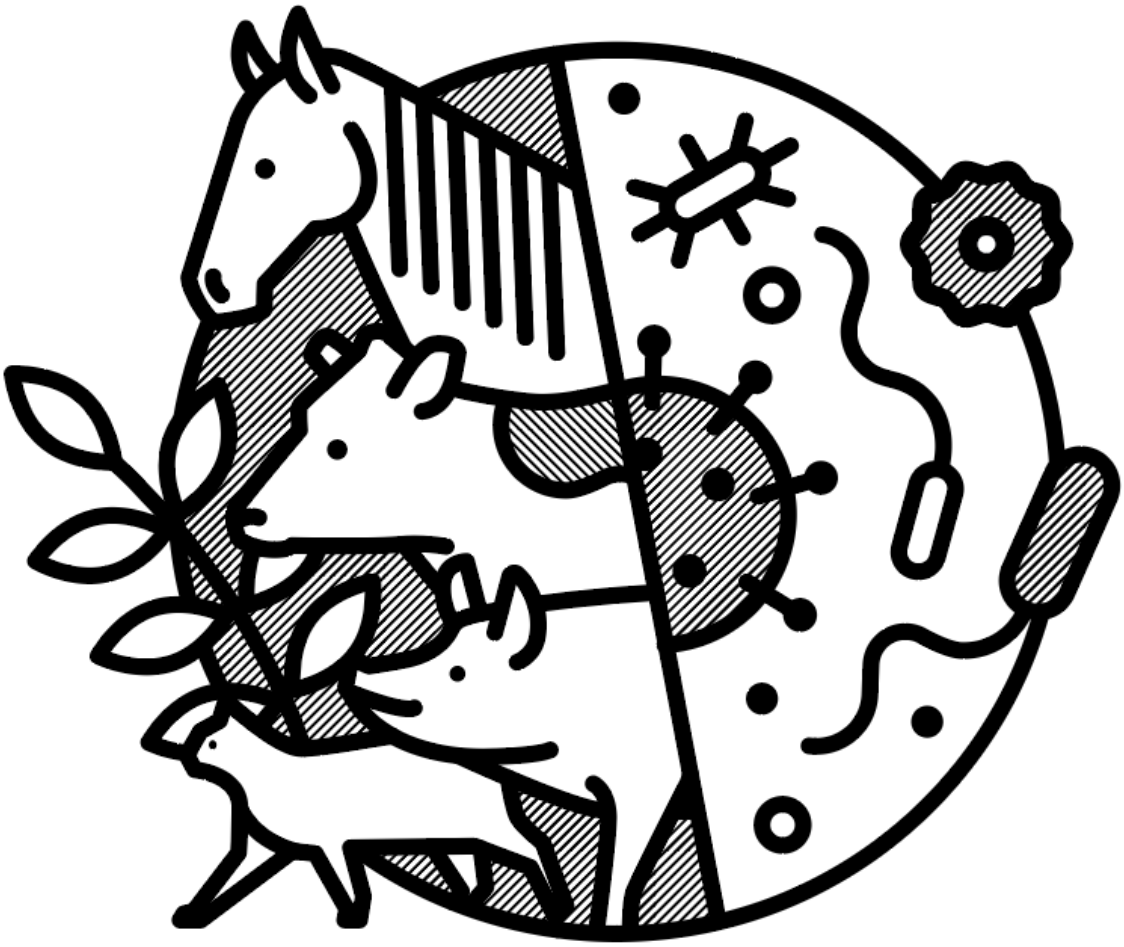
New Zealand Food Safety
Haumaru Kai Aotearoa

2023 Antibiotic Agricultural Compound Sales Analysis

September 2024



Te Kāwanatanga o Aotearoa
New Zealand Government

Ministry for Primary Industries
Manatū Ahu Matua

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1 Summary

Total antibiotic sales quantities decreased by 1,484 kg (3.6%) to 39,549 kg in 2023 down from 41,033 kg in 2022. This was the sixth year of consecutive decreases and was 45% below that reported in 2017.

Lower sales quantities were reported for 13 of the 15 classes of antibiotics evaluated with a combined reduction of 4,057 kg from 2022. The main contributors to the 2023 decrease were:

- the macrolides which decreased by 2,469 kg (65%),
- the sulphonamide and trimethoprim class which decreased by 667 kg (17%), and
- the aminoglycosides which decreased by 461 kg (15%).

The total combined increase for the two classes with higher sales was 2,573 kg consisting of the polypeptides (2,397 kg higher) and the tetracyclines class (176 kg higher). Excluding the polypeptides from the 2023 sales total, the quantity reported for the other 14 classes decreased by 10% to 35,665 kg compared to 39,547 kg in the previous year.

Total quantities of critically important antibiotics sold remain very low at 3,416 kg. This represents a decrease of 2,869 kg (46%) since 2022. The macrolides were the main contributor to the lower total for the critically important antibiotic classes with a 65% decrease to 1302 kg from 3,770 kg in 2022. Decreases were also reported for the aminoglycosides, third- and fourth-generation cephalosporins, and fluoroquinolones. There was a small increase in polymyxin sales.

2 Introduction

Antibiotics are essential for the treatment of bacterial infections in humans, animals, and plants. The treatment of infections in animals prevents unnecessary suffering and protects welfare. The incidence of antibiotic resistance is increasing around the world, and there are few new antibiotics being developed. The World Health Organization (WHO) has identified antimicrobial resistance as one of the top 10 global health threats facing humanity. Overuse and misuse of antibiotics can lead to the emergence of resistant bacteria that may not respond to antibiotic treatment. Thus, preservation of our current therapeutic options remains vital.

Antibiotic stewardship involves the prudent and sustainable use of antibiotics across all sectors, to help preserve therapeutic efficacy now and into the future. One way of monitoring antibiotic use is through sales. Although antibiotic sales data is not a direct measure of antibiotic use, it does provide information on the volume of antibiotics used and allows for trends to be seen over time. This allows the Ministry for Primary Industries (MPI) to evaluate whether sales trends indicate appropriate use of antibiotics and whether existing regulatory controls remain fit for purpose.

This report summarises the sales for antibiotic agricultural compounds during the 2023 calendar year, and compares the sales figures to those reported for the previous five-year period (2018-2022). Increases and decreases in antibiotic sales are then analysed with veterinary and industry input to compare the changes to animal populations, animal and crop disease pressures, and other trends that have a direct impact on antibiotic use. The evaluation of use through sales focuses on key sales subgroups, such as those antibiotics considered critically important to human and animal health, as well as certain primary industry sectors that contribute significantly to overall sales, though all antibiotic sales trends are reported. The result of this analysis is a comprehensive review of antibiotic sales within the reporting period, and an overview of any emerging trends that may require further consideration or changes to the regulatory framework.

The last public report on antibiotic sales in New Zealand evaluated data for the 2022 calendar year. This report can be found on the MPI website at: 2022 Antibiotic Agricultural Compound Sales Analysis

3 Background

Antibiotic agricultural compounds are substances containing one or more antibiotic active ingredient used to treat bacterial diseases in animals and plants. Veterinary medicines that contain antibiotics as active ingredients are registered under the Agricultural Compounds and Veterinary Medicines (ACVM) Act 1997. Those that contain antibiotics of importance to human health have a condition requiring authorisation by a veterinarian before they can be sold or used in animals. The few antibiotic horticultural treatments available for use in plants are similarly restricted, with strict controls on who can purchase these trade name products and how they are used. All registrants of antibiotic veterinary medicine and horticultural treatments are legally required to submit a yearly sales return to the Ministry for Primary Industries (MPI).

3.1 Methodology

The Antibiotic Agricultural Compound Sales Analysis is conducted in two phases. The first phase is the collation of sales data from registrants for the period of 1 January to 31 December for the reporting year with total sales of individual trade name products converted to sales of active ingredients by weight. Registrants are also asked to provide estimates of target species for the multi-species and multiple production species products sold during the year. The total sales in kilograms of active ingredient are then compared across animal sectors, within antibiotic classes, and within target species or crops to determine overall trends in sales relative to previous reporting years. This preliminary report is then provided to veterinarians, registrants, and primary industry animal and horticultural sectors to provide comment on the sales trends and the factors influencing antibiotic use within the reporting year.

The second phase of the process is to compile the sales data and the comments received from stakeholders to review sales trends in context with the reported disease pressures and other use factors. This provides insight into why sales may have changed through the reporting year, an indication of the current perspectives on antibiotic agricultural compound use, and an evaluation of how this year's sales trends compare with those of previous years. The outcome of this process is the annual Sales Analysis report (Figure 1).

Figure 1: The Antibiotic Agricultural Compound Sales Analysis methodology.

It is noted that some antibiotic products are manufactured in New Zealand for export and use overseas. The sales totals included in this analysis are for products sold and used within New Zealand and excludes sales of exported product.

3.2 Data limitations

The evaluation of annual antibiotic sales data as a proxy for assessing prudent use presents several limitations.

The amount of antibiotics reported as sales by registrants may not necessarily correlate with the amounts used during the sales period for various reasons, including either advance buying in anticipation for use later, or bulk purchases such as in-feed products which may be used over a

longer timeframe. This can impact sales volumes from year to year and as a result the volumes reported may be higher in one period and lower in the next. There may also be losses due to expiry dates being exceeded or treatments not being completed. When evaluating sales data returned by registrants none of these scenarios will be visible in the numbers of products reported.

Furthermore, there may also be complications regarding product approvals and veterinary authorisations. Where products are approved for use with multiple species it can be difficult to link the sales volumes to a particular species. Veterinarians have the authority to use their professional discretion to use antibiotics to treat their patients "off-label," or for a different species or treatment regime than that approved as part of that product's registration. Veterinarians can also authorise the use of human preparations, or import overseas remedies, if a suitable registered veterinary medicine is not available to treat their patient. While these applications of veterinary discretion are limited overall, they will have an impact on the ability of sales data to approximate use.

In addition, the reporting of antibiotic sales in kilograms of active ingredient does not consider the relative potencies and dose rates applicable to each individual active ingredient and agricultural compound. For example, administration of one antibiotic may be several times the amount needed for another equally efficacious antibiotic to achieve the same therapeutic effect. While some effort has been made to draw attention to this where relevant, such as for the penicillins, the impact on the sales analysis may not always be readily apparent or mitigatable.

Finally, the sales data used in this analysis relies on the submission of data and information from registrants and industry. MPI has no control over the accuracy or completeness of the data and information provided. The resulting analysis should therefore be regarded as indicative of overall sales trends and should not be over-interpreted.

3.3 Compounds not analysed or reported

There are certain compounds used as veterinary medicines in New Zealand that are considered out of scope for antibiotic sales data collection and analysis. These include the phosphoglycolipids (e.g., bambermycins), the quinoxalines (e.g., carbadox), the aminocoumarins (e.g., novobiocin), and the orthosomycins (e.g., avilamycin), which are not used in human medicine. The ionophore compounds lasalocid, monensin, and salinomycin, are also out of scope for the antibiotic sales analysis. Ionophores are not classed as antibiotics in New Zealand.

4 General trends in antibiotic sales

4.1 Total sales for 2023

A total of 39,549 kg of antibiotic active ingredients were sold in 2023, a decrease of 1,484 kg (3.6%) from 41,033 kg in 2022. This decrease continues the decline in total sales observed since 2017.

Lower sales quantities were reported for 13 of the 15 classes evaluated, with a combined reduction of 4,057 kg from 2022. The main contributors to the 2023 decrease were:

- the macrolides, which decreased by 2,469 kg (65%),
- the sulphonamide and trimethoprim class, which decreased by 667 kg (17%), and
- the aminoglycosides, which decreased by 461 kg (15%).

Smaller decreases were observed in sales of first- and second-generation cephalosporins down 109 kg (7%), third- and fourth-generation cephalosporins down 29 kg (24%), amphenicols down 0.1 kg (21%), fluoroquinolones down 3 kg (9%), fusidic acid down 0.1 kg (9%), lincosamides down 14 kg (21%), nitroimidazoles down 8 kg (23%), penicillins and clavulanic acid down 276 kg (1%), pleuromutilins down 22 kg (22%), and the streptogramins down 0.17 kg (3%).

The total combined increase for the two classes with higher sales was 2,573 kg consisting of the polypeptides (2,397 kg higher) and the tetracyclines class (176 kg higher).

Figure 2: Percentage of total sales for each antibiotic class in 2023

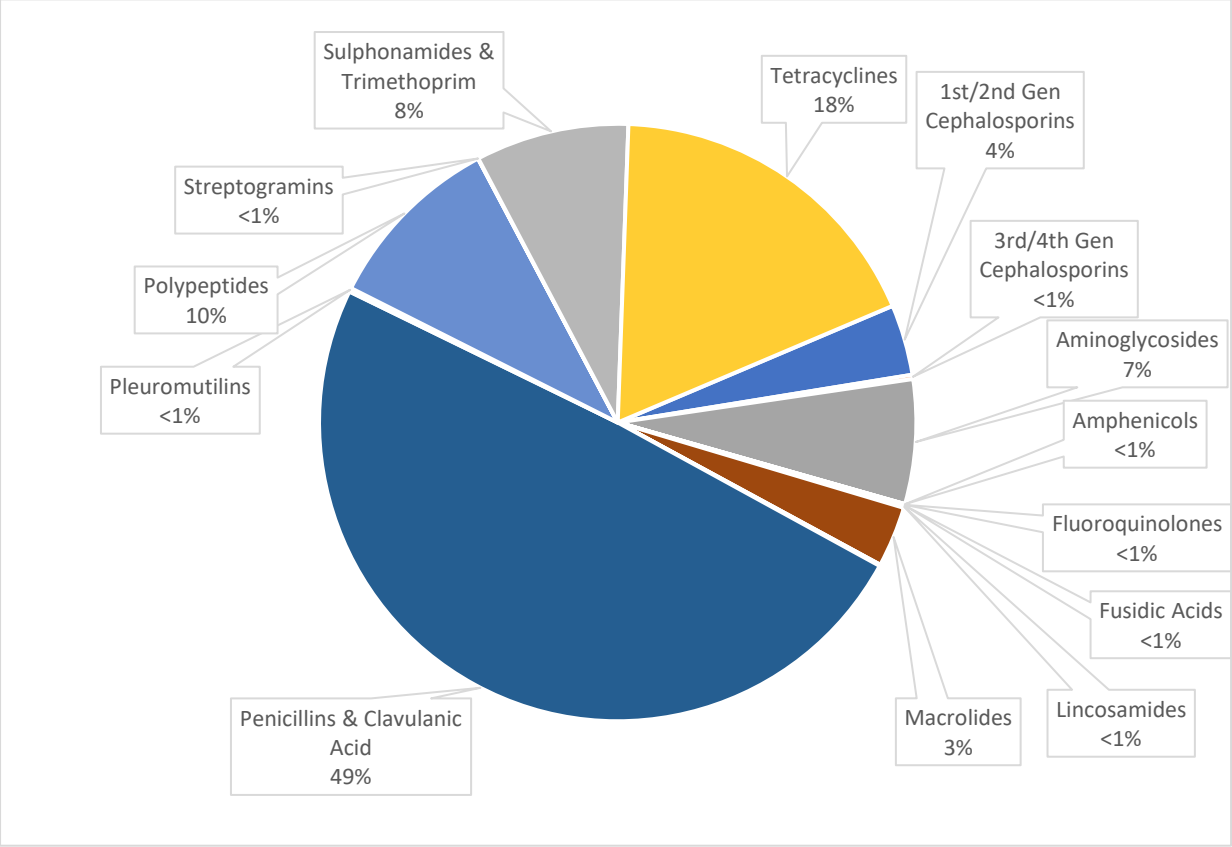
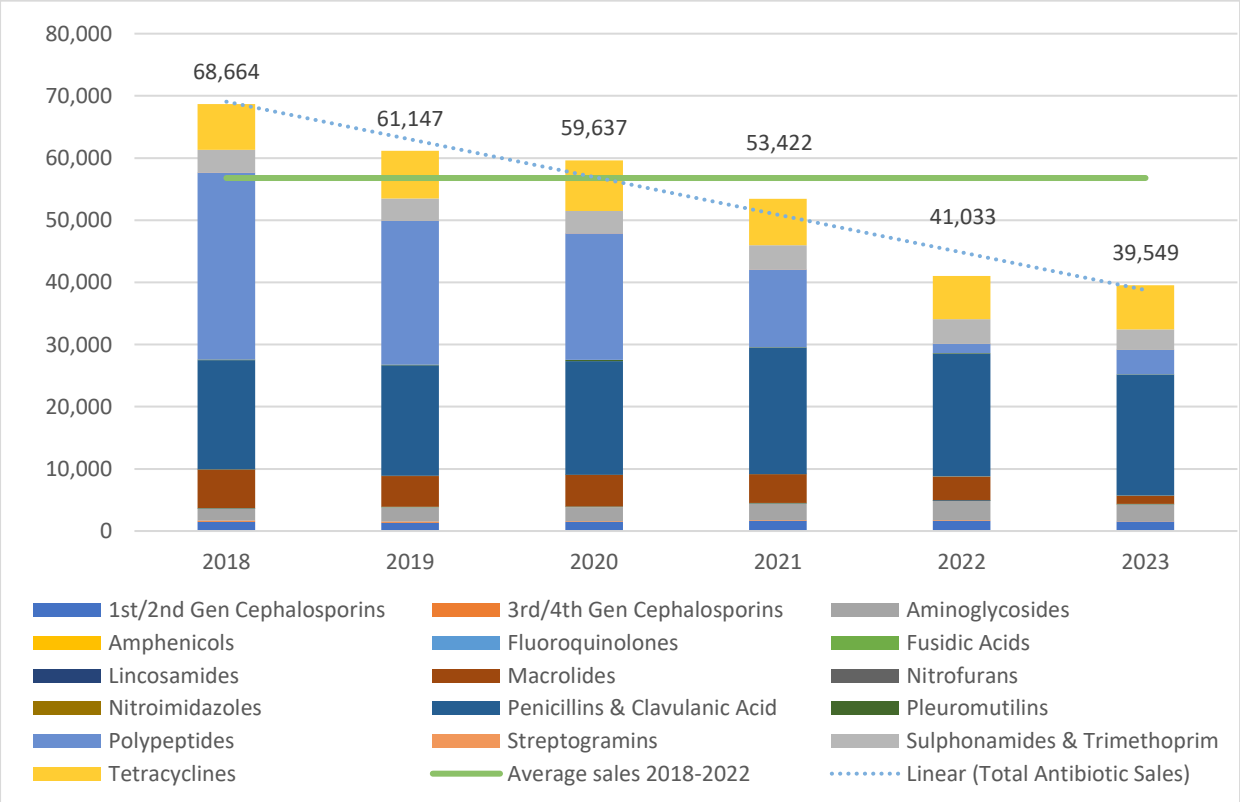


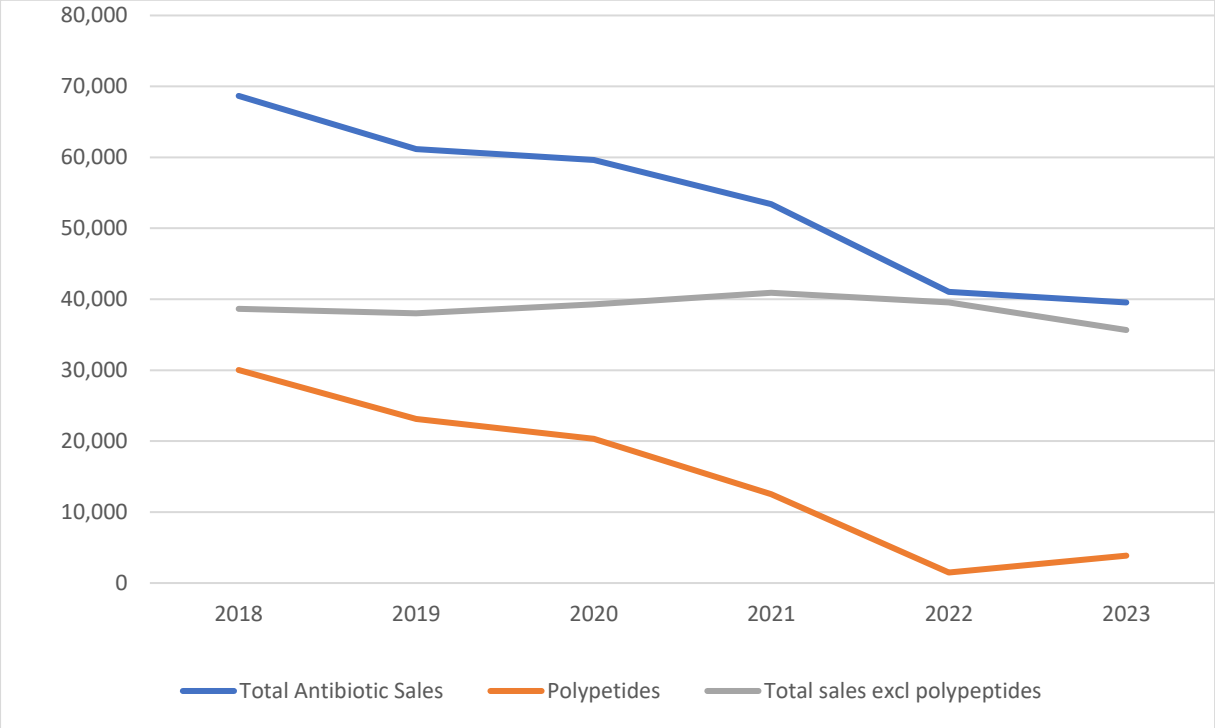
Figure 3:Total antibiotic sales quantities by class 2018-2023 (in kilograms)



Total antibiotic sales quantities in 2023 were 30% below the average for the previous five years.

Excluding the polypeptides from the 2023 sales total, the quantity reported for the other 14 classes decreased by 10% to 35,665 kg from 39,547 kg in the previous year. The impact of polypeptide sales on the total sales trend is shown in Figure 4 below. Quantities for the other classes (excluding polypeptides) had an average of 39,279 kg for the previous five years (2018-2022).

