

## BEEF INDUSTRY SAFETY SUMMIT

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**Project Title:** *Saccharomyces cerevisiae* Fermentation Products that Reduces the Presence, Virulence, and Antibiotic Resistance of *Salmonella* and the Presence of *E. coli* O157:H7 in Beef Cattle

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**Objective:** To determine the effects of a novel *Saccharomyces cerevisiae* fermentation product on *Salmonella* and *Escherichia coli* O157:H7 when supplemented to cattle.

### **Experimental Design and Analysis**

Approximately 1,500 heifers (700-900 lb) were randomly assigned to one of two treatment groups (10 pens/treatment; 75 animals/pen). One group received a standard diet containing monensin, tylosin, and a DFM, while the other group received a diet containing a prototype *Saccharomyces cerevisiae* fermentation product (SCFP; Diamond V) without the three aforementioned ingredients added to the Control diet. Heifers were fed diets for 125-146 days prior to harvest. Feces and lymph nodes were collected (20 carcasses/replicate) and subjected to selective and enumerative culture for *Salmonella* and *E. coli* O157:H7 (feces only). Pathogen load and prevalence was then determined. *Salmonella* isolates were subjected to a tissue culture invasion assay that predicts the virulence of the isolate. Isolates were also subjected to: (a) antibiogram analyses for florfenicol, ceftiofur, and enrofloxacin resistances, and (b) genetic analyses targeting the Newport, Typhimurium, and Dublin serotypes. Statistical analyses were performed using an ANOVA with Tukey's test for multiple comparisons.

### **Key Results**

Cattle fed SCFP had reduced *Salmonella* load and prevalence in fecal samples (74% and 54%, respectively) and in lymph nodes (86% and 72%, respectively). *Escherichia coli* O157:H7 load was decreased by 58% and prevalence was decreased by 35%. *Salmonella* invasiveness was decreased by 68% (fecal isolates) and 66% (lymph node isolates), which correlated with a decreased expression of a specific *Salmonella* invasion gene designated as *hila*. *Salmonella* resistance to florfenicol, ceftiofur, and enrofloxacin was decreased by 17-100% (fecal isolates) and 42-75% (lymph node isolates). The prevalence of *Salmonella* Newport, Typhimurium, and Dublin was decreased by 20-100% (fecal isolates) and 50-100% (lymph node isolates).

### **Relevance to the Beef Industry**

Developing pre-harvest methods to effectively reduce *Salmonella* and *E. coli* O157:H7 in beef cattle is critical to animal health and food safety. The results of this study suggest that SCFP can be used as a pre-harvest food safety intervention in beef cattle, especially since tylosin will soon become unavailable for use in cattle feed.

**Table 1.** Effects of *Saccharomyces cerevisiae* fermentation product (SCFP) on *Salmonella* and *E. coli* O157:H7 in the feces and lymph nodes of beef heifers. Values represent means across pens.

Parameter	Control	SCFP	P-value
<i>E. coli</i> O157:H7			
Fecal shedding, CFU/g	122	52	0.01
Fecal prevalence, %	57	37	0.05
<i>Salmonella</i>			
Fecal shedding, CFU/g	407	105	0.03
Fecal prevalence, %	13	6	0.04
Lymph node burden, CFU/g	6,642	902	0.02
Lymph node prevalence, %	14	4	0.02
Fecal isolates resistant to ceftiofur, enrofloxacin, or florfenicol, %	12.4	4.2	ND
Fecal isolates belonging to Dublin, Newport, or Typhimurium serotypes, %	6.4	4.3	ND
Lymph node isolates resistant to ceftiofur, enrofloxacin, or florfenicol, %	2.1	0.9	ND
Lymph node isolates belonging to Dublin, Newport, or Typhimurium serotypes, %	0.9	0.25	ND
<i>hliA</i> expression in fecal isolates (% of Control)	100	30	0.02
<i>hliA</i> expression in lymph node isolates (% of Control)	100	31	0.02