Preharvest Food Safety Practices in U.S. Feedlots, 2011

Pathogens that cause foodborne illness, such as *Salmonella* and *E. coli* O157:H7, can be found in cattle feces and on hides. In some cases, beef has been implicated as the source of human illness caused by foodborne pathogens. USDA's Food Safety and Inspection Service (FSIS) monitors the safety of meat at slaughter through the Hazard Analysis and Critical Control Points (HACCP) system. Because of the HACCP system, many new advances and decontamination technologies have been developed to improve the safety of meat. These in-plant interventions have been highly effective at reducing the occurrence of pathogens on carcasses such as *E. coli* O157:H7. However, these interventions do not prevent all foodborne pathogens. If the load of foodborne pathogens in cattle entering the plant is large, there is greater likelihood of carcass contamination at slaughter.[a]

Controlling potential foodborne pathogens at the farm level before cattle go to slaughter might decrease pathogen loads and augment in-plant interventions to reduce or eliminate the risk of contamination. FSIS recognizes the importance of preharvest practices in protecting food safety and recommends that slaughter establishments receive their cattle from beef producers that implement one or more documented preharvest practices to reduce fecal shedding of foodborne pathogens.[b] However, at present, there are a number of impediments to widespread implementation of preharvest practices designed to reduce foodborne pathogens including: 1) limited data on the effectiveness of available practices, 2) lack of financial incentives, and 3) limited numbers of products or processes approved by regulatory authorities.

NAHMS 2011 Feedlot study

The U.S. Department of Agriculture's National Animal Health Monitoring System (NAHMS) conducted the Feedlot 2011 study, an in-depth look at large feedlots (1,000 or more head capacity) in 12 States[1] and small feedlots (fewer than 1,000 head capacity) in 13 States.[2] Some of the results presented in this information sheet reflect only large feedlots, while others include both large and small feedlots.

Large feedlots accounted for 82.1 percent of the January 1, 2011, inventory of feedlot cattle in all U.S. feedlots but only 2.8 percent of all feedlots. Small feedlots accounted for 16.0 percent of the inventory on all U.S. feedlots and 92.9 percent of all U.S. farms with cattle on feed.

Vaccines

Current research suggests that vaccines can reduce fecal shedding of foodborne pathogens in cattle.[b] In the United States, one *E. coli* O157 vaccine has a conditional license for use in cattle, and several *Salmonella* vaccines are licensed (or have a conditional license) for use in cattle. At this time, a low percentage of feedlots vaccinate at least some cattle for *E. coli* or *Salmonella* (table 1).

Table 1. Percentage of feedlots that gave any cattle placed on feed the following vaccines, by feedlot capacity

	Percent Feedlots		
	Feedlot capacity (number head)		
Vaccine	**1,000–7,999**	**8,000 or more**	**All feedlots** (1,000 or more)
Salmonella (e.g., *Salmonella* Newport SRP®)	4.9	10.1	6.5
E. coli (e.g., Epitopix SRP® or Econiche®)	1.4	4.6	2.4

[1] Arizona, California, Colorado, Idaho, Iowa, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, Washington.
[2] Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, Pennsylvania, South Dakota, Texas, Wisconsin.

Monitoring foodborne pathogens

A low percentage of feedlots monitored (e.g., through testing) for either *E. coli* O157 or *Salmonella* (table 2).

Table 2. Percentage of feedlots monitoring the following food safety pathogens in cattle, by feedlot capacity

	Percent Feedlots		
	Feedlot capacity (number head)		
Food safety pathogen	**1,000–7,999**	**8,000 or more**	**All feedlots** (1,000 or more)
E. coli O157	5.9	13.2	8.0
Salmonella	5.3	10.7	6.9

Preharvest food safety prevention practices in feed or water

Feed or water management practices have been examined in research studies to investigate their effect on the prevalence of cattle shedding pathogens. Table 3 reports the frequency of use of some of these practices by U.S. feedlots. Many are infrequently used in feedlots, especially among those with capacity of fewer than 1,000 head. Because most past research has focused on *E. coli* O157, the description of effects below will be limited to this pathogen. This is not an exhaustive list of practices available for prevention of foodborne pathogens.