Figure 4: Impact of polypeptide quantities on overall sales (in kilograms)



4.2 Critically important antibiotics

4.2.1 Antibiotic classification and review

One of the objectives of the New Zealand Antimicrobial Resistance Action Plan, initiated in 2017, was to review and optimise antibiotic regulation. In 2019, the ACVM team began an extensive review and reassessment programme for all registered antibiotic trade name products. When complete, the reassessment programme will have assigned an importance classification to all antibiotic agricultural compounds in use in New Zealand and reassessed all antibiotic trade name products regarding label claims, dose rates, and prudent use statements. This will ensure approved uses reflect prudent use and good antimicrobial stewardship. For more information see the MPI website:

https://www.mpi.govt.nz/animals/veterinary-medicines-acvm/antimicrobial-resistance/

Formal reassessments of all registered products containing these antibiotic agricultural compounds are currently underway under section 29 of the ACVM Act 1997. Tranche 1 has been completed; the remaining tranches will be organised as follows:

Tranche 1	Tranche 2	Tranche 3	Tranche 4
•penicillins •3rd/4th generation cephalosporins •macrolides	•aminoglycosides •avilamycin •fluoroquinolones •lincosamides •1st/2nd generation cephalosporins	•fusidic acid •tetracyclines •sulphonamides and trimethoprim •polypeptides (zinc bacitracin and polymyxin)	•amphenicols •nitrofurans •nitroimidazoles •pleuromutilins •virginiamycin

For the purposes of this report, all registered compounds in the aminoglycoside class (excluding kasugamycin), third- and fourth-generation cephalosporin class, fluoroquinolone class, macrolide class, and polymyxin will be considered critically important antibiotics. The provisional classification of these antibiotics is based on the WHO list of critically important antimicrobials. The final New Zealand Food Safety (NZFS) antibiotic importance classifications will be applied to subsequent sales reports.

4.2.2 Overall summary of 2023 sales for critically important antibiotics

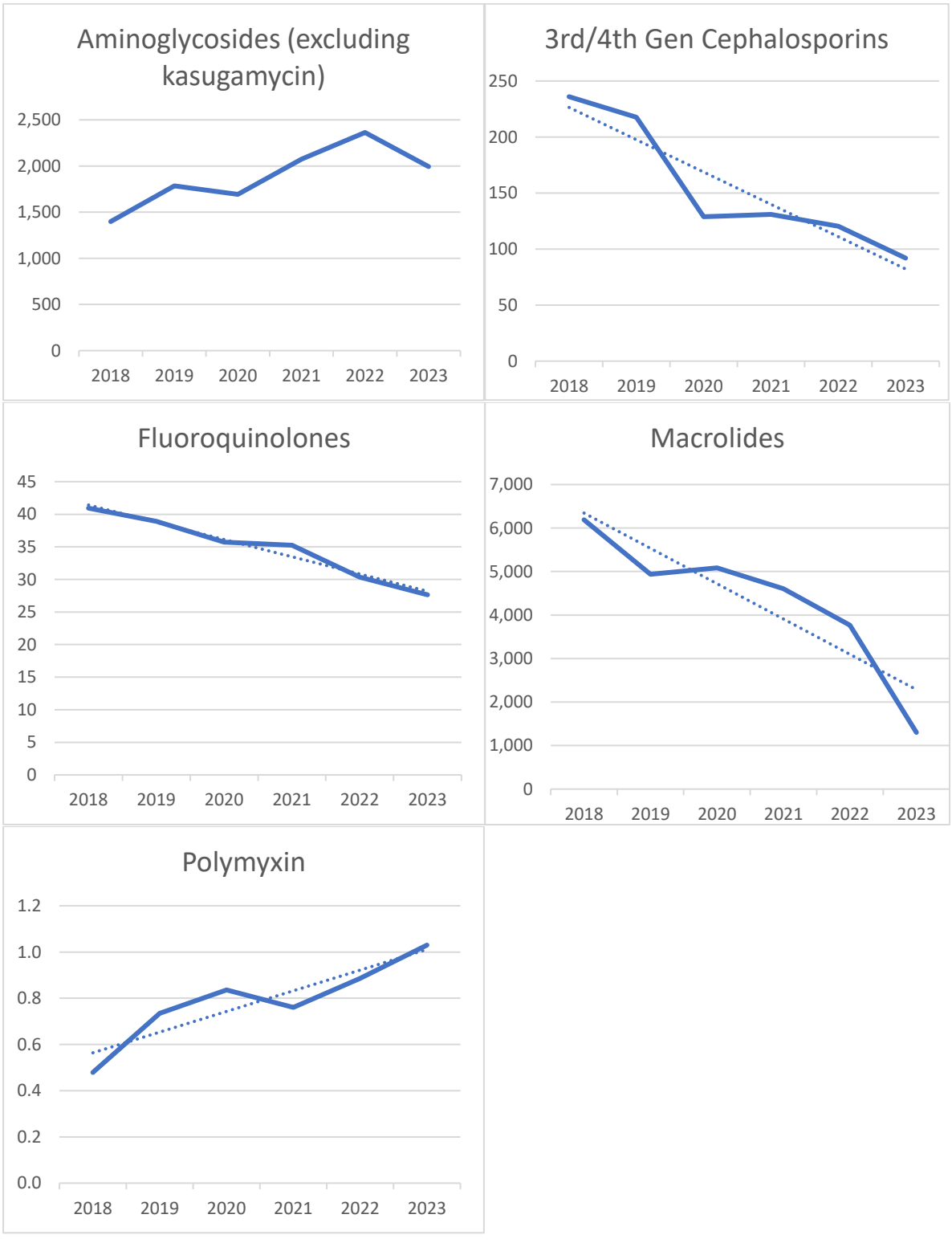
Critically important antibiotic compounds accounted for 9% of total antibiotic sales in 2023, with 3,416 kg reported compared to 6,285 kg in the previous year (a decrease of 46%).

Figure 5: Total critically important antibiotic sales quantities 2022-2023 (in kilograms)

Critically important antibiotics	2022	2023	Net change	Percentage change
3rd/4th Generation Cephalosporins	120.5 kg	91.9 kg	↓ 28.6 kg	↓ 24%
Fluoroquinolones	30.3 kg	27.6 kg	↓ 2.7 kg	↓ 9%
Aminoglycosides (excluding kasugamycin)	2,363.2 kg	1,993.6 kg	↓ 369.6 kg	↓ 16%
Macrolides	3,770.3 kg	1,301.7 kg	↓ 2,468.6 kg	↓ 65%
Polymyxin	0.9 kg	1.0 kg	↑ 0.1 kg	↑ 11%
Total sales	6,285.2 kg	3,415.8 kg	↓ 2,869.4 kg	↓ 46%

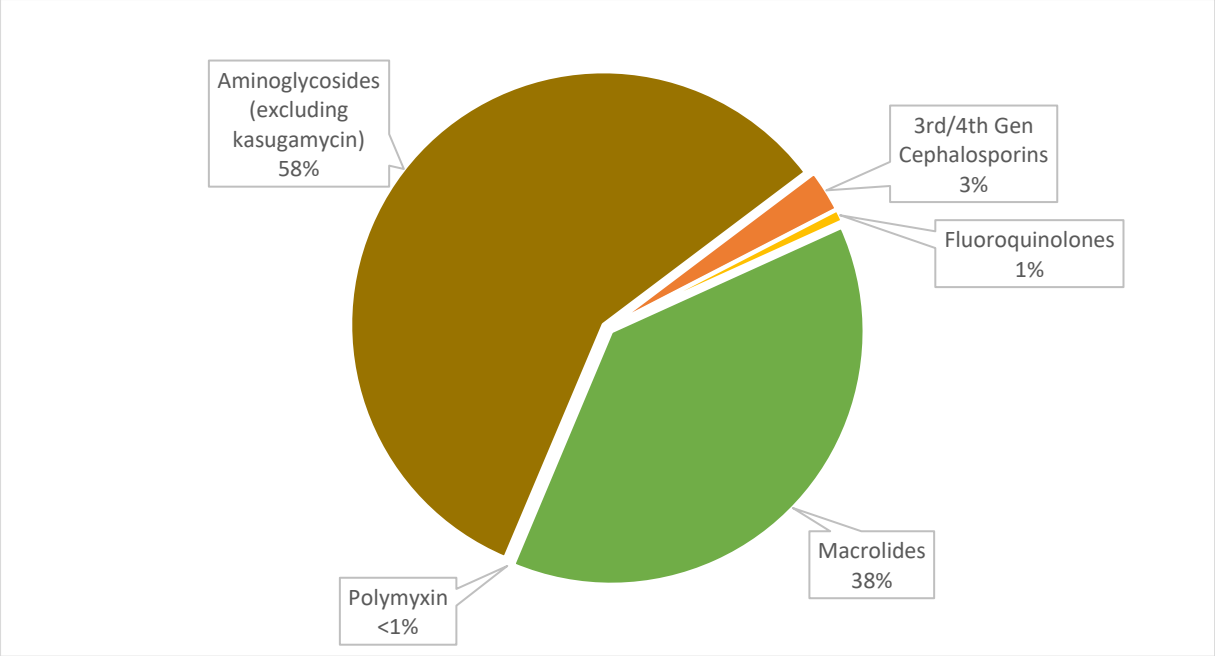
The macrolides were the main contributor to the lower total for the critically important classes with a 2,469 kg (65%) decrease to 1302 kg from 3,770 kg in 2022. Decreases were also reported for the aminoglycosides, third- and fourth-generation cephalosporins, and fluoroquinolones. There was a small increase in polymyxin.

Figure 6: Critically Important Antibiotic class sales quantities over time (in kilograms)



Over the previous five years the largest decreases in sales quantities have occurred in the macrolide class of antibiotics. Sales totals of the macrolides have decreased from 6,190 kg in 2018 to 1,302 kg in 2023.

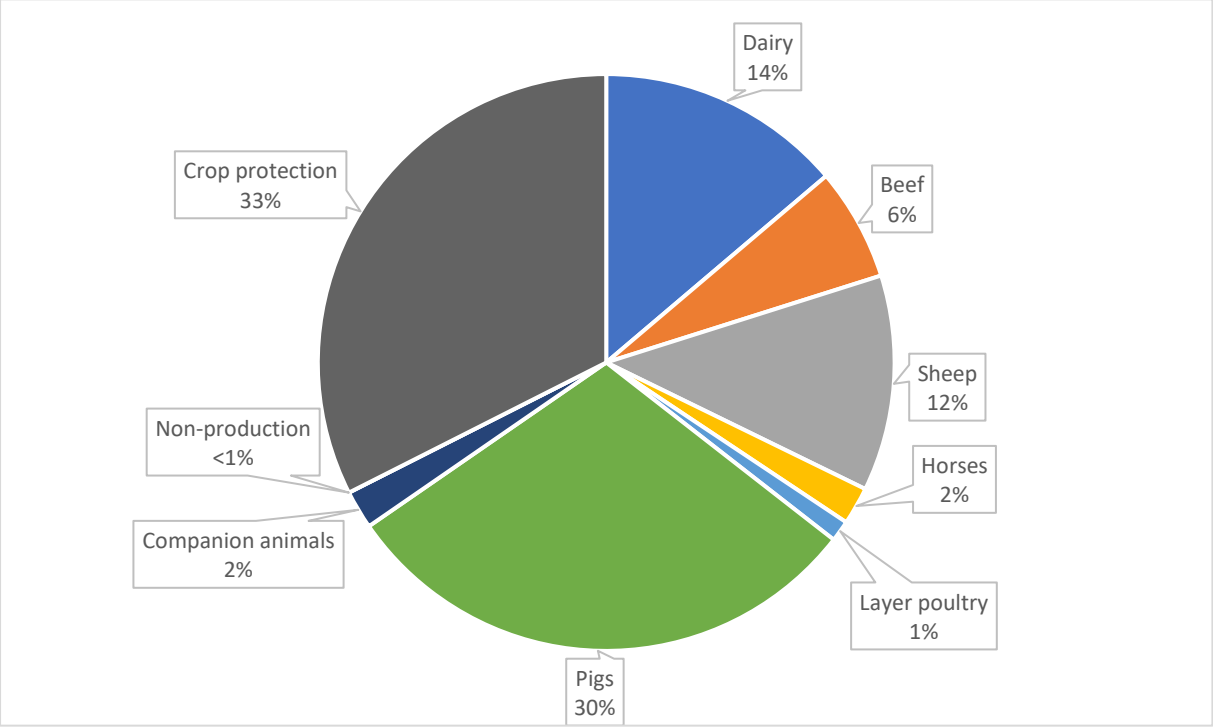
Figure 7: Distribution of 2023 sales quantities within the critically important antibiotic sub-group



The aminoglycosides accounted for 58% of critically important antibiotic sales (up from 38% in 2022). The macrolides accounted for 38% (down from 60% in 2022) and the remaining 4% of the critically important antibiotic sales quantity consisted of the third- and fourth-generation cephalosporins, fluoroquinolones, and polymyxin with a total of 121 kg.

Thirty three percent of critically important antibiotics quantities were sold for use in crops. Thirty percent were sold for use in pigs, primarily due to sales of tylosin, in the macrolide class. Dairy cattle had the next highest sales quantities (14%) primarily due to macrolide and third- and fourth-generation cephalosporin sales.

Figure 8: Distribution of critically important antibiotics by sector



Thirty four percent of critically important antibiotics were administered by injection, 32% by spray for crop protection, 18% via feed (due to tylosin), and 13% via water. The remainder were administered orally, intramammary (IMM), intra-aural, intra-ocular, or topically.

Figure 9: Sales of critically important antibiotics by administration methods 2023

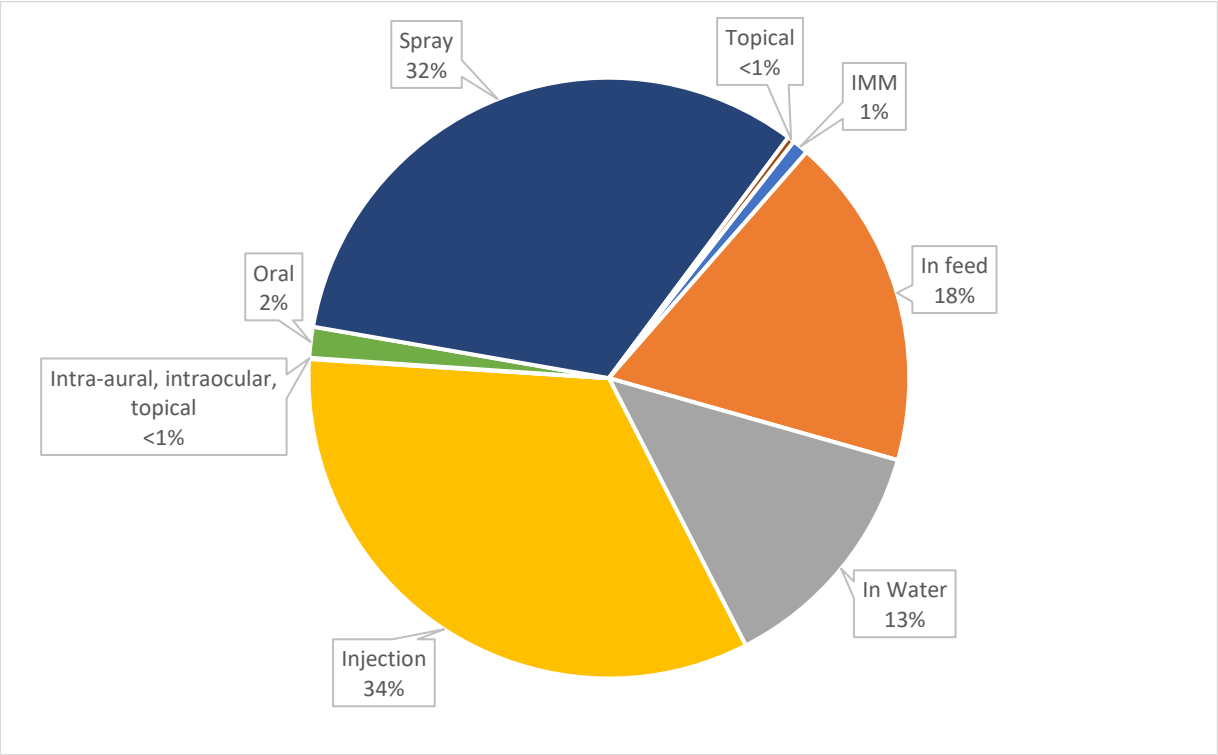
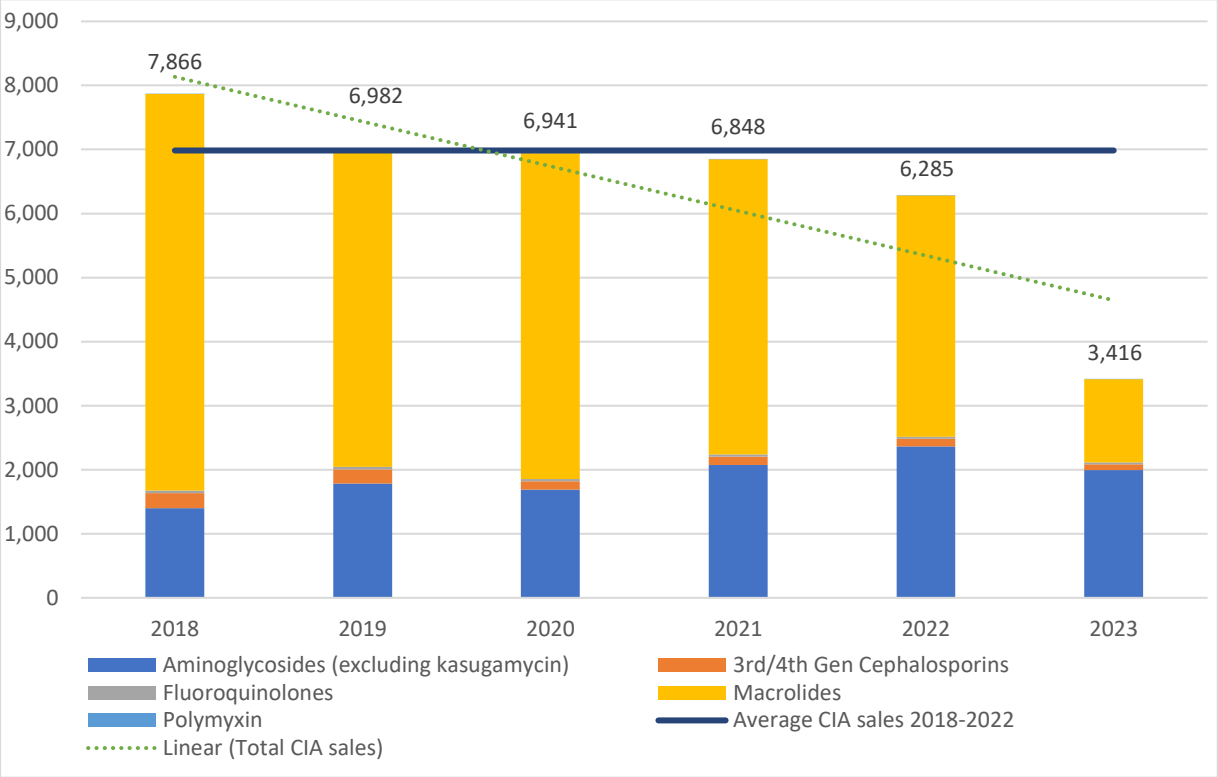


Figure 10: Critically Important Antibiotic sales quantities 2018-2023 (in kilograms)



Critically important antibiotic sales were 51% lower than the average for the previous five years.

5 Antibiotic sales trends by class

5.1 Aminoglycosides

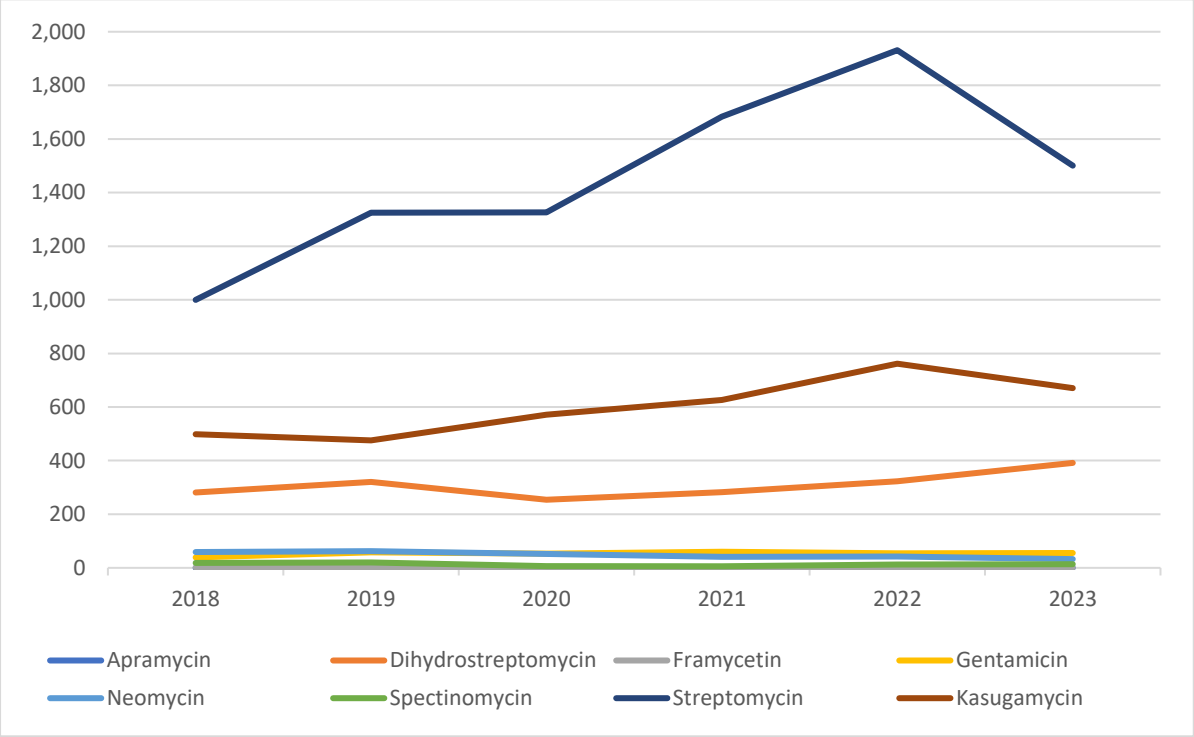
Sales of aminoglycosides decreased to 2,664 kg from 3,125 kg in 2022. This class contributed 7% to the total sales quantity compared to 8% in the previous year. The decrease in sales volume was mainly due to decreases in volumes of horticultural streptomycin and kasugamycin. Aminoglycosides are used in a wide range of companion and production animal species, with streptomycin and kasugamycin approved for use in certain fruit crops.

