible plant surfaces with bacterial foodborne pathogens reduces the chance of success of post-harvest disinfection procedures, as *E. coli* O157 becomes protected in the plant tissue.
- Plant pathogens serve as a reservoir of antibiotic resistance genes present in human pathogens, and these genes are transferred from plant pathogens to *E. coli* O157 in plant lesions.
- Seeds produced by plants contaminated with foodborne pathogens will be contaminated internally with bacterial pathogens and produce contaminated products.

Results

This research has been funded at more than $500,000 by the U.S. Department of Agriculture's Cooperative State Research, Education, and Extension Service (USDA-CSREES). In addition to Ohio State, scientists with the College of Wooster and Michigan State University are taking part in this inititative.

Preliminary research indicates that *E. coli* can be recovered from fruits and vegetables that researchers have tried to disinfect using extreme laboratory procedures, far beyond anything that would be used in a home or commercial setting. This suggests that the pathogens can find a way to survive and reproduce inside plant tissues, where they are protected from disinfecting solutions.

Future

Findings from this research project will be critical to reducing pre-harvest contamination of vegetable crops by foodborne pathogens and ultimately minimizing the risk of infection at the dinner table. In addition, the project includes an outreach component aimed at delivering educational programs that vegetable growers need to improve food safety. The research team will conduct a survey to find out exactly what farmers know about foodborne-pathogen contamination and come up with targeted programs in areas where the knowledge is limited.

THE OHIO STATE UNIVERSITY OARDC

THE OHIO STATE UNIVERSITY COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

This research is supported in part by state of Ohio funds allocated to the Ohio Agricultural Research and Development Center of The Ohio State University.

January 2007 FS41-07