The management practices in table 3 have varying effects on the presence of *E. coli* O157. For example, in most but not all studies, feeding distiller's grains has been shown to increase *E. coli* O157 shedding in cattle.[b] In addition, a number of studies have shown that fasting prior to slaughter increases O157 shedding in cattle.[b] Most research shows that treating water with chlorine has a negligible effect on O157 shedding.[a] The use of ionophores has had inconclusive results on O157 shedding, but there may be an interaction between ionophore use and ration components.[c] While some research has shown a decrease in O157 shedding following a change from a high grain ration to a high forage ration prior to slaughter, as a whole results are inconclusive.[c] In addition, this practice has a detrimental effect on performance (body weight) and is not practical. The addition of seaweed extract to rations has been evaluated, but the effect on O157 shedding is insufficient to recommend its use.[d] As a whole, results to date indicate that beta-agonists in rations have minimal effects on O157 shedding.[c] Of the management practices in table 3, probiotics in rations may have the most promise at reducing O157 shedding, but not all probiotics are equally effective.[a] None of these practices appears to be effective alone at reducing the prevalence of foodborne pathogens, but there is potential for combinations of practices (e.g., vaccines and probiotics) to control these pathogens. However, these combinations of practices have yet to be fully evaluated.

Table 3. Percentage of feedlots by management practice and by feedlot capacity

	Percent Feedlots	
	Feedlot capacity (number head)	
Management practice	**1–999**	**1,000 or more**
Fed distiller grains as part of the ration	25.6	90.5
Fasted prior to transportation to slaughter	11.3	15.9
Provided water that was treated with chlorine	7.9	8.2
Gave an ionophore, such as Rumensin® or Cattlyst®	28.7	90.5
Switched from a high grain ration to a primarily hay ration at finish	7.3	3.3
Fed seaweed extract (e.g., Tasco-14®) prior to slaughter	0.0	0.6
Fed a beta-agonist (OptaFlexx® or ractopamine)	3.9	36.9
Fed a beta-agonist (Zilmax® or zilpaterol)	1.6	10.6
Fed probiotics in feed (e.g., *Lactobacillius acidophilus*, Bovamine®)	8.3	28.5

Summary

Preharvest practices specifically targeted toward reducing shedding of foodborne pathogens (e.g., vaccines, seaweed extract, chlorine treatment of water, or switching from grain to hay diets) are not commonly practiced in U.S. feedlots. Practices that have additional benefits other than the potential to reduce foodborne pathogens (e.g., feeding of ionophores or probiotics) are more commonly practiced, especially in large feedlots.

References

a. Loneragan GH, Brashears MM. 2005. Pre-harvest interventions to reduce carriage of *E. coli* O157 by harvest-ready feedlot cattle. *Meat Science* 71:72–78.

b. USDA–Food Safety and Inspection Service. 2010, Pre-harvest management controls and intervention options for reducing *Escherichia coli* O157:H7 shedding in cattle. Available at: http://www.fsis.usda.gov/PDF/Reducing_Ecoli_Shedding_In_Cattle_0510.pdf

c. Callaway TR, Edrington TS, Loneragan GH, Carr MA, Nisbet DJ. 2013. Shiga-toxin-producing *Escherichia coli* (STEC) ecology in cattle and management based options for reducing fecal shedding. *Agriculture, Food & Analytical Bacteriology*. 3:39–69.

d. Beef Industry Food Safety Council. Production best practices (PBP) to aid in the control of foodborne pathogens in groups of cattle. Available at: http://www.bifsco.org/CMDocs/BIFSCO/Production%20Best%20Practices.pdf

---

For more information, contact:

USDA–APHIS–VS–CEAH–NAHMS
NRRC Building B, M.S. 2E7
2150 Centre Avenue
Fort Collins, CO 80526-8117
970.494.7000
http://nahms.aphis.usda.gov

#667.0213