Figure 11: Total aminoglycoside sales quantities 2022-2023 (in kilograms)

Aminoglycosides	2022	2023	Net change	Percentage change
Apramycin	0.0 kg	0.0 kg	0.0 kg	0%
Dihydrostreptomycin	322.8 kg	391.5 kg	↑ 68.7 kg	↑ 21%
Framycetin	0.3 kg	0.3 kg	0.0 kg	0%
Gentamicin	54.3 kg	55.7 kg	↑ 1.4 kg	↑ 3%
Kasugamycin	761.6 kg	670.6 kg	↓ 91.0 kg	↓12%
Neomycin	41.7 kg	32.7 kg	↓ 9.0 kg	↓ 22%
Spectinomycin	13.0 kg	13.4 kg	↑ 0.4 kg	↑ 3%
Streptomycin (horticulture)	1,608.3 kg	1,108.5	↓ 499.8 kg	↓ 31%
Streptomycin (veterinary)	322.8 kg	391.5 kg	↑ 68.7	↑ 21%
Total sales	3,124.8 kg	2,664.2 kg	↓ 460.6 kg	↓ 15%

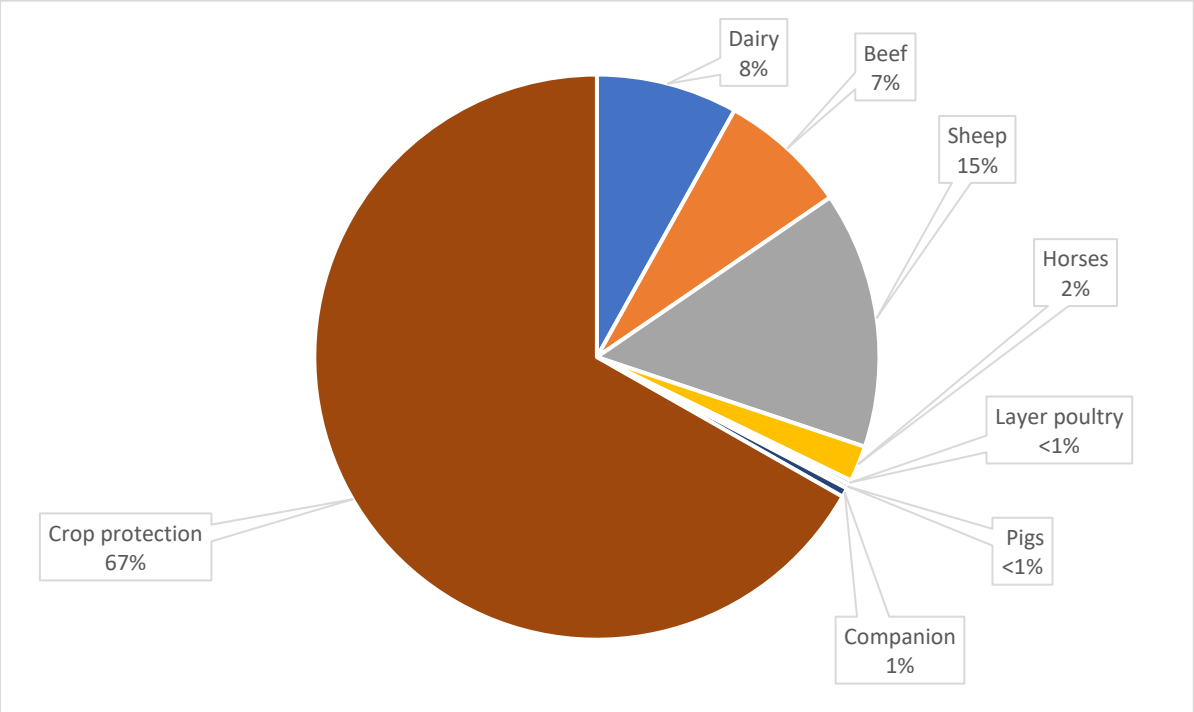
Overall total aminoglycosides sales were 15% lower compared to 2022 and 1.3% lower than 2021. No sales of apramycin were reported.

Figure 12: 2023 aminoglycosides sales quantities compared to the previous five-year sales trends (in kilograms)



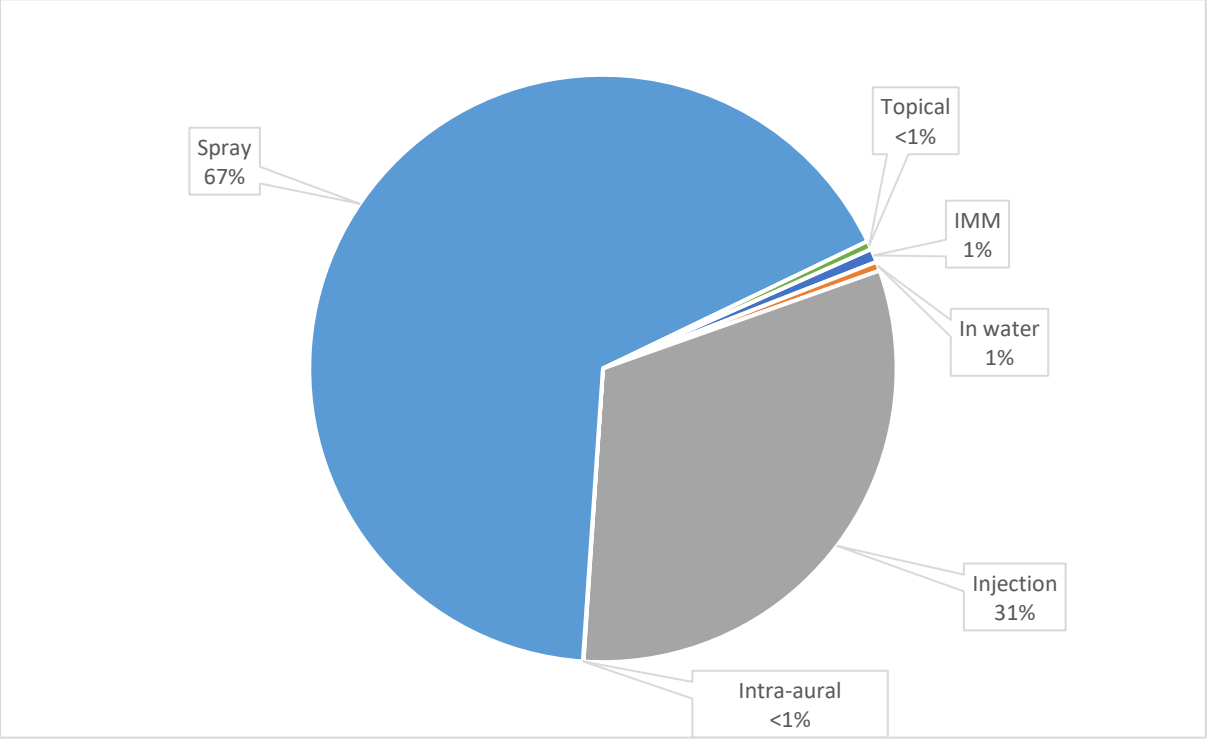
Sixty seven percent of aminoglycoside quantities were sold for use in crop protection with the remainder sold for use in animals.

Figure 13: Distribution of aminoglycosides sales quantities by sector



Horticultural aminoglycosides are administered by spray. Thirty-one percent of veterinary aminoglycosides are administered by injection with the remainder by intramammary treatments, in water, topically, or by intra-aural methods.

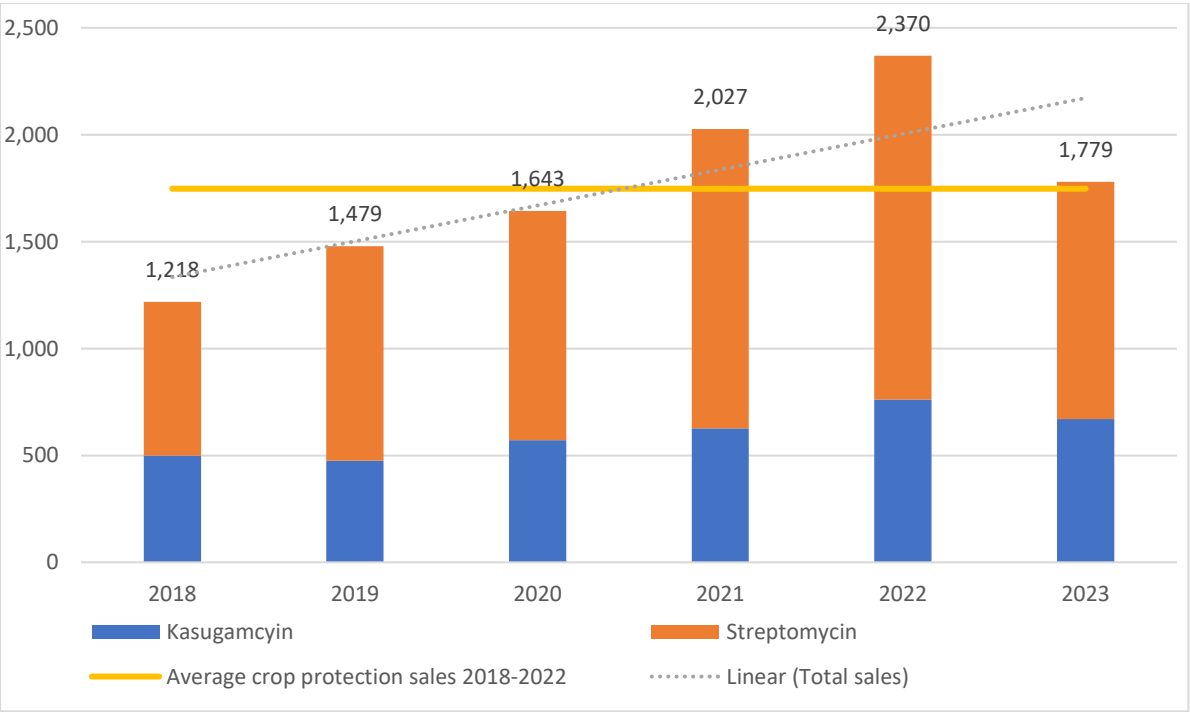
Figure 14: Sales of aminoglycosides by administration methods 2023



5.1.1 Crop protection aminoglycoside sales

Total sales of aminoglycosides sold in trade name products for crop protection decreased by 25% to 1,779 kg, following a 17% increase in the previous year. The percentage contribution to total antibiotic sales decreased to 4% from 6% in 2022.

Figure 15: Total crop protection aminoglycosides sales quantities 2018-2023 (in kilograms)



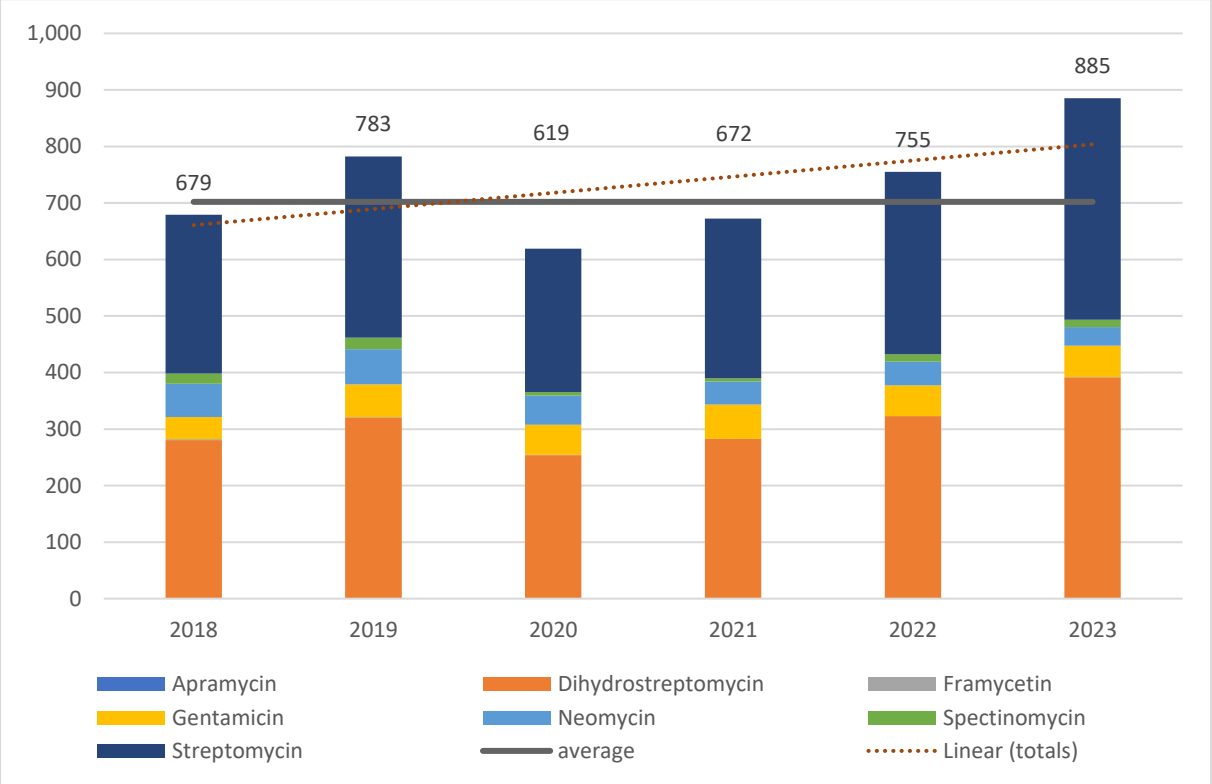
Further analysis can be found in the crop protection antibiotic section 6.8.

5.1.2 Veterinary aminoglycoside sales

Quantities of veterinary aminoglycosides increased by 17% in 2023 to 885 kg with higher amounts reported for five of the six antibiotics with sales. Total veterinary aminoglycosides sales accounted for 33% of the class total and 2% of overall total sales. Veterinary aminoglycosides were used for the following:

- Streptomycin and dihydrostreptomycin are used to treat a variety of gram-negative bacterial infections. Sales for these compounds increased by 21% to 783 kg and accounted for 88% of veterinary aminoglycoside sales.
- Spectinomycin is used to treat respiratory infections and enteritis in poultry and pigs.
- Framycetin is used exclusively in companion animals for the treatment of ear and skin infections.
- Neomycin is used in dairy cattle as a treatment for mastitis and is also commonly used for treating skin and eye infections in companion animals.
- Gentamicin is used in companion animals and horses to treat a variety of gram-negative infections.

Figure 16: Total veterinary aminoglycoside sales quantities 2018-2023 (in kilograms)



Sales of veterinary aminoglycosides were 26% above the previous five-year sales average.

5.2 Cephalosporins

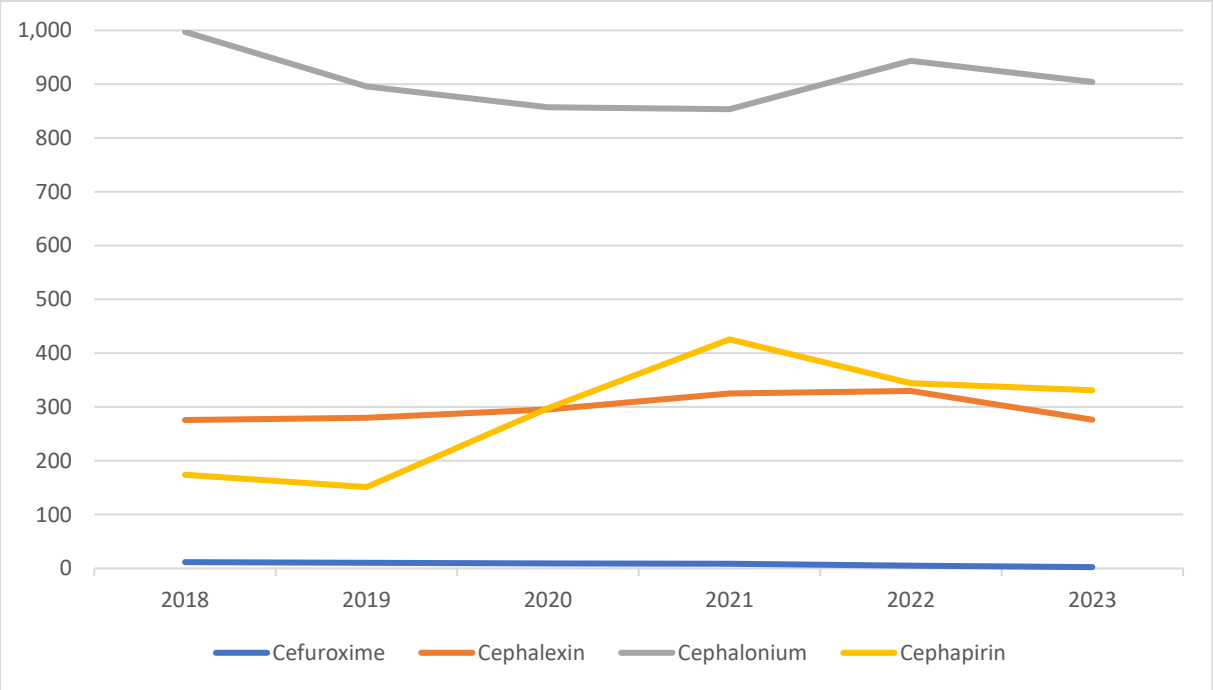
5.2.1 First- and Second-Generation Cephalosporins

Sales of first- and second-generation cephalosporins decreased by 7% to 1,514 kg and accounted for 4% of total antibiotic sales. Sales quantities were reduced for all antibiotics in the class with a total reduction of 110 kg.

Figure 17: Total first- and second-generation cephalosporins sales quantities 2022-2023 (in kilograms)

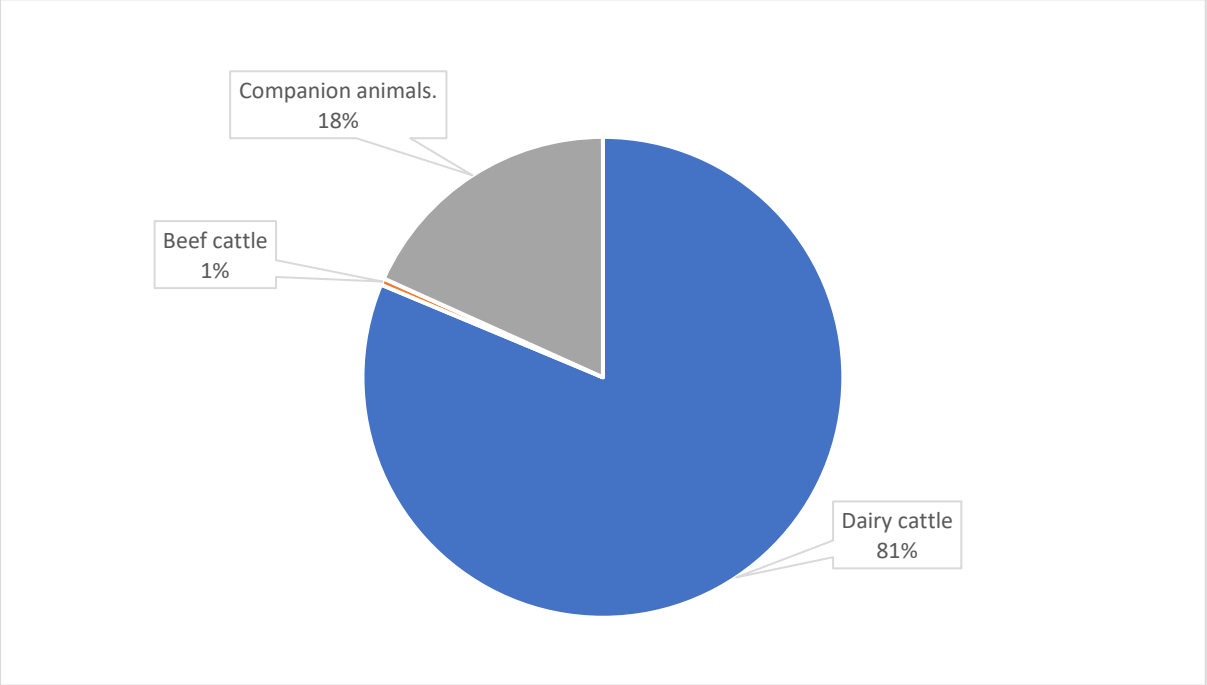
1st/2nd Generation Cephalosporins	2022	2023	Net change	Percentage change
Cefuroxime	5.2 kg	2.3 kg	↓ 2.9 kg	↓ 56%
Cephalexin	329.7 kg	276.4 kg	↓ 53.3 kg	↓ 16%
Cephalonium	943.6 kg	904.0 kg	↓ 39.6 kg	↓ 4%
Cephapirin	344.5 kg	331.2 kg	↓ 13.3 kg	↓ 4%
Total sales	1,623 kg	1,513.9 kg	↓ 109.1 kg	↓ 7%

Figure 18: 2023 first- and second-generation cephalosporin sales quantities compared to the previous five-year sales trends (in kilograms)



Eighty one percent of class sales were contained in cattle-only products with cephalonium registered for use in dry cattle therapy products and cefuroxime used in lactating cattle therapy products. Cephapirin is registered for use in cattle-only products with around one-third of sales for intrauterine and two-thirds in intramammary treatments. Cephalexin has been used exclusively in companion animal species since 2017, despite being registered for injectable use in multiple species and intramammary products for cattle.

Figure 19: Distribution of first- and second-generation cephalosporins by sector



Distribution of first- and second-generation cephalosporins was mainly by intramammary methods (75%) with 18% delivered orally and 7% by intrauterine delivery.

