On Farm Food Safety Strategies

INTERVENTION SUMMARY	
Status	Some Currently Available and some Emerging Technologies
Location	Farm and Feedlot
Intervention type	Diet manipulation or vaccination
Treatment time	Months
Regulations	Manipulation of feed ingredients approved Use of vaccines, supplements, additives and probiotics require approval
Effectiveness	Variable
Likely Cost	Variable
Value for money	Difficult to ascertain at present
Plant or process changes	Any changes would occur on farm or at feedlot Animal handling facilities would be required to administer treatments
Environmental impact	Few alterations envisaged
OH&S	Handling of animals involves a certain amount of risk Animal treatments and feed additives may have specific handling and storage requirements
Advantages	May be possible to prevent or reduce excretion of E. coli O157:H7 in animal faeces.
Disadvantages or Limitations	No consensus in literature Supplements and vaccines not yet available May leave residuals in the meat

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The farm or feedlot is the origin of micro-organisms introduced onto carcasses during slaughter and dressing. During rearing, numerous factors interact to affect the visual cleanliness and pathogen shedding characteristics of livestock. Age, coat length, clipping, journey time, feeding and abattoir have been found to influence coat cleanliness, while in Britain sex, breed, transport vehicle floor type, transport vehicle dirtiness and housing prior to transport were not significantly related to visual cleanliness of cattle (Davies et al. 2000). A lot of interest has been taken in the effects of modifying the diet or feeding probiotics to animals to reduce shedding of pathogens such as E. coli O157, but results are conflicting, probably because of the complexity of the interactions between all the factors involved.

A number of research groups have considered the effects of different feed ingredients and diet manipulation on the shedding of pathogens by livestock, but the results are often conflicting. It appears that change in diet and management practices could precipitate increased shedding of pathogens, perhaps as an outcome of the “stress” caused by the change *per se*. An extract from the brown seaweed *Ascophyllum nodosum* has been used as a feed additive to promote stress tolerance, and researchers found that feeding this brown seaweed supplement to feedlot cattle 14 days prior to harvest was associated with decreased prevalence of *E. coli* in faeces and on hides, but more research would be necessary to confirm these results (Barham *et al.* 2001).

There is also significant research into the feeding of probiotics, or “good bacteria”, to livestock to competitively exclude the pathogens. In the poultry industry, a product containing a cocktail of 29 organisms (Preempt™) has been approved by the US FDA for reduction of *Salmonella* incidence in flocks. Some organisms have shown promise in reducing the incidence of *E. coli* O157:H7 in calves (Zhao *et al*. 1998), while natural products of some other *E. coli* strains, the colicins, seem to have some inhibitory effects on *E. coli* O157:H7 (Murinda *et al.* 1996, Etcheverria *et al.* 2006). Sodium chlorate, given by mouth to cattle, sheep and pigs has been shown to reduce *Salmonella* Typhimurium and *E. coli* O157:H7 in the intestinal content (Anderson *et al.* 2001; Edrington *et al.* 2003; Loneragan and Brashears 2005), and work is underway to see if this can be used in the field. No regulatory approvals have been granted to date for sodium chlorate in the US, EU or Australia.

Water troughs have been shown to support *E. coli* O157, and be a source of colonisation of previously ‘clean’ animals, so control of pathogen populations in the water could be a possible means of reducing the incidence. Chlorine would appear to be the treatment of choice, but some strains of *E. coli* are particularly resistant to chlorine, and animal water troughs often contain large amounts of organic material, which would inactivate the chlorine.

Vaccination of poultry against *Salmonella enterica* serotype Enteritidis PT4 has been very effective in reducing the incidence of this organism within poultry flocks and eggs and has had a substantial impact on the incidence of salmonellosis in humans in the UK (Adak *et al.* 2002), and there is substantial research into the production of a vaccine against *E. coli* O157:H7 for cattle, and preliminary trials in Canada have shown promise (Huffman 2002), though there is currently no regulatory approval.

Use of vaccines, supplements, additives and probiotics require approval by the Australian Pesticides and Veterinary Medicines Authority (APVMA).

On farm intervention strategies for *E. coli* O157:H7 in cattle (adapted from Brashears *et al*. 2005)

Intervention strategy	USDA approved	Cattle type	Effective?	Estimated Cost (A$)
Diet formulation				
Forage-based diets	Yes	Mature dairy	Yes	Unknown
Grain-based diets	Yes	Sheep model, dairy, steers	Yes	Unknown
Whole cottonseed	Yes	Finishing beef	No	Variable based on season & geographic location
Diet supplements				
Probiotic bacteria	Yes	Finishing beef, weaned calves	Yes	~2-3¢ per animal per day in feedlot
Brown seaweed	Yes	Finishing beef	Yes	~$5-$6 per animal
Vaccination	No	Finishing beef	Yes	~$1.50-$3.00/animal
Sodium chlorate	No	Mature dairy	Yes	Unknown
Antibiotics				
Neomycin	No	Finishing beef	Yes	~$2/animal

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