

## Antibiotic Residues in Dairy Manure

### Part 1: Critically important antimicrobials labeled for dairy use

#### Critically important antibiotics

Most antibiotics used by modern dairy farms are also important human medicines (Table 1). As antibiotic resistance can spread through the environment<sup>[1]</sup>, development of resistance at a dairy farm has the potential to reduce the efficacy of these medicines in humans. To address this concern the World Health Organization (WHO) has established a list of

*Critically Important Antimicrobials for Human Medicine* based on two criteria: 1) the antimicrobial is the sole, or limited, therapy, to treat serious bacterial infections in people, and 2) the antimicrobial is used to treat infections in people caused by bacteria from non-human sources or by bacteria that may acquire resistance from non-human sources<sup>[2]</sup>.

**Table 1.** Antibiotics used on dairies and their importance as antimicrobials for human medicine according to the WHO. **Critically important antibiotics (meeting both criteria) are listed in red.** **Highly important antibiotics (meeting one of the two criteria) are listed in blue.** Important antibiotics (used by humans and livestock) are listed in grey.

Drug Class	Antibiotic	Trade Name(s)	Labeled for ‡				
			Calves	Heifers	Lact. Cows	Dry Cows	Other
Aminocoumarin	Novobiocin*	AlbaDry Plus				X	
Aminoglycosidases	Dihydrostreptomycin Sulfate	Quartermaster				X	
	Neomycin	Neomycin	X	X			
	Spectinomycin Sulfate	Adspec	X	X			
	Spectinomycin Sulfate	Linco-Spectin†					X
Amphenicol	Florfenicol *	Nuflor, Resflor	X	X			
Cephalosporins	Ceftiofur Crystalline Free Acid *	Excede	X	X	X	X	
	Ceftiofur Hydrochloride *	Excenel	X	X	X	X	
	Ceftiofur Hydrochloride *	Spectramast DC				X	
	Ceftiofur Hydrochloride *	Spectromast LC			X		
	Ceftiofur Sodium *	Ceftiflex, Naxcel	X	X	X	X	
	Cephapirin Sodium	ToDay			X		
Lincosamides	Lincomycin Hydrochloride	Linco-Spectin†					X
	Pirlimycin Hydrochloride	Pirsue			X		
Macrolides	Erythromycin	Erythromycin	X	X	X	X	
	Tildipirosin *	Zuprevo		X			
	Tilmicosin	Micotil 300, Pulmotil 90	X	X			
	Tulathromycin *	Draxxin	X	X			
	Tylosin *	Tylan 50, Tylan 200, TyloVed	X	X			
Penicillins	Amoxicillin Trihydrate	AmoxiMast			X		
	Ampicillin	Polyflex	X	X	X	X	
	Cloxacillin Benzathine	Dryclox, Orbenin				X	
	Hetacillin Potassium	Hetacin, Polymast			X		
	Penicillin G	Agri-Cillin, Bactracillin G, Norocillin, PenAqueous, Penicillin, Penject, PenOne, ProPen	X	X	X	X	
	Penicillin G	AlbaDry Plus, Quartermaster				X	
	Sulfonamides	Sulfadimethoxine	Albon, Dimethox, Sulfadimethoxine, Sulfamed, Sulfasol	X	X	X	X
	Sulfamethazine	Aureo S 700, SMZ 454, SupraSulf, Sustain III	X	X			
Tetracyclines	Chlortetracycline	Aureo S 700, Aureomycin, Chlormax, Chloronex, CLTC 100, Pennchlor 64	X	X			
	Oxytetracycline	Agrimycin, Duramycin, Liquimycin, Noromycin, Oxybiotic, Oxytet 100, Pennox, Terra-Vet, Terramycin, Tetroxy 343, Vetrimycin	X	X	X		
	Oxytetracycline	Biomycin 200, Liqumycin LA 200, Tetracycline SP 324 Powder	X	X	X	X	
Quinolones	Enrofloxacin *	Baytril, Enroflox 100	X	X			

\* veterinary usage only.

† used as a bovine semen preservative.

‡ can be used in non-labeled animal classes providing Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA) is followed.

### Antimicrobials of veterinary importance

The World Organisation for Animal Health (OIE) has similarly ranked classes antibiotics for their importance to veterinary medicine based on two criteria: 1) input from surveyed veterinarians, and 2) the ability of an antimicrobial to treatment serious animal disease and the availability of alternative antimicrobial agents (Table 2)<sup>[3]</sup>.

**Table 2.** List of antimicrobials of importance to animal medicine according to OIE. Critically important meet both criteria, highly important meet one criteria.

Drug Class	Importance
Aminocoumarin	Important
Aminoglycosidases	Critically important
Amphenicol	Critically important
Cephalosporins (3rd gen.)	Critically important
Lincosamides	Highly Important
Macrolides	Critically important
Penicillins	Critically important
Sulfonamides	Critically important
Tetracyclines	Critically important
Quinolones (2nd gen.)	Critically important
Ionophores	Highly Important

### Ionophores

Ionophores are antimicrobials that have a different mode of action than antibiotics, and thus are classified differently. Though ionophores are used extensively as prophylactics in livestock and poultry production, they are not used as human medicines. As such, while ionophores are considered ‘highly important’ as veterinary medicines (Table 2), they are not ranked by the WHO for their importance as human medicines (Table 1).

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#### REFERENCES

- <sup>[1]</sup> Oliver & Gooch. 2017. Antibiotic resistance and dairy production - Frequently asked questions. [http://www.manuremanagement.cornell.edu/Pages/General\\_Docs/AMR/FAQ-AMR&Dairy.pdf](http://www.manuremanagement.cornell.edu/Pages/General_Docs/AMR/FAQ-AMR&Dairy.pdf)
- <sup>[2]</sup> WHO. 2017. Critically important antimicrobials for human medicine. 5<sup>th</sup> Revision 2016. Ranking of medically important antimicrobials for risk management of antimicrobial resistance due to non-human use. World Health Organization. Geneva, Switzerland.
- <sup>[3]</sup> OIE. 2015. List of antimicrobial agents of veterinary importance. World Organisation for Animal Health. Paris, France.