Figure 20: Sales of first- and second-generation cephalosporins by administration methods 2023

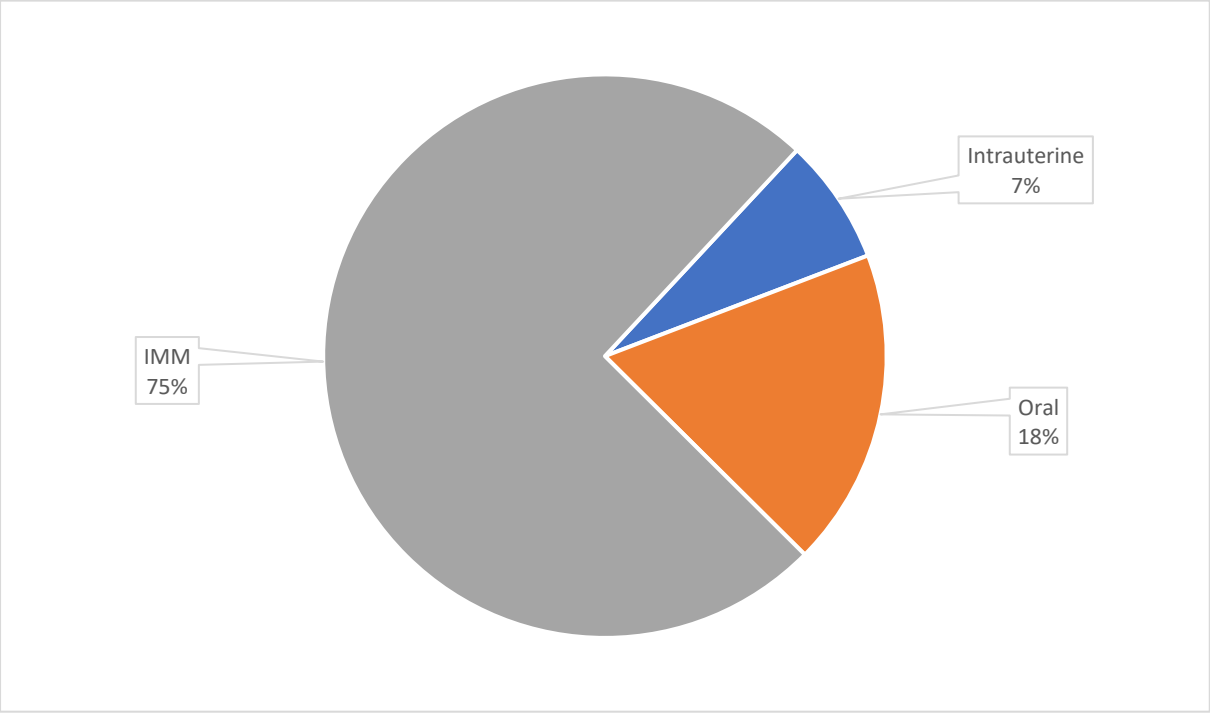
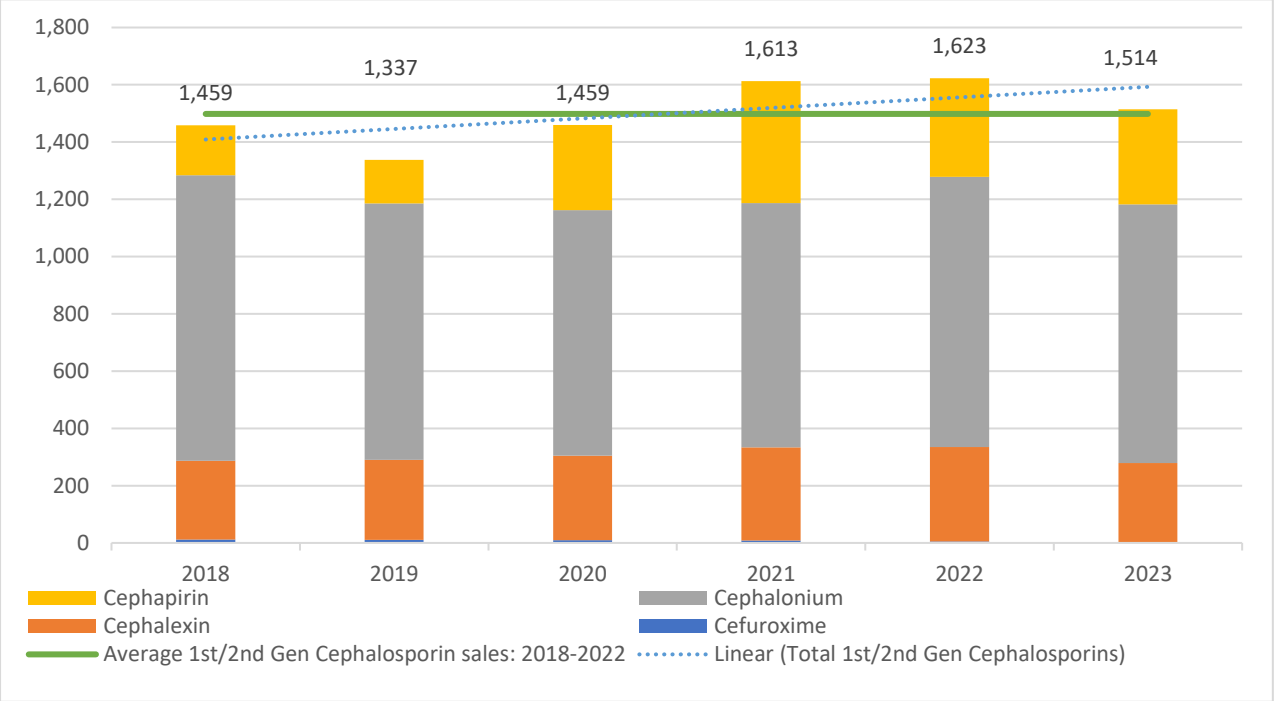


Figure 21: Total first- and second-generation cephalosporin sales quantities 2018-2023 (in kilograms)



Sales of first- and second-generation cephalosporins were 1% above the previous five-year sales average.

5.2.2 Third- and fourth-generation cephalosporins

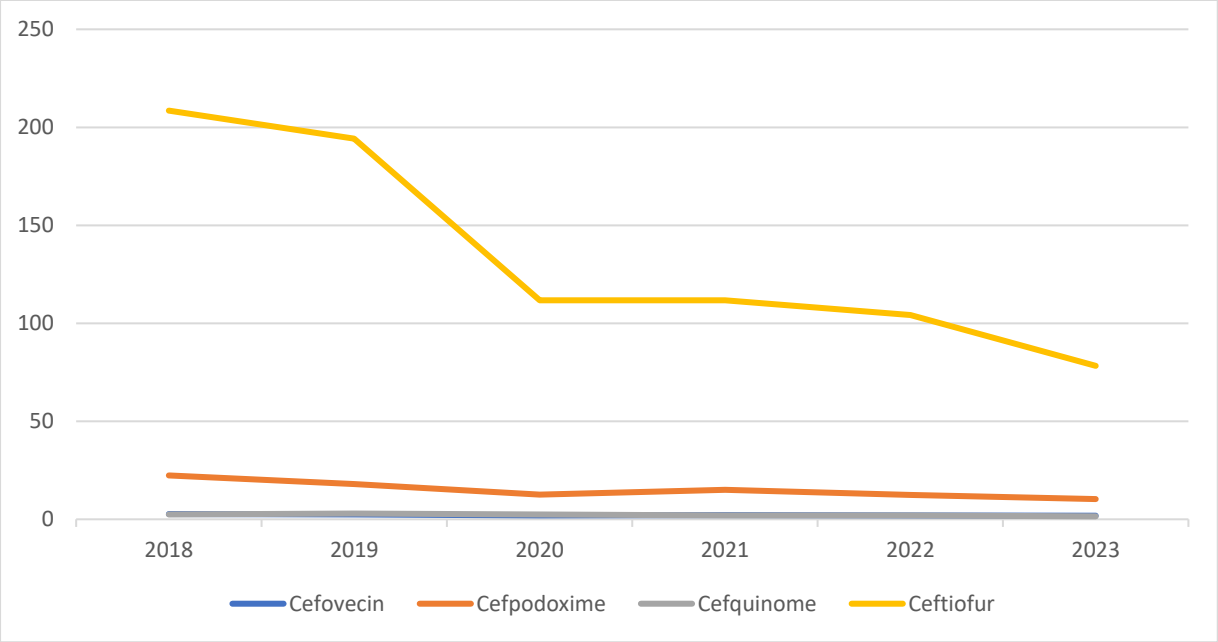
Quantities of third- and fourth-generation cephalosporins sold in 2023 decreased by 24% to 92 kg with decreases reported for all four antibiotics in this class, all of which are regarded as critically important antibiotics in New Zealand accounting for 0.2% of total antibiotic sales and 3% of critical antibiotic sales.

Figure 22: Total third- and fourth-generation cephalosporins sales quantities 2022-2023 (in kilograms)

3rd/4th Generation Cephalosporins	2022	2023	Net change	Percentage change
Cefovecin	2.0 kg	1.8 kg	↓ 0.2 kg	↓ 8 %
Cefpodoxime	12.3 kg	10.3 kg	↓ 2.0 kg	↓ 17%
Cefquinome	2.0 kg	1.5 kg	↓ 0.5 kg	↓ 24%
Ceftiofur	104.2 kg	78.3 kg	↓ 25.9 kg	↓ 25%
Total sales	120.5 kg	91.9 kg	↓ 28.6 kg	↓ 24%

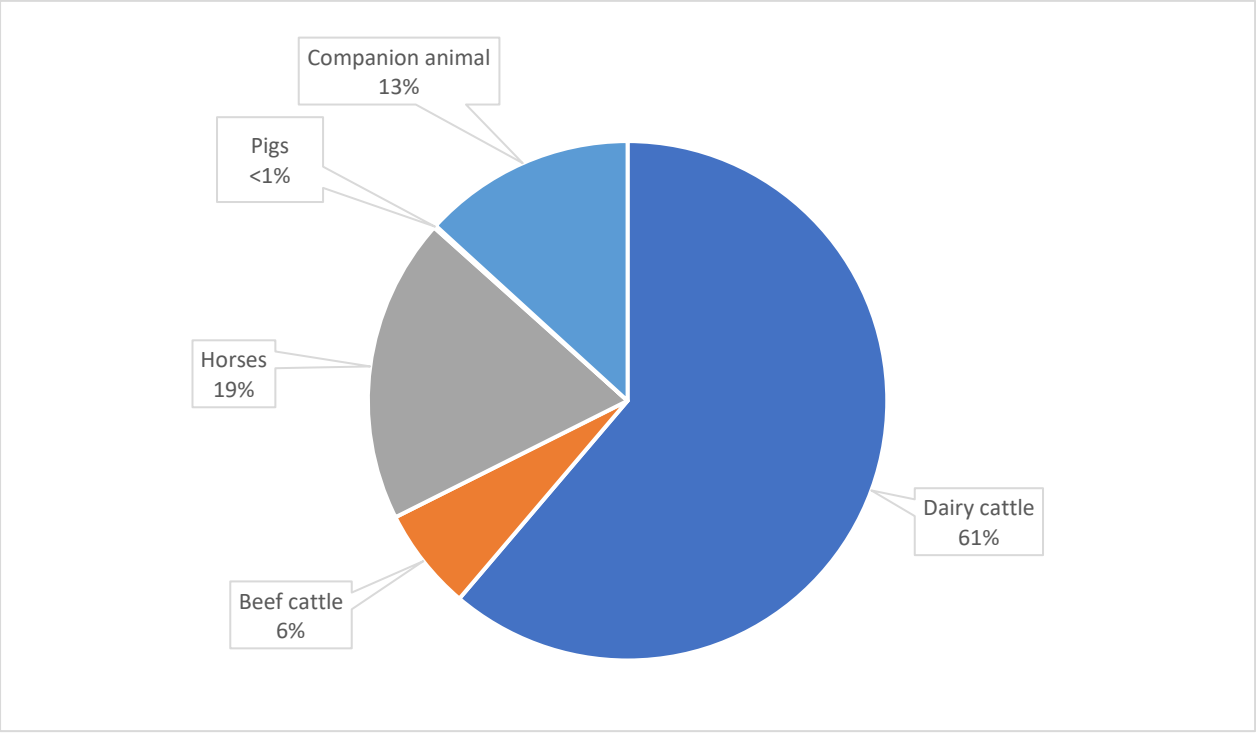
Ceftiofur accounted for 85% of class sales with 78 kg (down from 104 kg in 2022). Quantities of both ceftiofur and cefquinome were at their lowest for ten years.

Figure 23: 2023 third- and fourth-generation cephalosporin sales quantities compared to the previous five-year sales trends (in kilograms)



Cefquinome is registered for use in cattle and pigs. Ceftiofur is registered for use in cattle, horses, and pigs. Cefpodoxime and cefovecin are registered for use in cats and dogs.
Sixty-one percent of the quantity sold of third- and fourth-generation cephalosporins were contained in dairy cattle products, 19% sold in horse products, 13% in companion animals, 6% in beef cattle, and 0.15% sold for use in pigs.

Figure 24: Distribution of third- and fourth-generation cephalosporins by sector



Eighty-nine percent of the class was sold for delivery by injection, 11% by oral means, and less than 0.13% by intramammary methods.

Figure 25: Sales of third- and fourth-generation cephalosporins by administration methods 2023

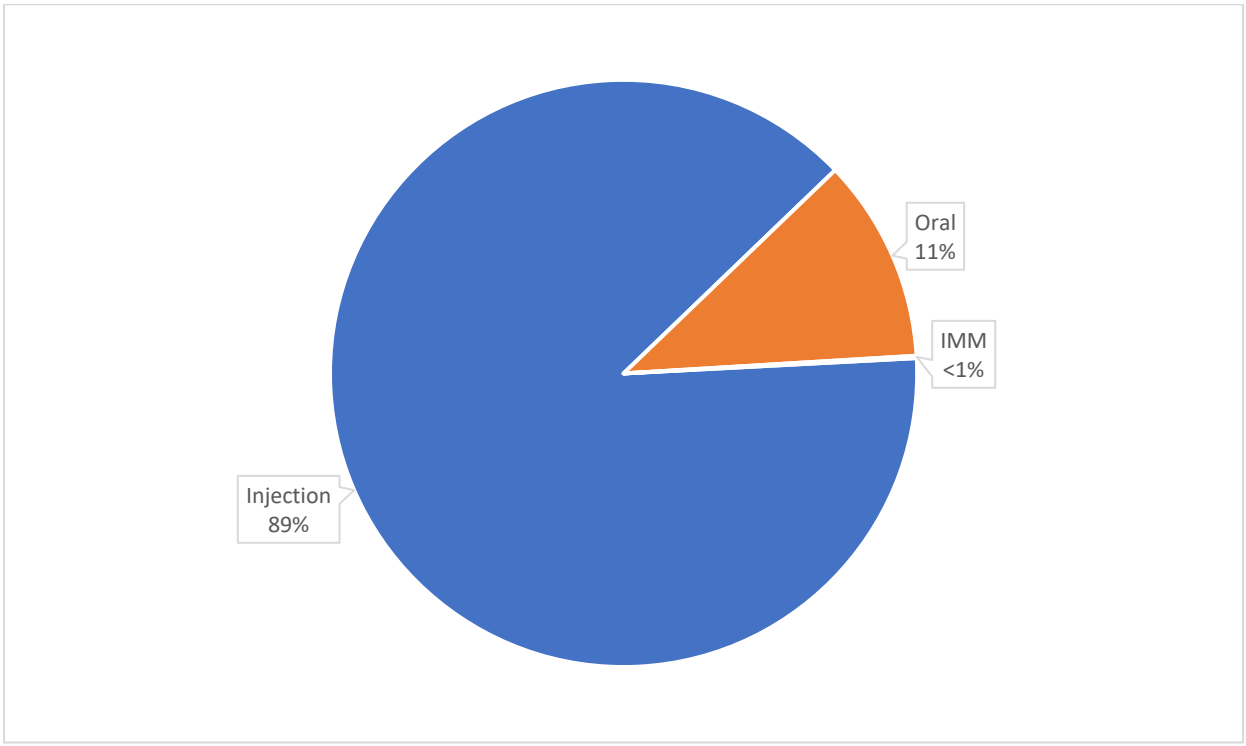
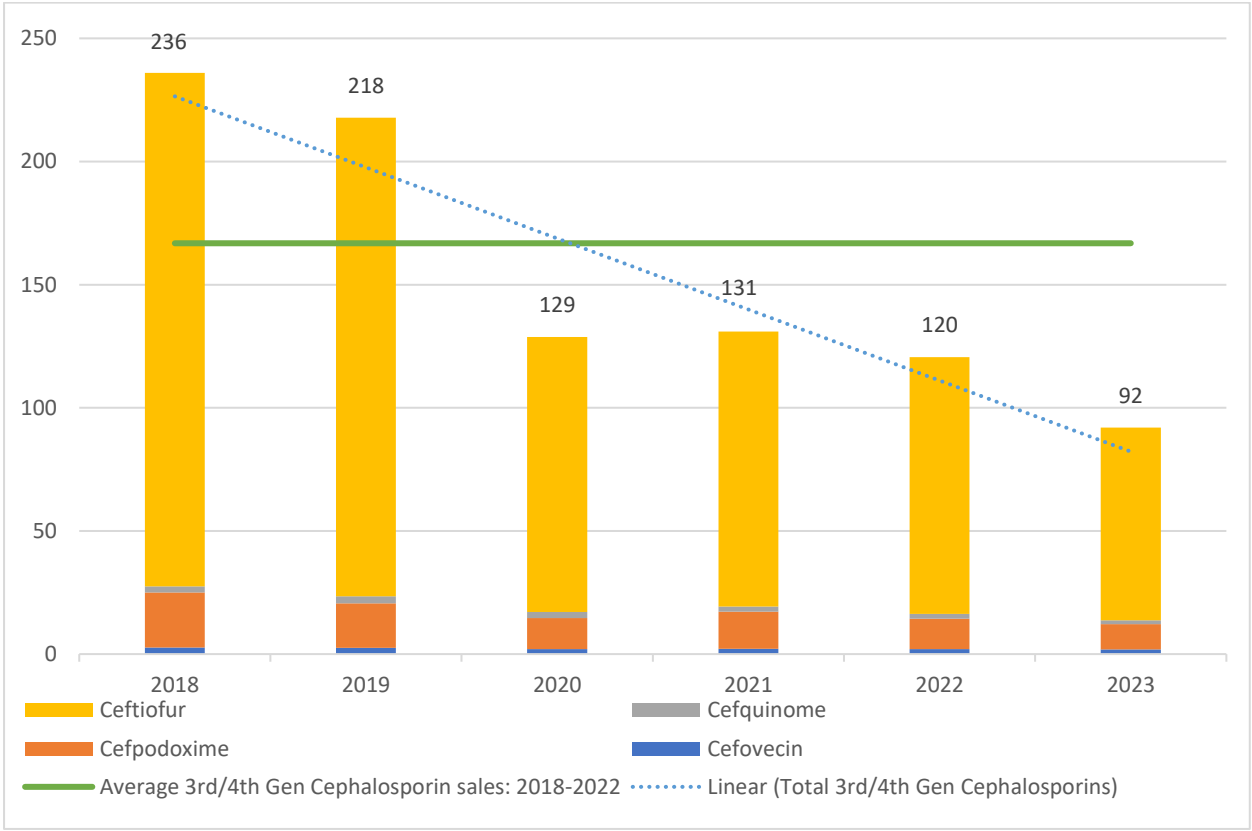


Figure 26: Total third- and fourth-generation cephalosporin sales quantities 2018-2023 (in kilograms)



Third- and fourth-generation cephalosporins sales were 45% below the average for the previous five years.

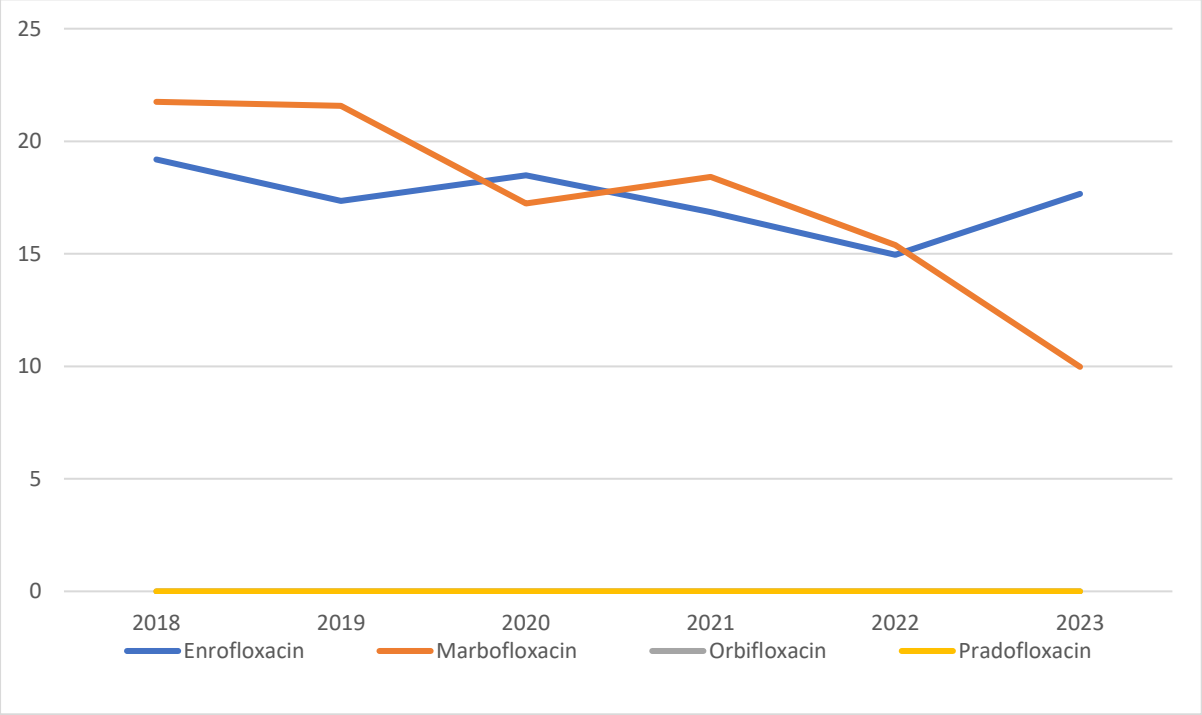
5.3 Fluoroquinolones

Overall sales quantities for this critically important class continued to decline with lower amounts reported for both antibiotic active ingredients with sales. The total sold was 27.6 kg in 2023, a decrease of 9% since 2022. The fluoroquinolones continue to comprise a very small proportion (0.07%) of total antibiotic sales and 0.8% of critical antibiotic sales. No sales were reported for either orbifloxacin or pradofloxacin in 2023.

