Presence and Persistence of Generic *E. coli*, STEC, and *Listeria monocytogenes* in Organic Integrated Crop Livestock Spinach Field in California and Minnesota

**Introduction**

- Integrated Crop-Livestock Farming (ICLF) enhances soil health and quality of organic fields by using animals to graze crop residue or cover crops, before transplanting fresh produce to the fields.
- However, untreated animal manure may mediate transfer of foodborne pathogens to fresh produce through soil contamination.

**Aim**

- Assess presence and persistence of generic *E. coli* (gEc) and presence of *E. coli* O157:H7, non-O157 Shiga toxin-producing *E. coli* (STEC) and *Listeria monocytogenes* (Lm) in certified organic spinach fields where small ruminants graze cover-crop in California and Minnesota.

**Method**

- Randomized complete block experiment (4 replicates) with winter cover-crop grazed with sheep/goat (WG), winter cover crop tilled without grazing (WT), and fallow (WF) treatments
- Sample Collection and Processing
  - 36 soil samples (3 samples × 3 treatments × 4 blocks) collected on 0-, 7-, 30-, 60-, 90-, and 120-days post-grazing (DPG).
  - 20 pre- and post-grazing fecal samples and spinach were collected.
  - All the samples were tested for gEc, *E. coli* O157:H7, non-O157 STEC, and Lm. The amount of gEc in soil was quantified by Most Probable Number (MPN).
- Data analysis
  - Descriptive statistics were used to summarize the prevalence of foodborne pathogens (*E. coli* O157:H7, non-O157 STEC, Lm).
  - ANOVA was used to compare mean MPN of gEc (log MPN +1/g) in soil among treatments on each sampling day.

**Results**

- **Foodborne pathogens**
  - No foodborne pathogens (*E. coli* O157:H7, non-O157 STEC, Lm) in Soil and Spinach were observed both in CA and MN (year1).
  - Non-O157 STEC (4/12, 33%) was observed in post-graze fecal samples from sheep in CA, and Lm (5/40, 12.5%) was observed in pre-graze fecal samples from goats in MN. None of *E. coli* O157:H7 was observed in the fecal samples from CA and MN.
- **Generic *E. coli* as a surrogate of foodborne pathogens**
  - Number of positive and mean concentration of gEc in soil over time
  - In both CA and MN, mean gEc MPNs (log MPN +1/g) were highest at 30-DPG in WG, but those in WF or WT remained constantly low.
  - A significant difference in mean gEc MPNs among treatments was observed at 30-DPG in CA, and at 7-, 30-, and 60-DPG in MN.
  - Preliminary data from this study (year1) indicate that ICLF shows minimal risk of transferring foodborne pathogens to produce after 120-days post-grazing, showing no difference from non-grazed area. Additional studies are needed to assess the effect of climate, animals, and soil conditions on pathogen persistence.

**Acknowledgements**

Funding for this project was made possible by the USDA -AMS through grant AM200100XXXXG032. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the USDA.

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