Figure 27: Total fluoroquinolones sales quantities 2022-2023 (in kilograms)

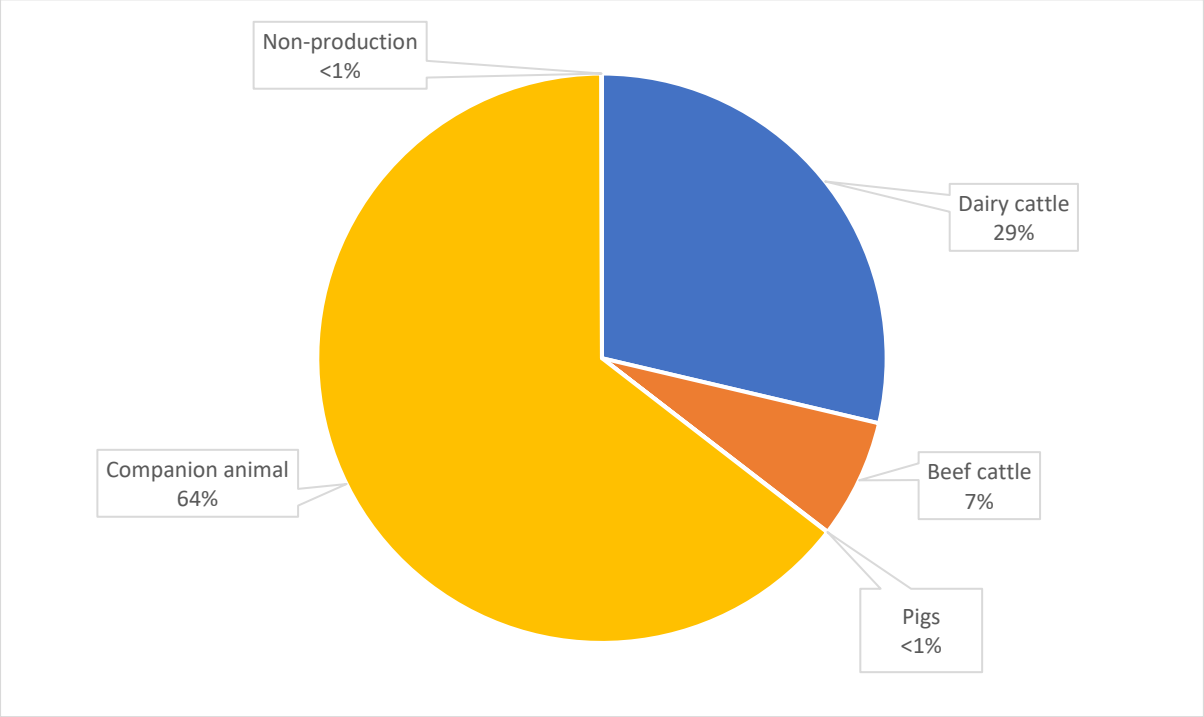
Fluoroquinolones	2022	2023	Net change	Percentage change
Enrofloxacin	14.9 kg	17.6 kg	↑ 2.7 kg	↑ 18 %
Marbofloxacin	15.4 kg	10.0 kg	↓ 5.4 kg	↓ 35%
Total sales	30.3 kg	27.6 kg	↓ 2.7 kg	↓ 9%

Figure 28: 2023 fluoroquinolones sales quantities compared to the previous five-year sales trends (in kilograms)



Sixty four percent of the quantity sold in this class were contained in companion animal products, with 35% sold in cattle products and 0.03% sold for use in pigs. Enrofloxacin is registered for use as a treatment for respiratory tract, urinary and gastrointestinal infections in cattle, pigs, and companion animals. Marbofloxacin is used to treat mastitis in dairy cattle and respiratory diseases and mastitis metritis agalactia syndrome (MMA) in pigs. Marbofloxacin is also used to treat ear infections in companion animals.

Figure 29: Distribution of fluoroquinolones by sector



*Figures may not add to the total due to rounding.

Sixty-three percent of fluoroquinolones were administered orally, 36% by injection and the remainder by intra-aural means.

Figure 30: Sales of fluoroquinolones by administration methods 2023

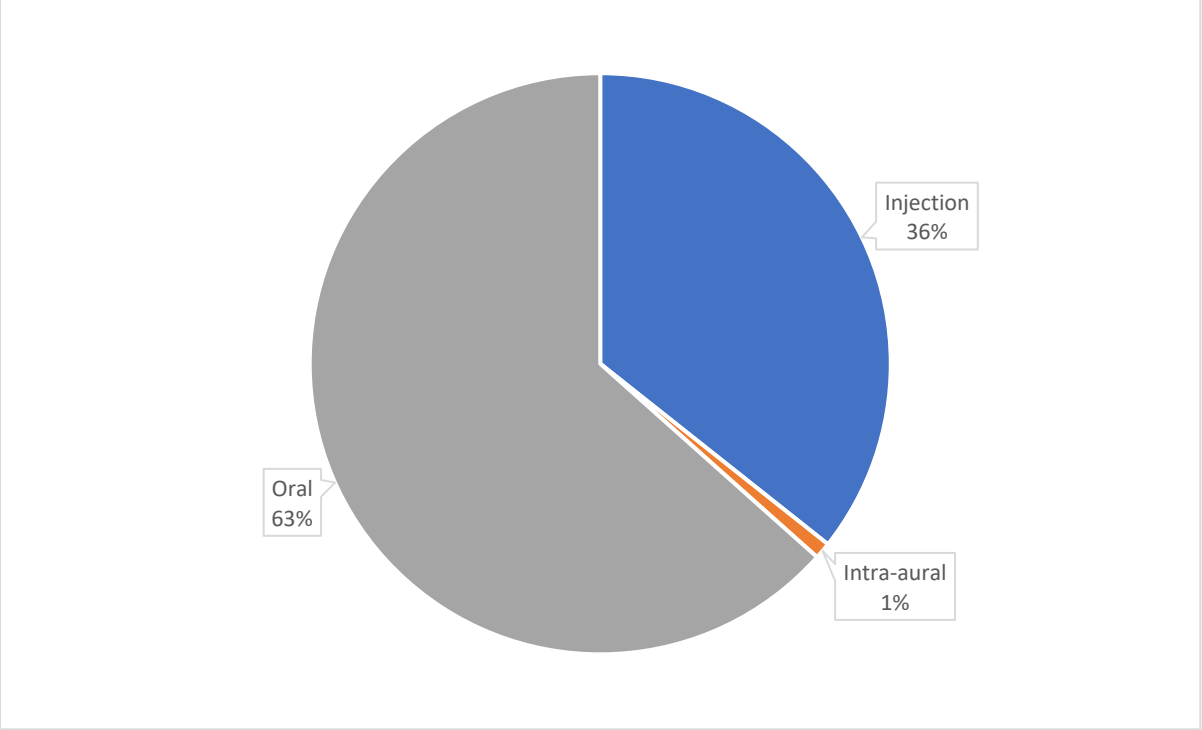
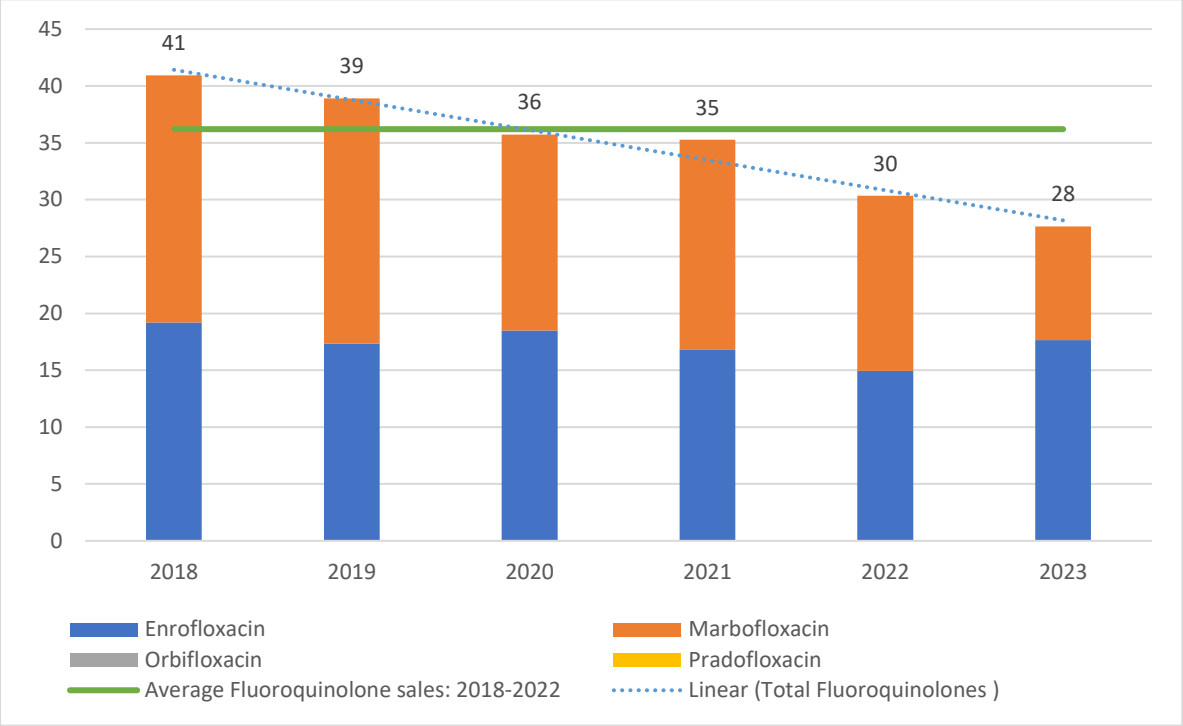


Figure 31: Total fluoroquinolone sales quantities 2018-2023 (in kilograms)



Sales of fluoroquinolones in 2023 were 24% below the average for the previous five years.

5.4 Fusidic acid

Sales of fusidic acid remained at a similar level to those reported for the previous three years at 1 kg with a decrease of 0.1kg compared to 2022. Fusidic acid is registered for use in companion animals as a topical treatment for eye, ear, and skin infections.

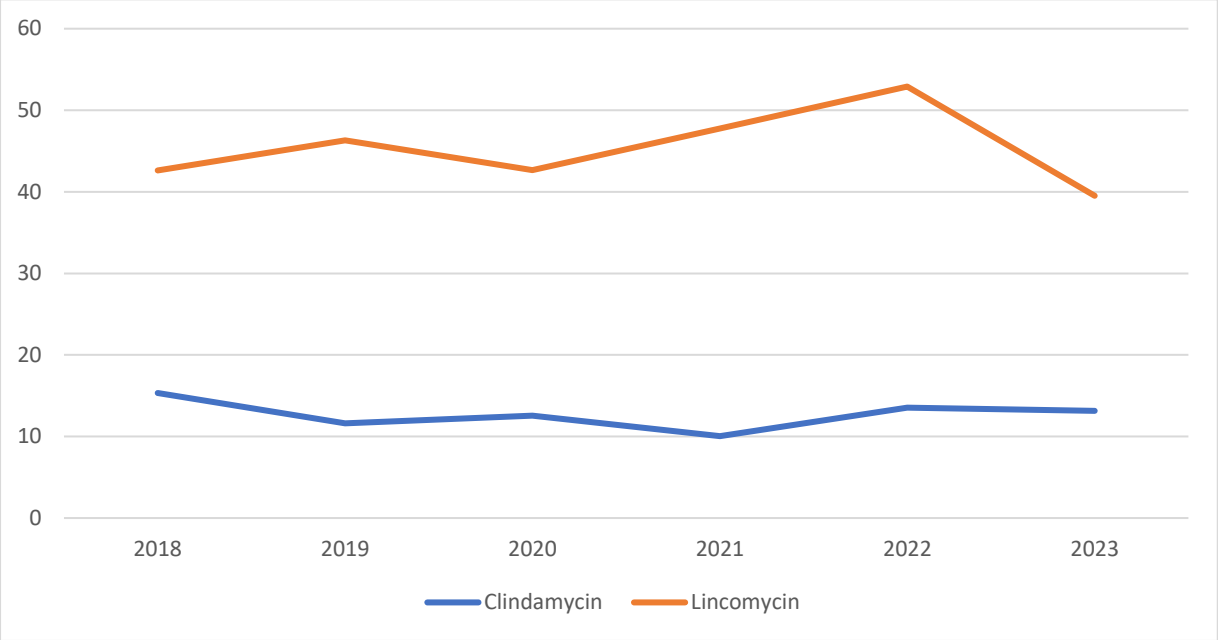
5.5 Lincosamides

Totals sales quantities for the lincosamide class decreased by 21% to a total of 52.6 kg compared to 66.4 kg in 2022. Lincosamides accounted for 0.1% of total antibiotic sales.

Figure 32: Total lincosamides by sales quantities 2022-2023 (in kilograms)

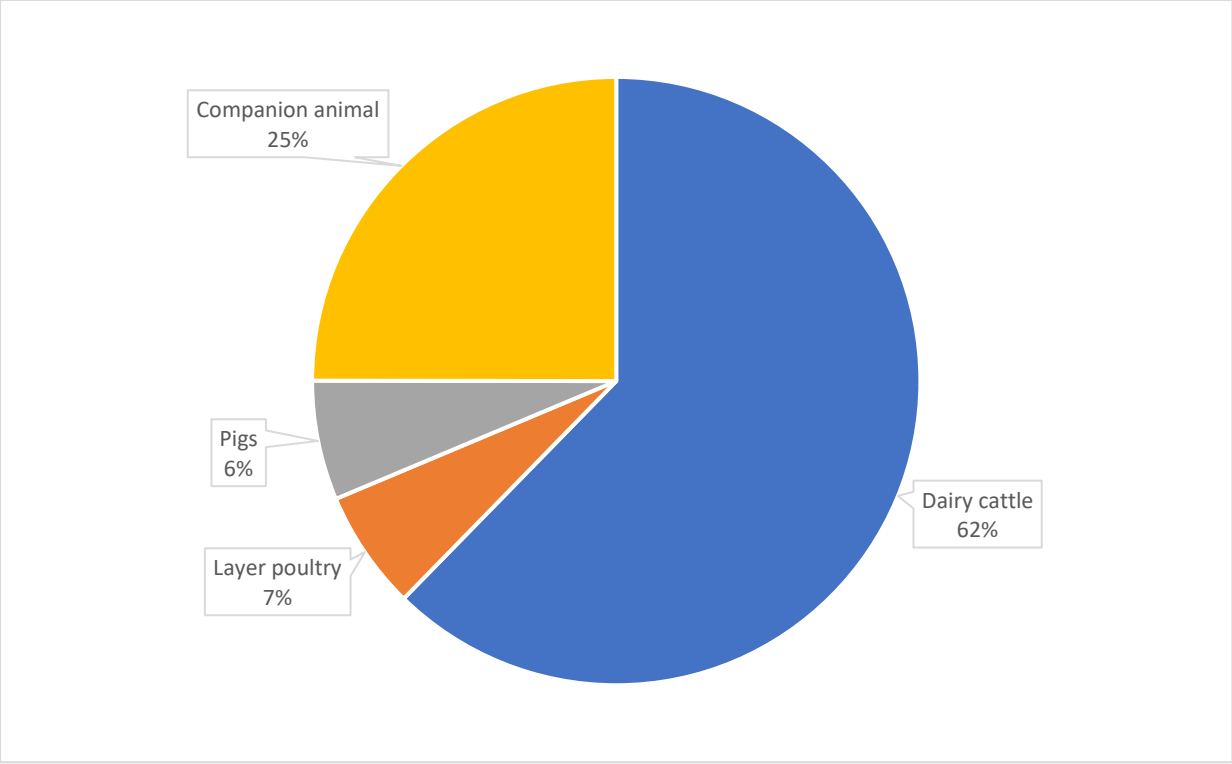
Lincosamides	2022	2023	Net change	Percentage change
Clindamycin	13.5 kg	13.1 kg	↓ 0.4 kg	↓ 3 %
Lincomycin	52.9 kg	39.5 kg	↓ 13.4 kg	↓ 25%
Total sales	66.4 kg	52.6 kg	↓ 13.8 kg	↓ 21%

Figure 33: 2023 lincosamides sales quantities compared to the previous five-year sales trends (in kilograms)



Lincomycin (in combination with neomycin) is registered for the treatment of mastitis in cattle. Lincomycin (in combination with spectinomycin) is registered for the treatment of respiratory diseases in poultry and enteritis and infectious arthritis in pigs. Clindamycin is registered to treat skin, bone, and dental infections in dogs and cats.

Figure 34: Distribution of lincosamides by sector



Lincomycin was sold in intramammary products in cattle (62% of class sales) and for in water products in poultry and pigs (13% of class sales). Clindamycin was sold in oral products for companion animals (25% of class).

Figure 35: Sales of lincosamides by administration methods 2023

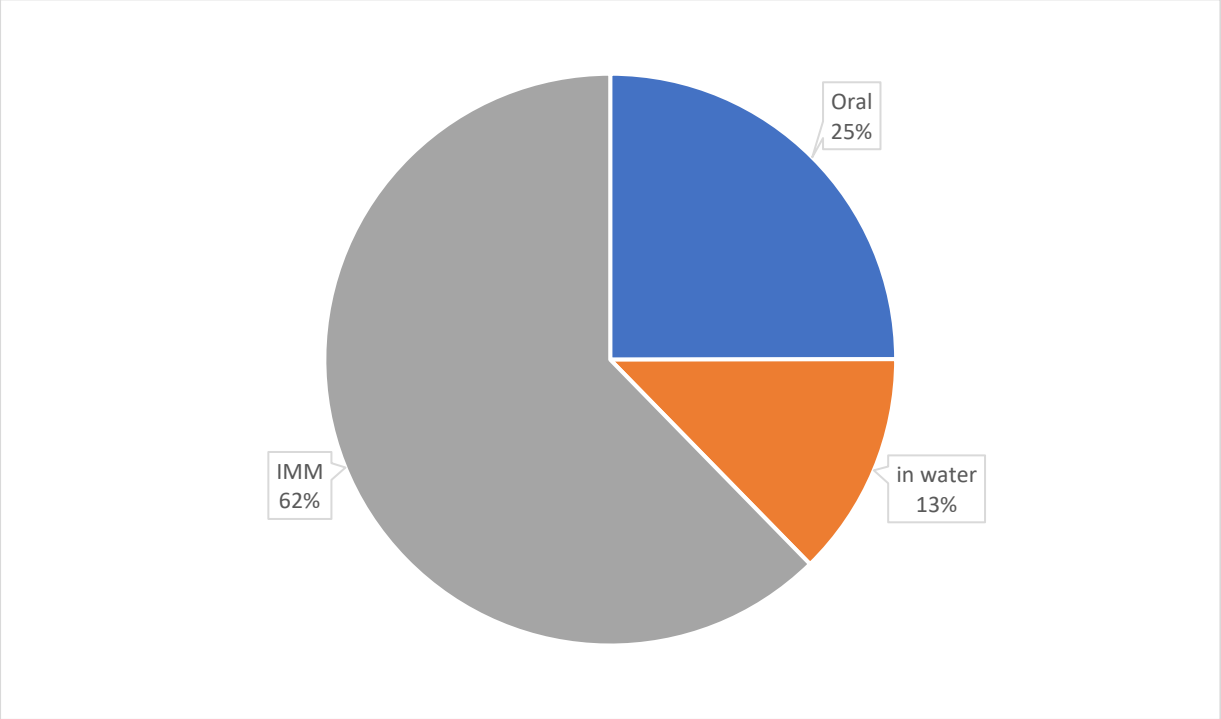
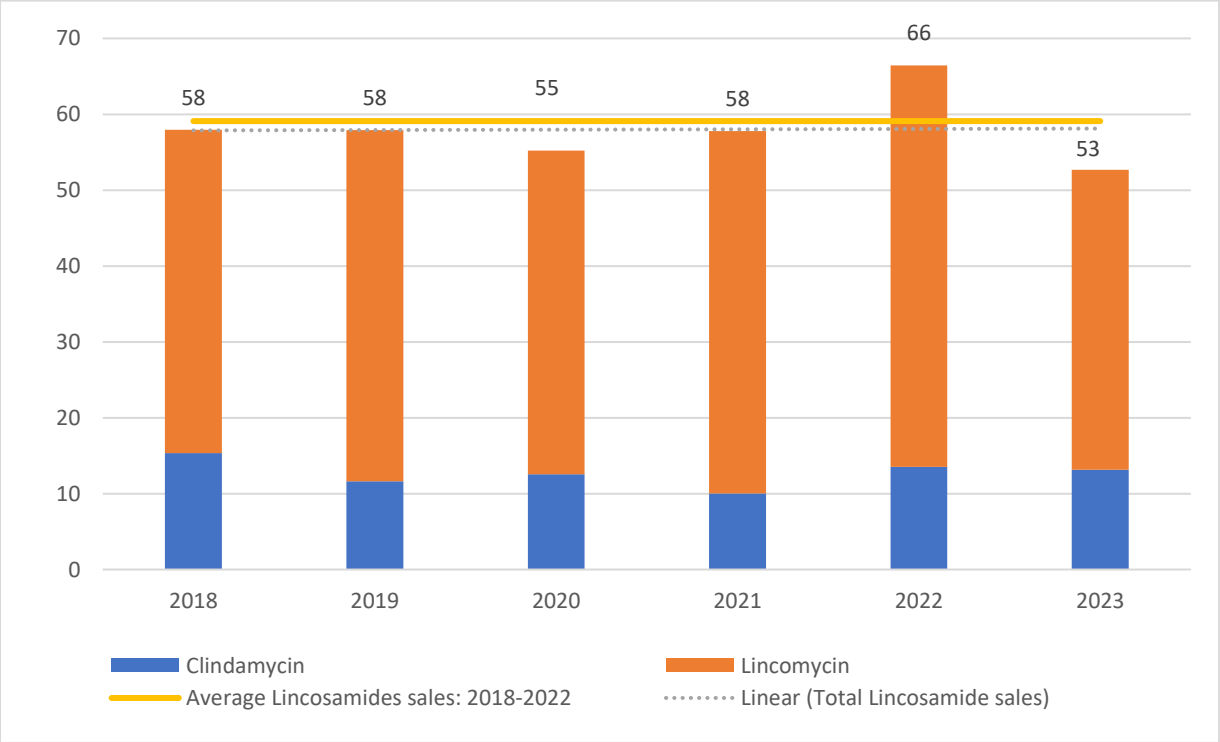


Figure 36: Total lincosamides sales quantities 2018-2023 (in kilograms)



Lincosamide sales were 11% below the average for the previous five years.

5.6 Macrolides

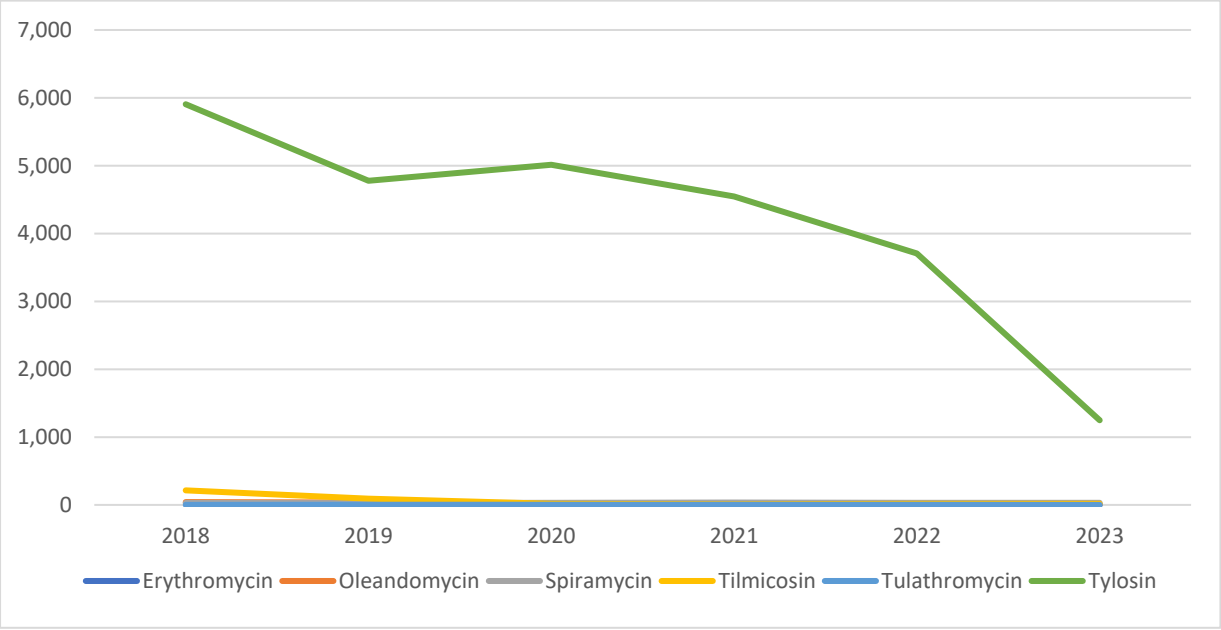
Sales quantities for this critically important class decreased by 65% from 3,770 kg to 1,302 kg with the contribution to total antibiotic sales at 3%. The macrolides accounted for 38% of critically important antibiotic sales in 2023.

Figure 37: Total macrolides sales quantities 2022-2023 (in kilograms)

Macrolides	2022	2023	Net change	Percentage change
Erythromycin	0.0 kg	0.0 kg	0.0 kg	0%
Oleandomycin	14.1 kg	10.0 kg	↓ 4.1 kg	↓ 29%
Spiramycin	33.0 kg	28.9 kg	↓ 4.1 kg	↓ 12%
Tilmicosin	16.0 kg	15.0 kg	↓ 1 kg	↓ 6%
Tulathromycin	0.4 kg	0.1 kg	↓ 0.3 kg	↓ 75%
Tylosin	3,706.8 kg	1,247.7 kg	↓ 2,459.1 kg	↓ 66%
Total Macrolide sales	3,770.3 kg	1,301.7 kg	↓ 2,468.6 kg	↓ 65%

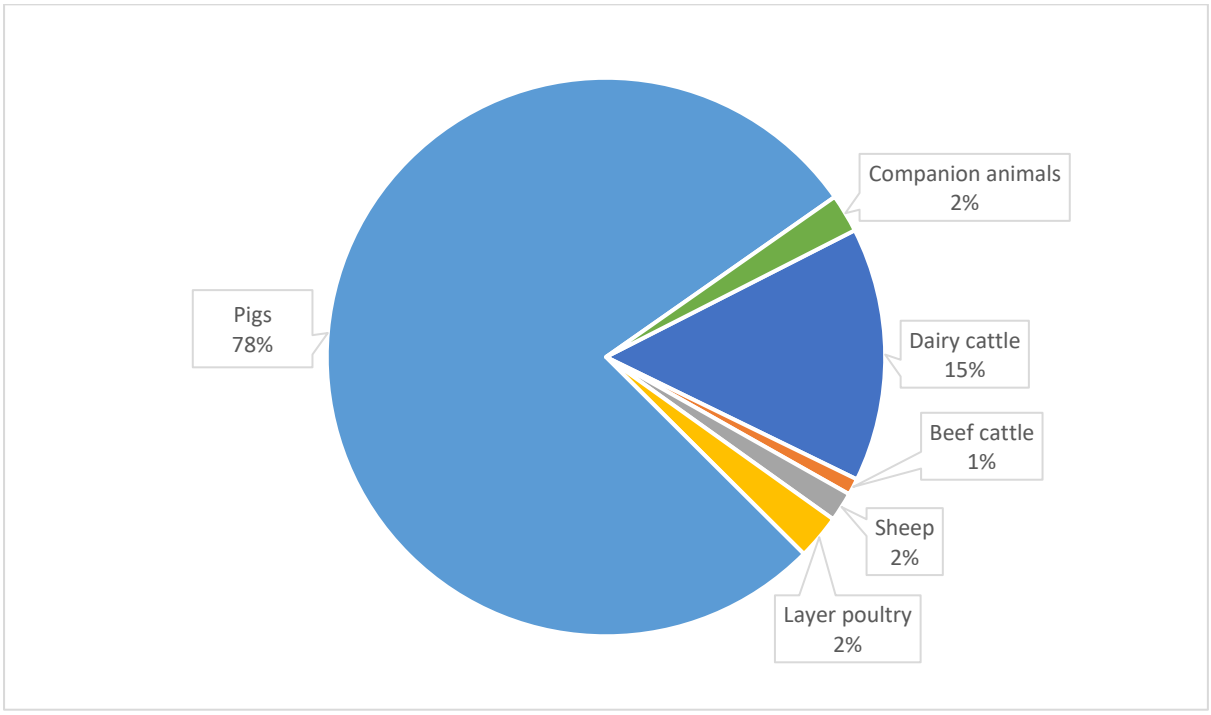
Sales quantities decreased for all antibiotics in the macrolide class with the largest quantity reduction for tylosin which was 2,459 kg lower than the previous year.

Figure 38: 2023 macrolide sales quantities compared to the previous five-year sales trends (in kilograms)



Tylosin is registered as a treatment for respiratory disease in chickens; ileitis, pneumonia, and arthritis in pigs; mastitis and respiratory disease in cattle; and mastitis and respiratory disease in sheep and goats. Tilmicosin is registered as a treatment for respiratory disease in cattle and footrot in sheep; oleandomycin is registered for use in lactating cattle therapies; and spiramycin is used in companion animal treatments. Seventy-eight percent of macrolides sales were sold for use in pigs, 16% in cattle, 2% in layer poultry, 2% in sheep and 2% in companion animals.

Figure 39: Distribution of macrolides by sector



Just under half of macrolides sales (47%) were in-feed products, 33% sold as in-water products, 17% administered by injection, with the remainder administered by intramammary or oral methods.

Figure 40: Macrolides sales by administration methods 2023

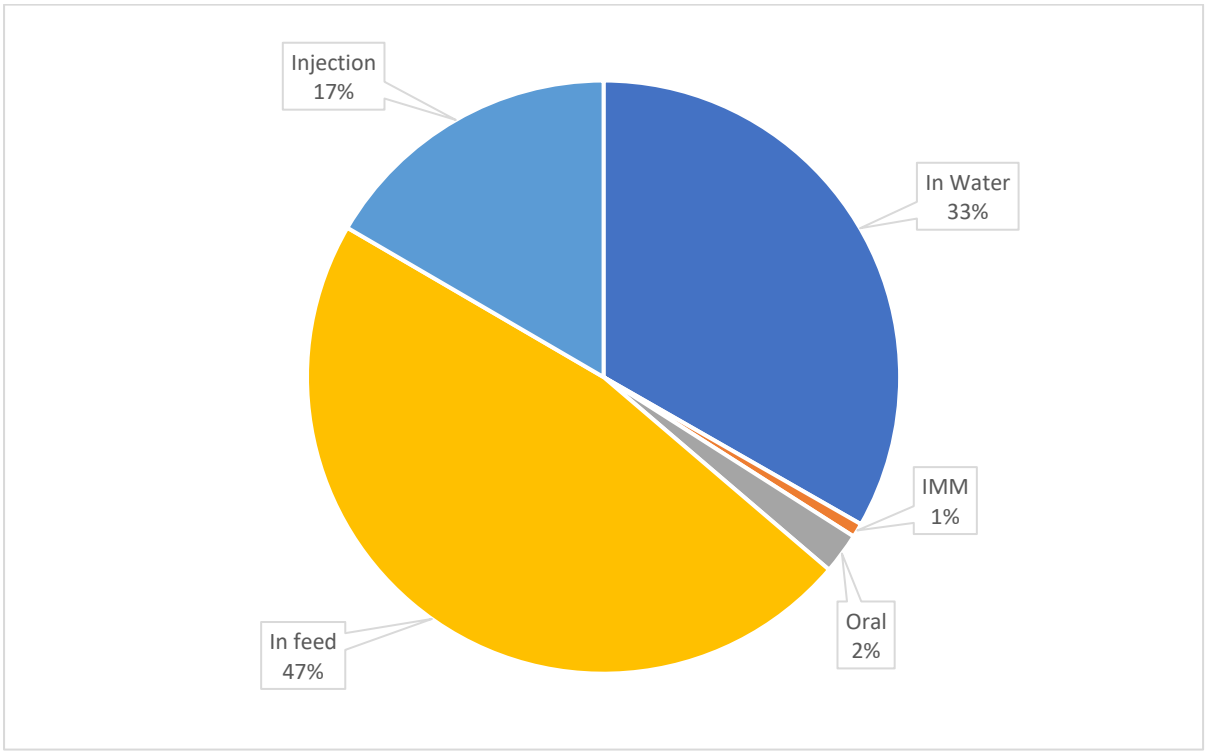
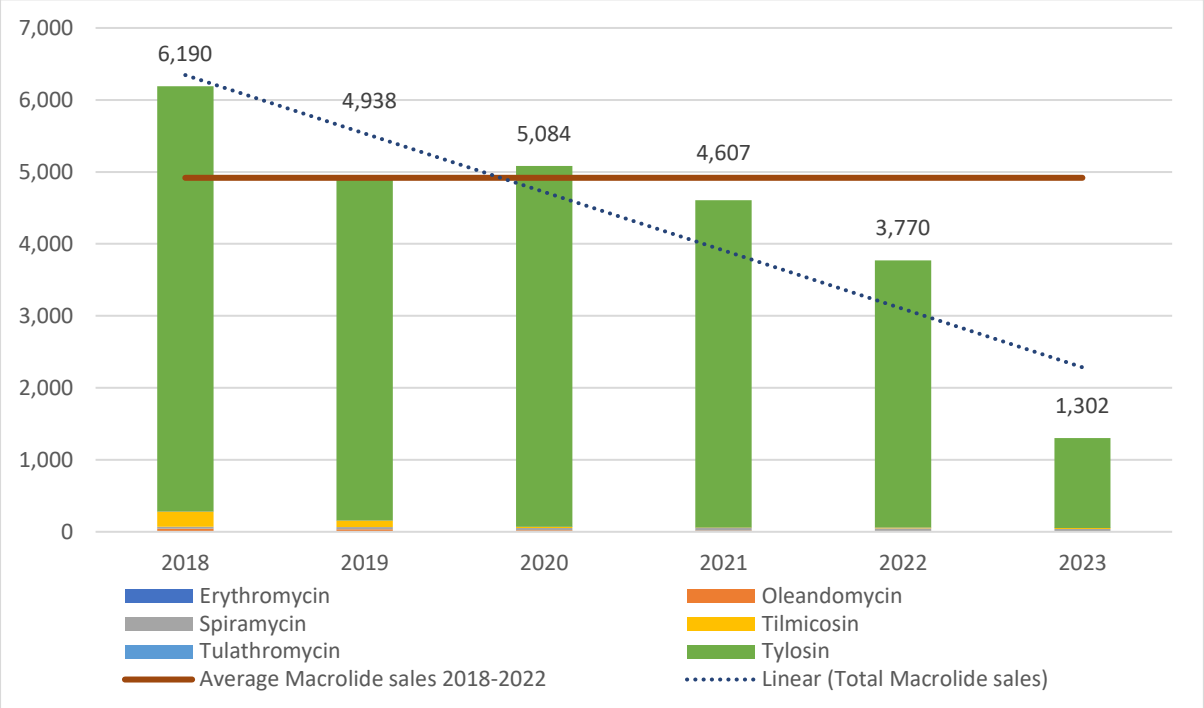


Figure 41: Total macrolides sales quantities 2018-2023 (in kilograms)



Overall sales for the macrolide class have decreased since 2018. The 2023 sales total was 74% below the average for the previous five years.

5.7 Nitrofurans

There were no registered nitrofuran products in 2023.

5.8 Nitroimidazoles

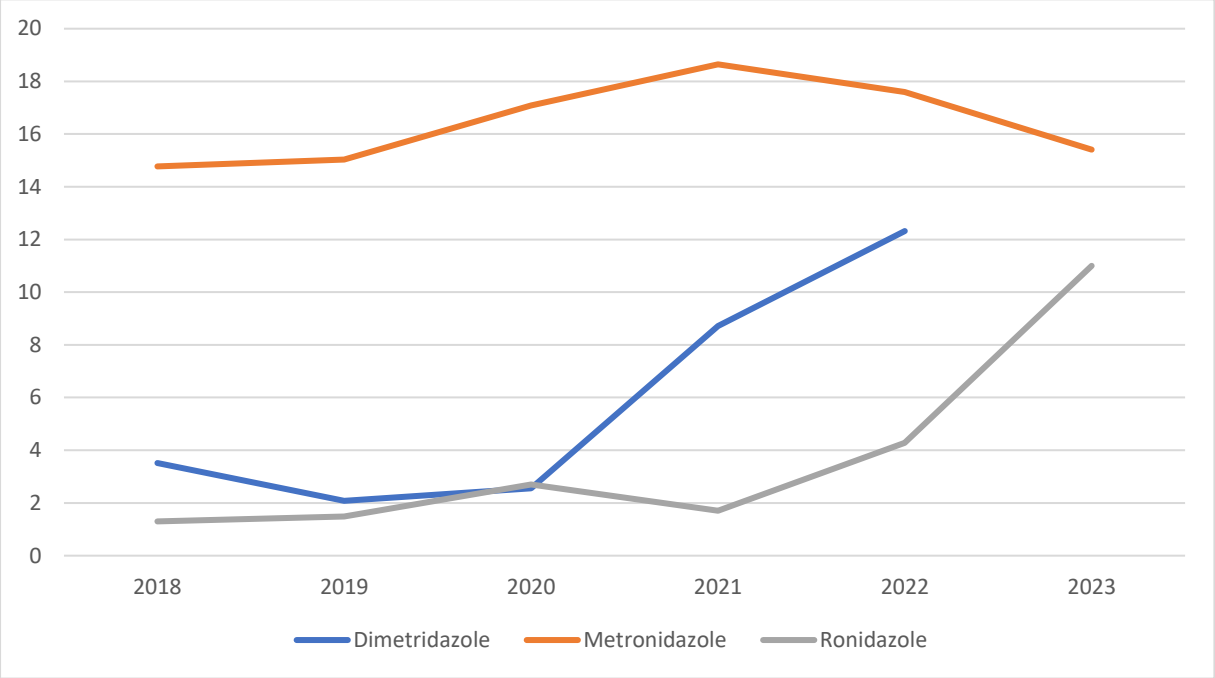
An accurate sales total for this class could not be calculated as, despite best efforts from NZFS, dimetridazole quantities were not able to be obtained for the 2023 sales period.

Figure 42: Total nitroimidazoles sales quantities 2022-2023 (in kilograms)

Nitroimidazoles	2022	2023	Net change	Percentage change
Dimetridazole	12.3 kg	N/A	N/A	N/A
Metronidazole	17.6 kg	15.4 kg	↓ 2.2 kg	↓ 12%
Ronidazole	4.3 kg	11.0 kg	↑ 6.7 kg	↑ 157%
Total sales	34.2 kg	26.4 kg	N/A	N/A

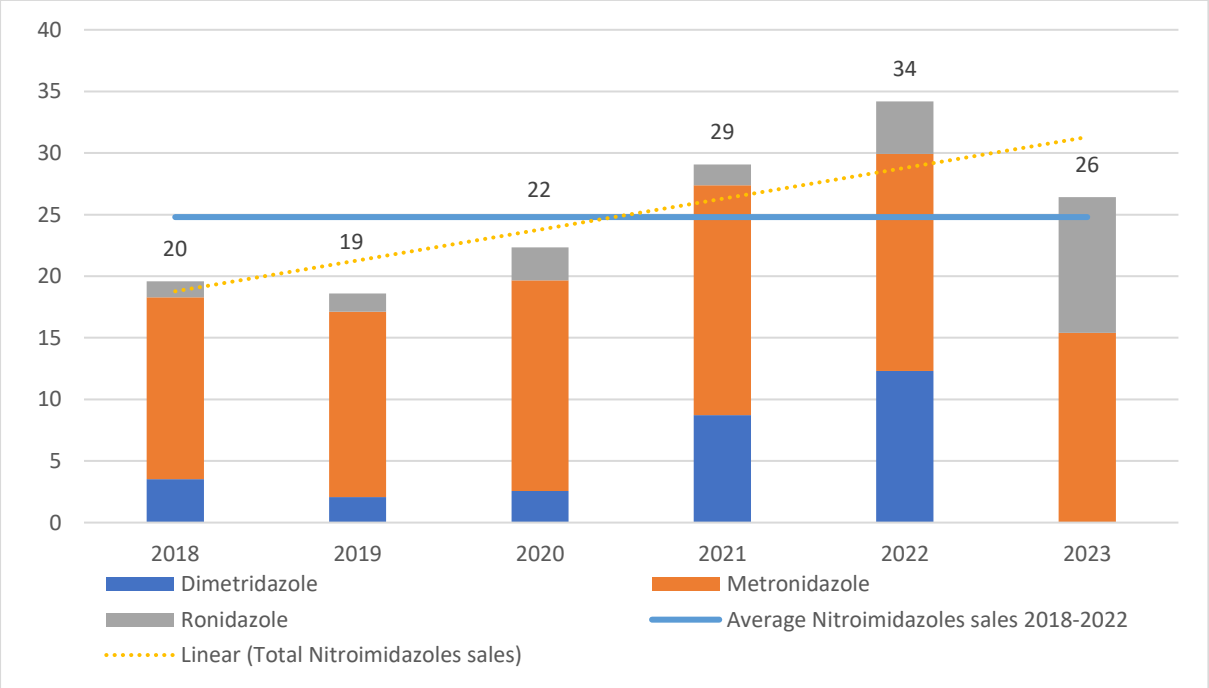
Metronidazole was sold in oral treatments and ronidazole was sold for in-water delivery. Dimetridazole is administered in water.

Figure 43: 2023 nitroimidazoles sales quantities compared to the previous five-year sales trends (in kilograms)



Dimetridazole is registered to treat dysentery in pigs, blackhead in poultry and game birds, and canker in pigeons. Ronidazole is registered for treatment of canker in pigeons whereas products containing metronidazole (used in combination with spiramycin) were found in companion animal products.

Figure 44: Total nitroimidazoles sales quantities 2018-2023 (in kilograms), excluding 2023 sales for dimetridazole



5.9 Penicillins and clavulanic acid

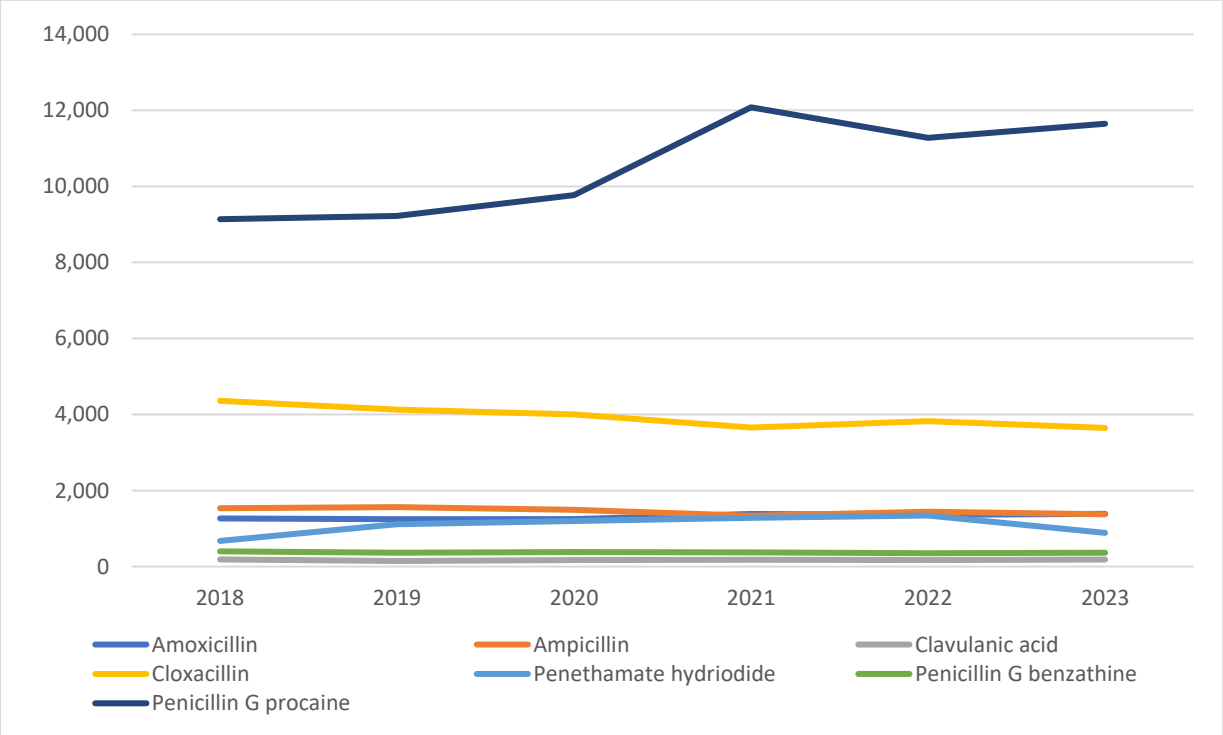
The penicillins were the largest single class of antibiotic compounds in terms of both volumes sold and the number of products with sales. The quantity sold in 2023 was 1% lower at 19,480 kg

compared to 2022. The percentage share of the total sales for this class increased slightly to 49% from 48% in 2022. Dose rates of active ingredients for penicillins are often higher compared to other classes of antibiotics due to differing potencies. This may result in higher quantities of penicillins used per treatment compared to other classes.

Figure 45: Total penicillins and clavulanic sales quantities 2022-2023 (in kilograms)

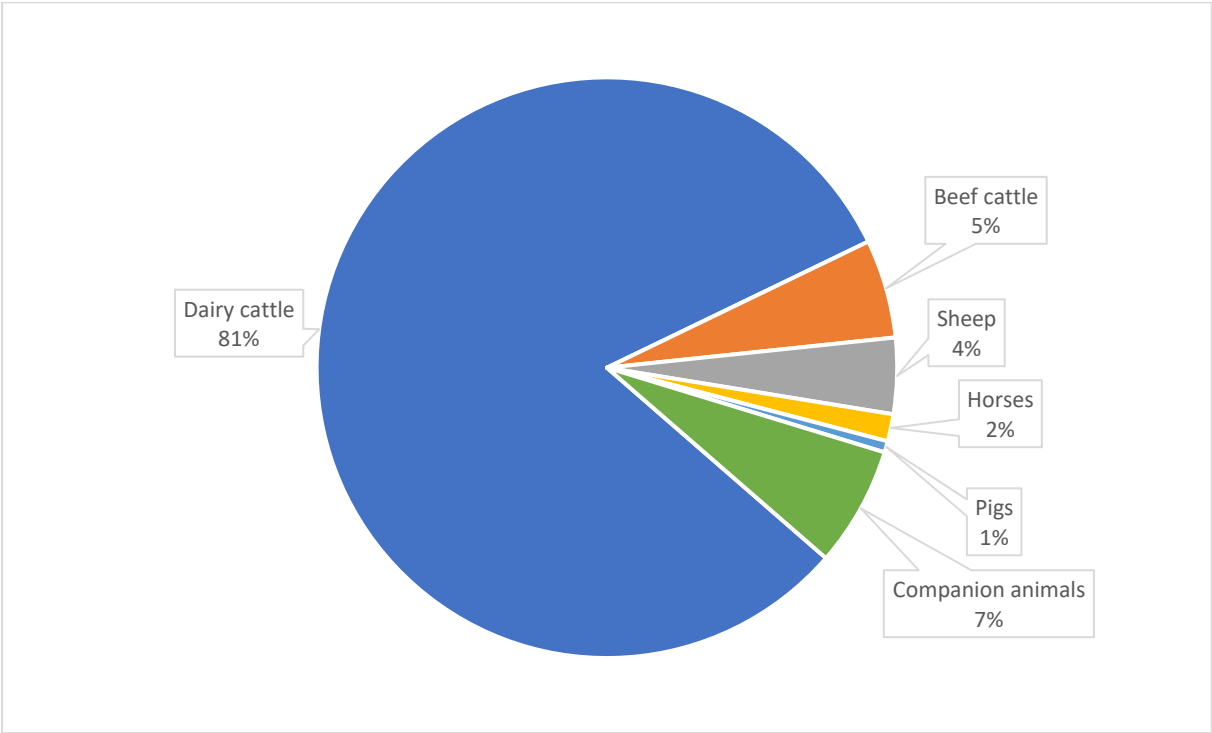
Penicillins and clavulanic acid	2022	2023	Net change	Percentage change
Amoxicillin	1,354.0 kg	1,387.0 kg	↑ 33.0 kg	↑ 2%
Ampicillin	1,438.5 kg	1,371.3 kg	↓ 67.2 kg	↓ 5%
Clavulanic acid	168.9 kg	184.5 kg	↑ 15.6 kg	↑ 9 %
Cloxacillin	3,823.4 kg	3,646.5 kg	↓ 176.9 kg	↓ 5%
Penethamate hydriodide	1,342.3 kg	883.5 kg	↓ 458.8 kg	↓ 34%
Penicillin G benzathine	350.4 kg	361.8 kg	↑ 11.4 kg	↑ 3%
Penicillin G procaine	11,278.7 kg	11,645.2 kg	↑ 366.5 kg	↑ 3%
Total penicillin sales	19,756.2 kg	19,479.8 kg	↓ 276.4 kg	↓ 1%

Figure 46: 2023 penicillins and clavulanic acid sales quantities compared to the previous five-year sales trends (in kilograms)



Eighty-one percent of the penicillin class was sold for use in dairy cattle, with smaller quantities sold in companion animals, beef cattle, sheep, horses, and pigs.

Figure 47: Distribution of penicillins and clavulanic acid by sector



Fifty-nine percent of penicillins were sold for administration by injection, 36% by intramammary methods, and 5% in oral treatments. The remainder (less than 1%) was sold in intra-ocular products.

Figure 48: Penicillin sales by administration methods 2023

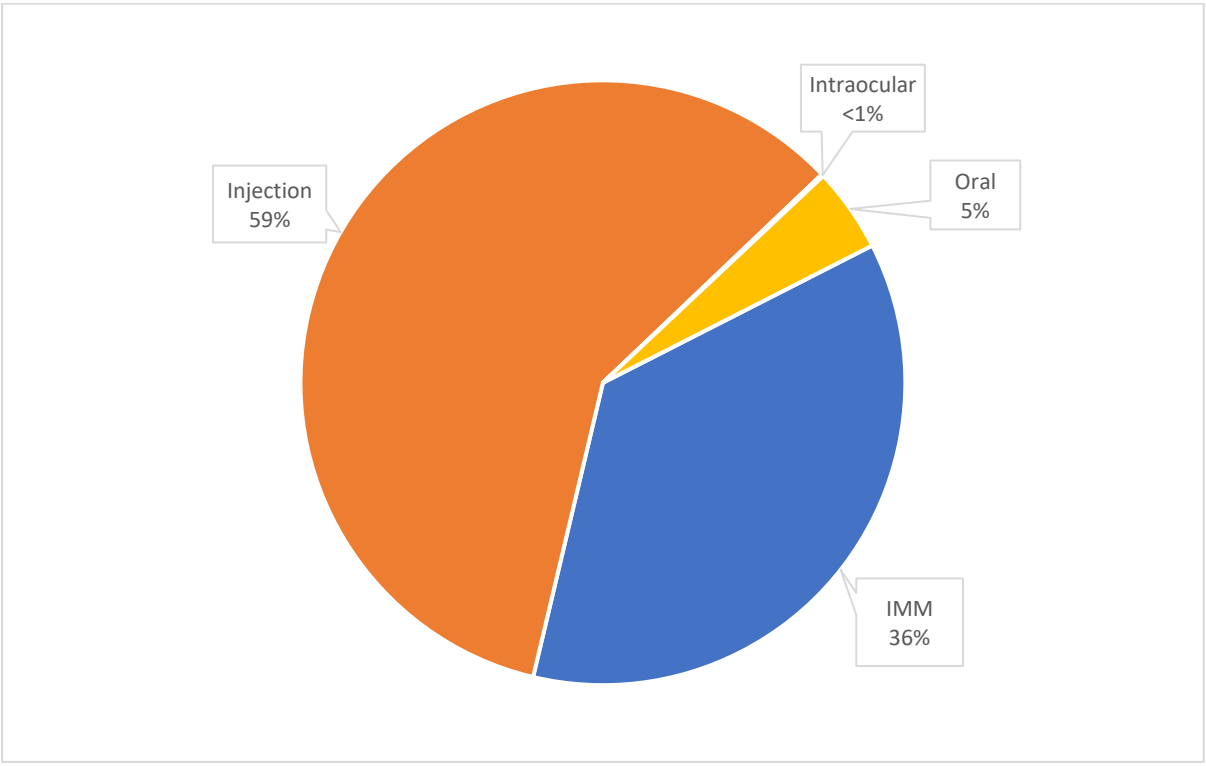
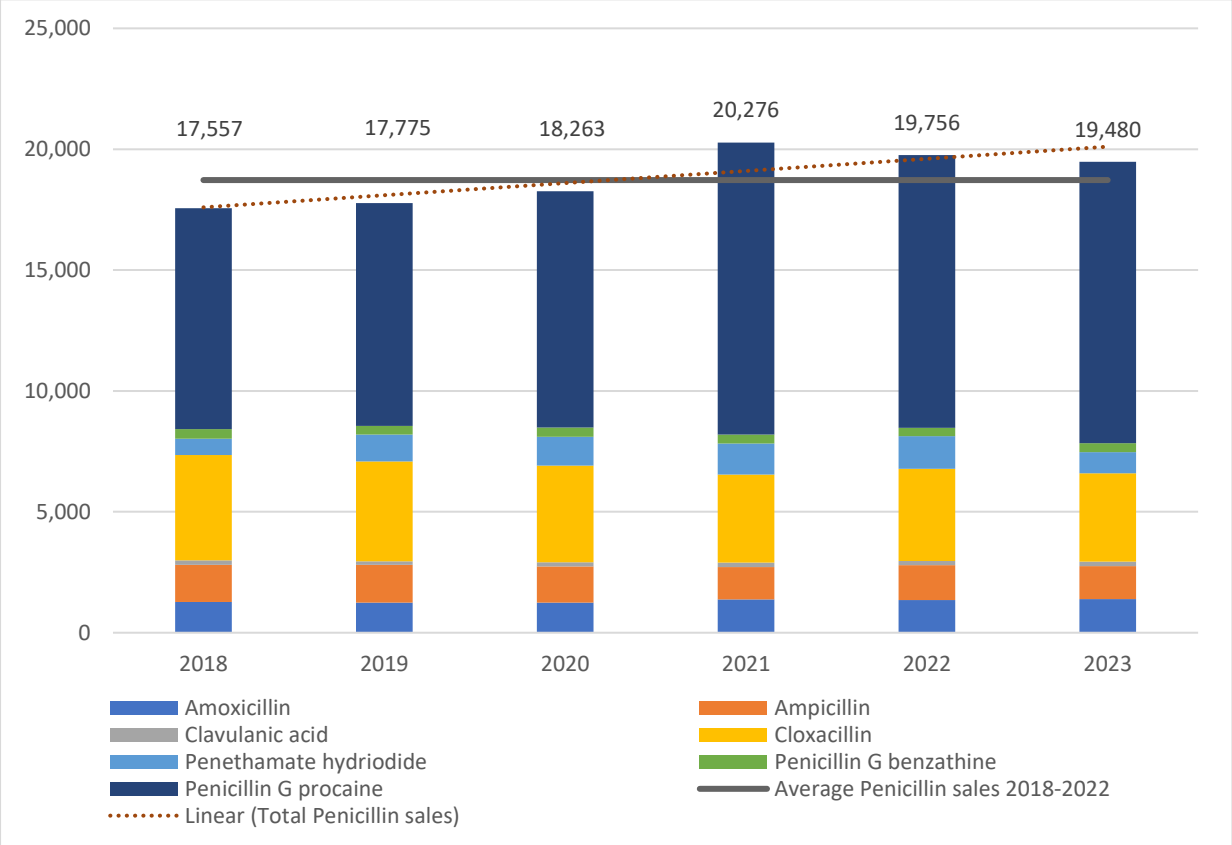


Figure 49: Total penicillin sales quantities 2018-2023 (in kilograms)

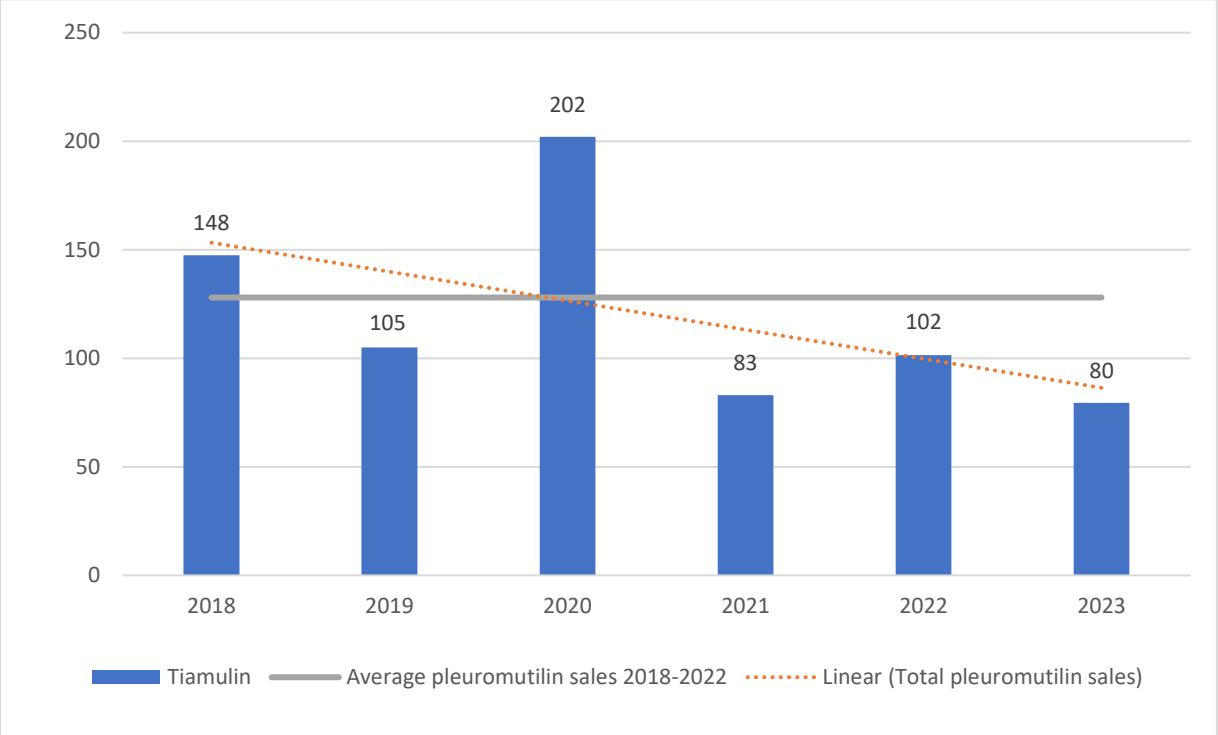


Total penicillins class sales were 4% above the average for the previous five years.

5.10 Pleuromutilins

Tiamulin is the sole pleuromutilin registered in New Zealand for use in poultry and pigs. All sales quantities in 2023 were attributed by registrants for use in layer poultry. Sales decreased by 22% in 2023 to 80 kg following a 22% increase from the previous year. All tiamulin sold was for in-feed administration. Tiamulin is registered to treat respiratory disease in poultry and pneumonia and dysentery in pigs. The sales for the pleuromutilin class remain very low at 0.2% of total antibiotic sales.

Figure 50: Total pleuromutilins sales quantities 2018-2023 (in kilograms)



Total pleuromutilin class sales were 38% below the average for the previous five years.

5.11 Polypeptides

5.11.1 Polymyxin

Sales of the critically important antibiotic polymyxin increased by 0.1 kg in 2023 to 1 kg and accounted for 0.03% of critically important antibiotic sales. Polymyxin is found in topical treatments registered for use in companion animals and horses. All polymyxin sales in 2023 were attributed by registrants for use in companion animals.

5.11.2 Zinc bacitracin

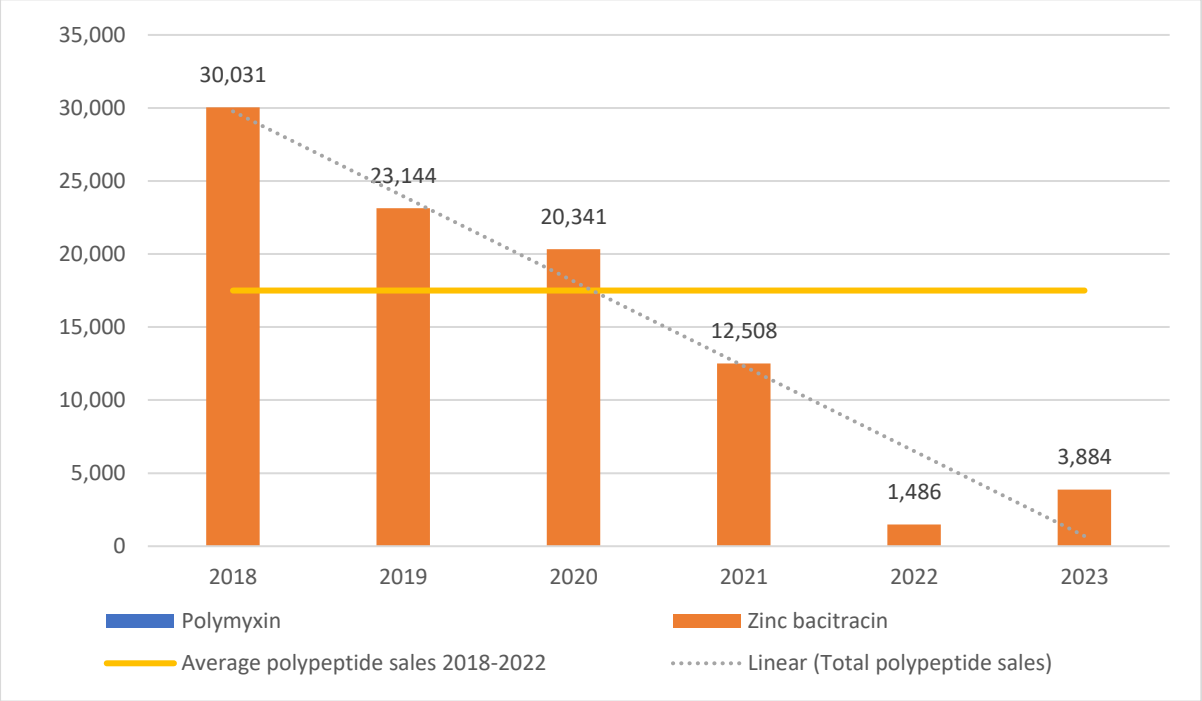
Zinc bacitracin, which is classified as an important antibiotic, accounted for over 99% of the class sales volume. Sales increased by 161% in 2023 to 3,883 kg from 1,485 kg in 2022. This compound was sold for use in meat poultry (99.9%) administered in feed, and for topical treatment in companion animals (0.01%) in 2023.

Figure 51: Total polypeptides sales quantities 2022-2023 (in kilograms)

Polypeptides	2022	2023	Net change	Percentage change
Polymyxin	0.9 kg	1.00 kg	↑ 0.1	↑ 11%
Zinc bacitracin	1,485.4 kg	3,882.7 kg	↑ 2,397.3kg	↑ 161%
Total sales	1,486.3 kg	3,883.7 kg	↑ 2,397.4	↑ 161%

Sales of polypeptides accounted for 10% of the overall sales total, up from 4% in the previous year.

Figure 52: Total polypeptides sales quantities 2018-2023 (in kilograms)

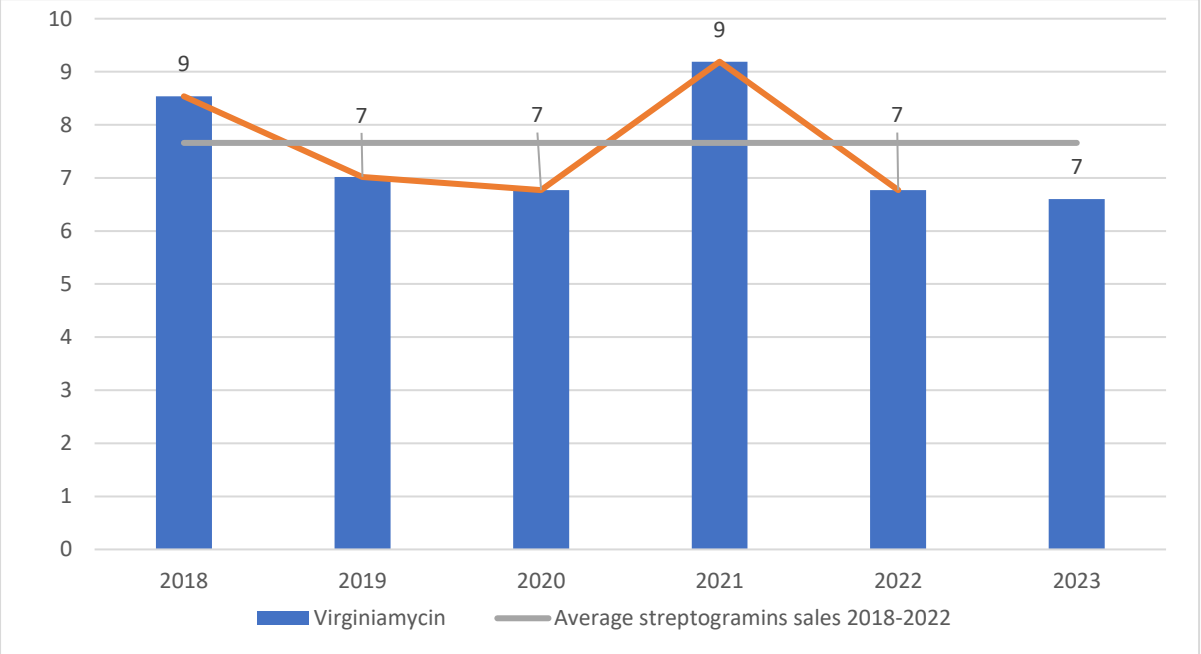


Sales of polypeptides were 78% lower than the average for the previous five years.

5.12 Streptogramins

Virginiamycin is the sole representative of the streptogramins class. Sales of this compound remained relatively unchanged at 7 kg with all reported quantities sold in horse-specific in-feed products. Virginiamycin is registered for use in horses to reduce the risk of laminitis and in poultry for the prevention and treatment of necrotic enteritis. Streptogramins accounted for 0.02% of total sales in 2023. Annual sales of streptogramins are reasonably consistent at around 7-9 kg.

Figure 53: Total streptogramins sales quantities 2018-2023 (in kilograms)



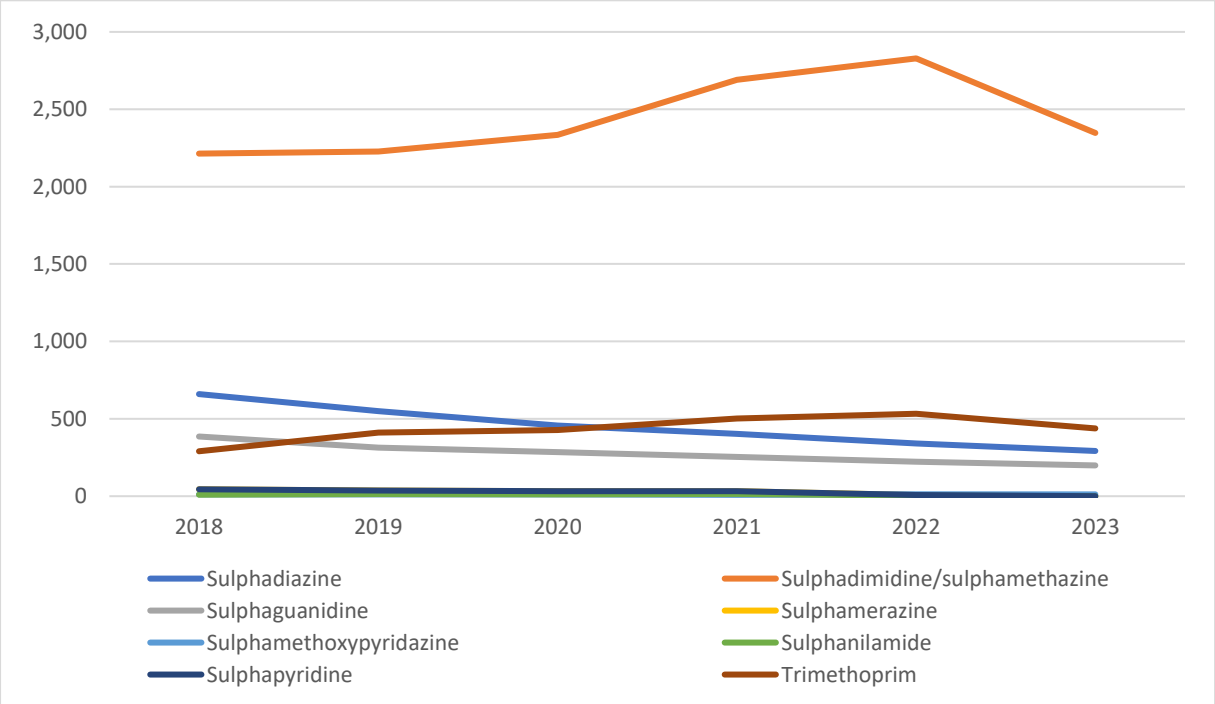
5.13 Sulphonamides and trimethoprim

Overall sulphonamides and trimethoprim sales decreased by 667 kg (17%) in 2023 to 3,285 kg which accounted for 8% of total antibiotic sales compared to 10% in 2022. Products containing sulphonamides and trimethoprim are generally formulated as multi-active combinations of antibiotics, most commonly including trimethoprim with one, two, or three sulphonamides.

Figure 54:Total sulphonamides and trimethoprim 2022-2023 (in kilograms)

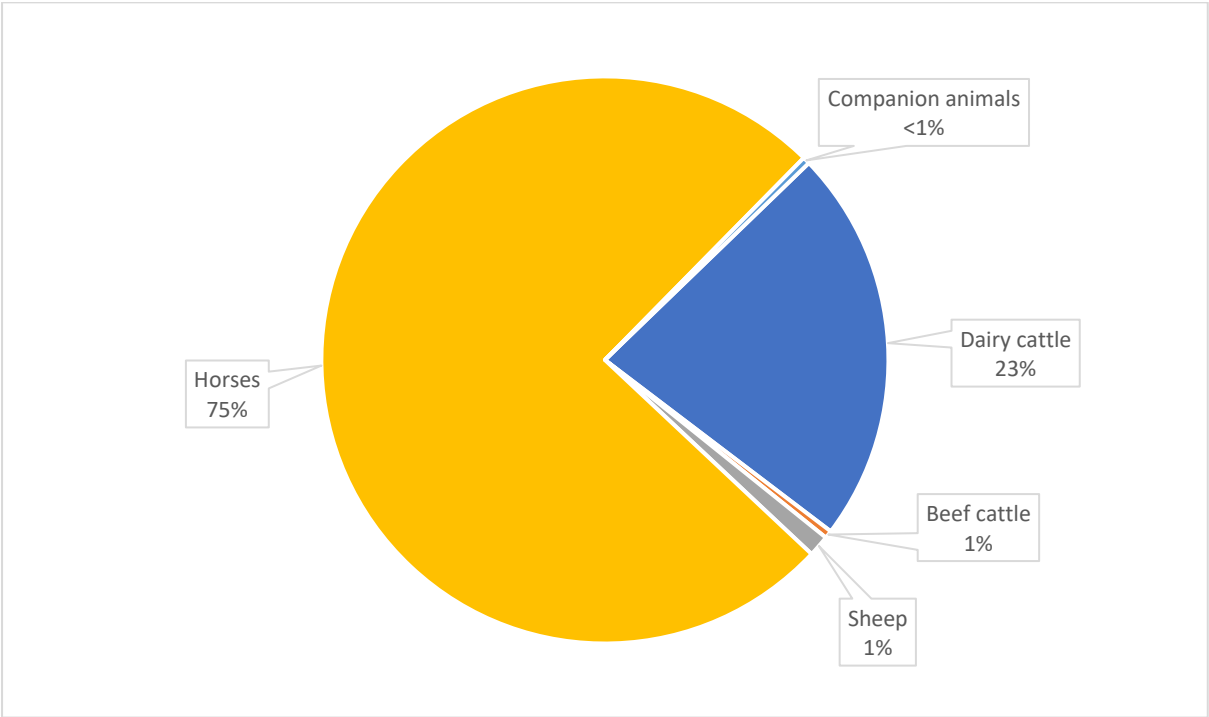
Sulphonamides and trimethoprim	2022	2023	Net change	Percentage change
Sulphadiazine	340.2 kg	292.2 kg	↓ 48.0 kg	↓ 14%
Sulphadimidine/sulphamethazine	2,828.8 kg	2,346.3 kg	↓ 482.5 kg	↓ 17%
Sulphaguanidine	222.2 kg	198.8 kg	↓ 23.4 kg	↓ 11 %
Sulphamerazine	6.7 kg	0.0 kg	↓ 6.7 kg	↓ 100%
Sulphamethoxypyridazine	12.4 kg	10.7 kg	↓ 1.7 kg	↓ 14%
Sulphanilamide	2.9 kg	0.0 kg	↓ 2.9 kg	↓ 100 %
Sulphapyridine	6.7 kg	0.0 kg	↓ 6.7 kg	↓ 100%
Trimethoprim	532.5 kg	437.0 kg	↓ 95.5 kg	↓ 18%
Total sales	3,952.4 kg	3,285.0 kg	↓ 667.4 kg	↓ 17%

Figure 55: 2023 sulphonamides and trimethoprim sales quantities compared to the previous five-year sales trends (in kilograms)



Over 75% of the sulphonamides and trimethoprim class quantity sold was for use in horses, 23% in dairy cattle the remaining 2% in sheep, beef, and companion animals. The sulphonamides, with or without potentiation with trimethoprim, are used to treat respiratory, intestinal, urinary tract and other infections.

Figure 56: Distribution of sulphonamides and trimethoprim by sector



Most products containing sulphonamides and trimethoprim compounds were sold as oral treatments (67%), in-feed treatments (29%), with the remaining 5% for administration by injection, or oral/intra-uterine means.

Figure 57: Sulphonamides and trimethoprim sales administration methods in 2023

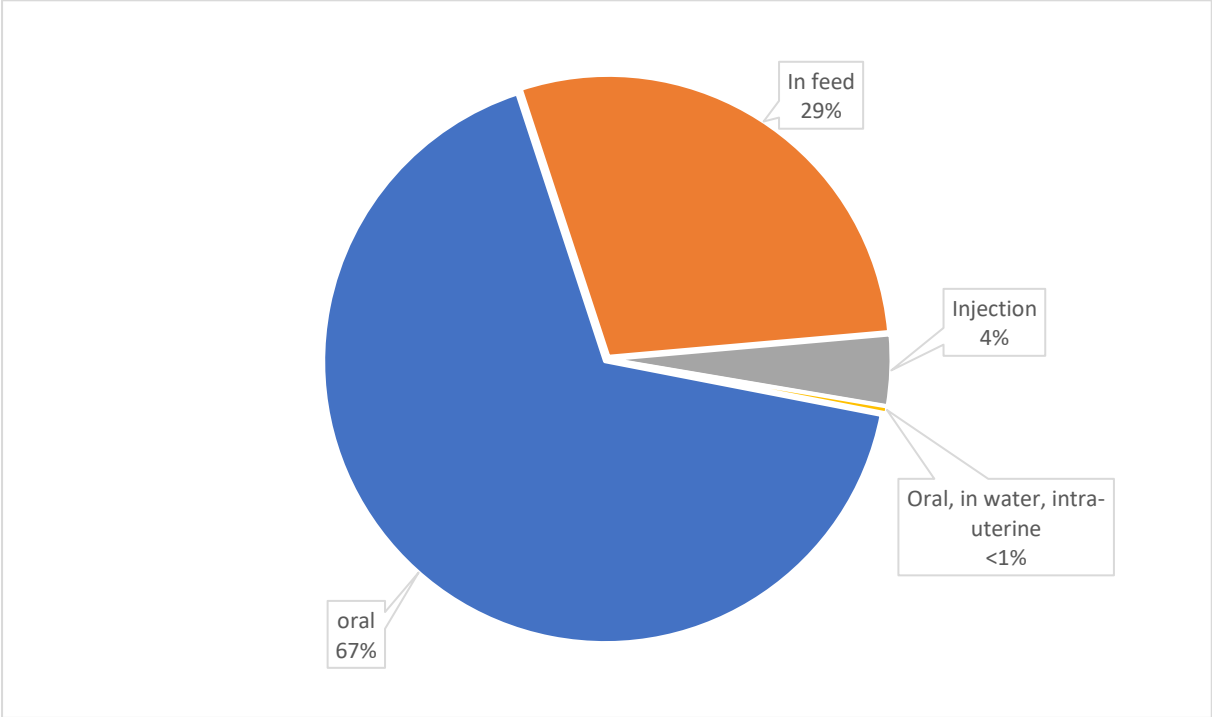
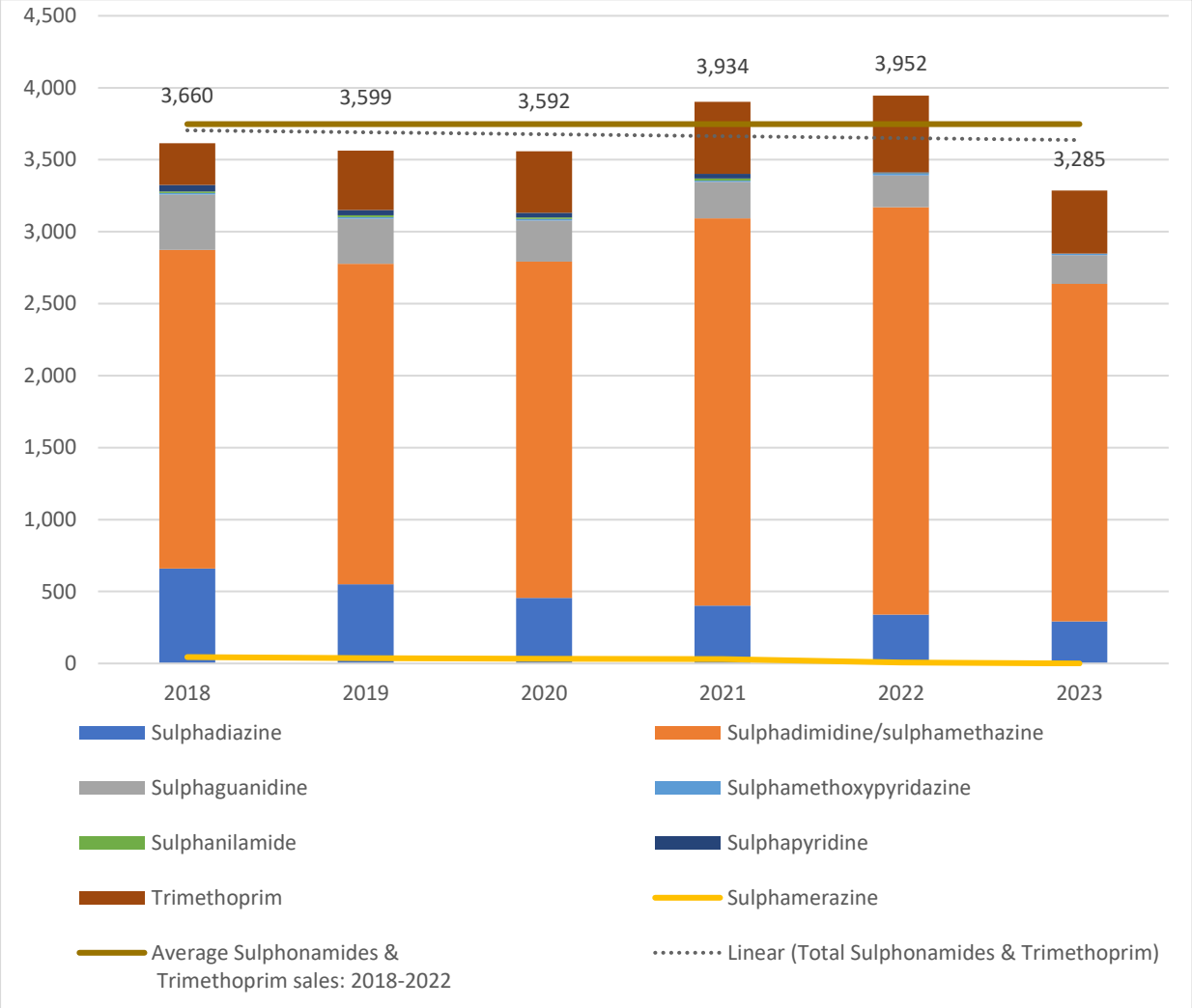


Figure 58: Total sulphonamides and trimethoprim sales quantities 2018-2023 (in kilograms)



Sales for the sulphonamide and trimethoprim class were 12% lower than the average for the previous five years.

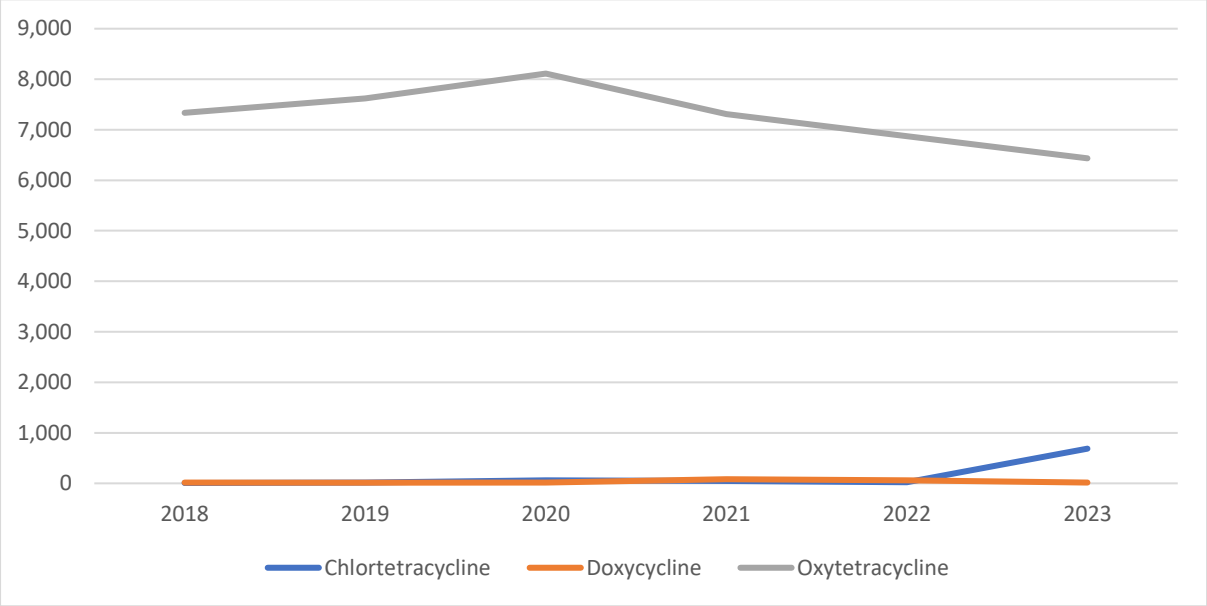
5.14 Tetracyclines

Tetracycline sales increased by 176 kg (3%) in 2023 to 7,135 kg which accounted for 18% of total sales. Sales data for 2023 included antibiotics imported under special circumstance approvals for the first time. Special circumstance approvals were obtained for the importation of 662 kg of chlortetracycline and 23 kg of oxytetracycline.

Figure 59: Total tetracyclines 2022-2023 (in kilograms)

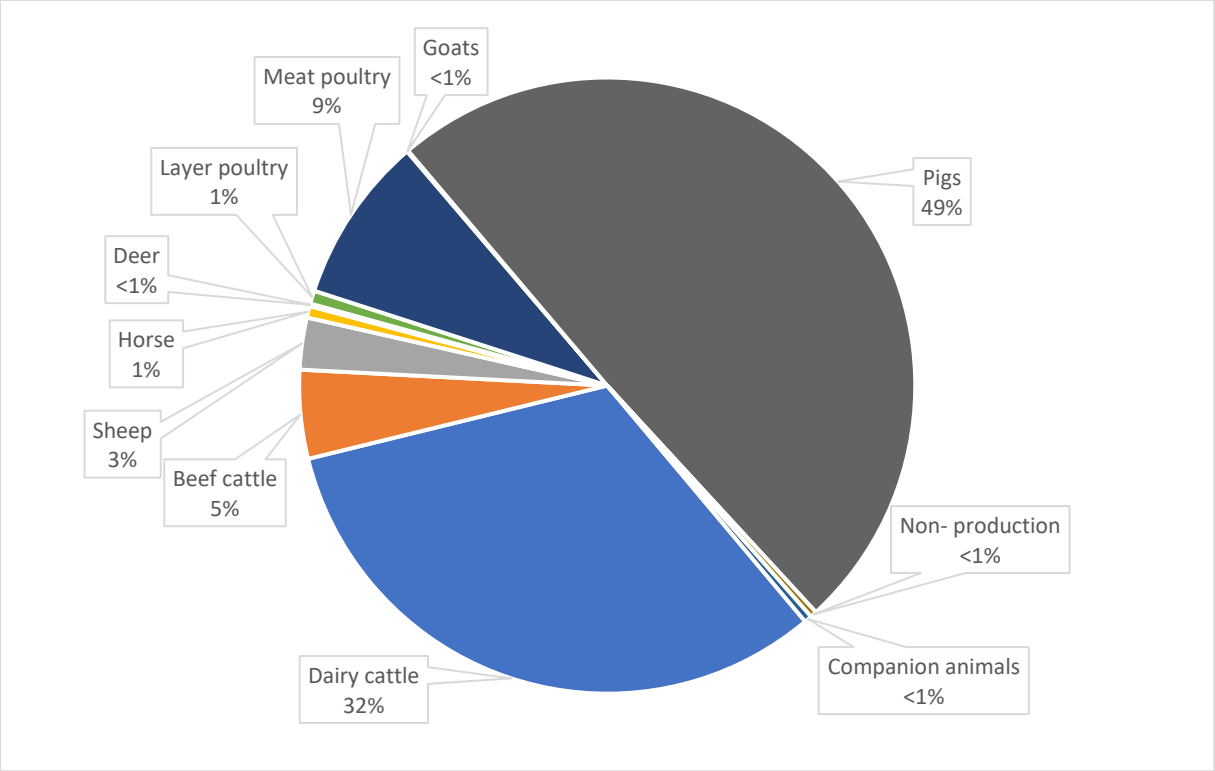
Tetracyclines	2022	2023	Net change	Percentage change
Chlortetracycline	23.0 kg	687.0kg	↑ 664.0 kg	↑ 2,886%
Doxycycline	62.1 kg	13.8 kg	↓ 48.3 kg	↓ 78%
Oxytetracycline	6,873.4 kg	6,433.7 kg	↓ 439.7 kg	↓ 6%
Total sales	6,958.5 kg	7,134.5 kg	↑ 176 kg	↑ 3%

Figure 60: 2023 tetracyclines sales quantities compared to the previous five-year sales trends (in kilograms)



The majority of tetracyclines were sold for use in pigs (49%) and dairy cattle (32%). The remainder were sold for use in poultry, beef cattle, sheep, horses, goats, deer, companion animals, and non-production animals. Oxytetracycline is a broad-spectrum antibiotic effective against a range of gram-positive and gram-negative bacteria, and was sold for use in cattle, layer poultry, pigs, horses, and sheep. Chlortetracycline was primarily sold for use in meat poultry, with smaller quantities sold for use in dairy cattle, sheep and layer poultry. Doxycycline was sold in products registered for use in companion animals including caged birds.

Figure 61: Distribution of tetracyclines by sector



Most of the tetracycline class sales were administered as in-feed products (46%) with a further 23% by injection, 11% in water, 5% applied topically, with the remainder (less than 1%) by oral, intrauterine, intramammary, or intra-ocular methods.

Figure 62: Tetracyclines sales by administration methods in 2023

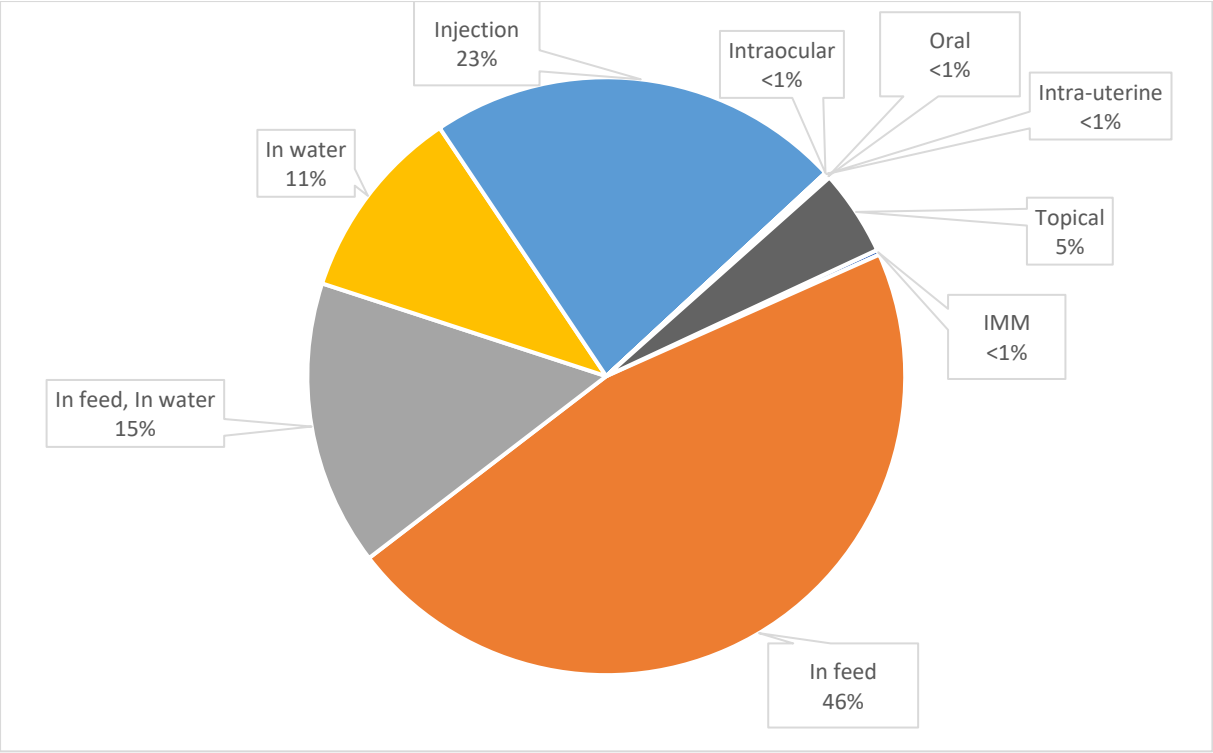
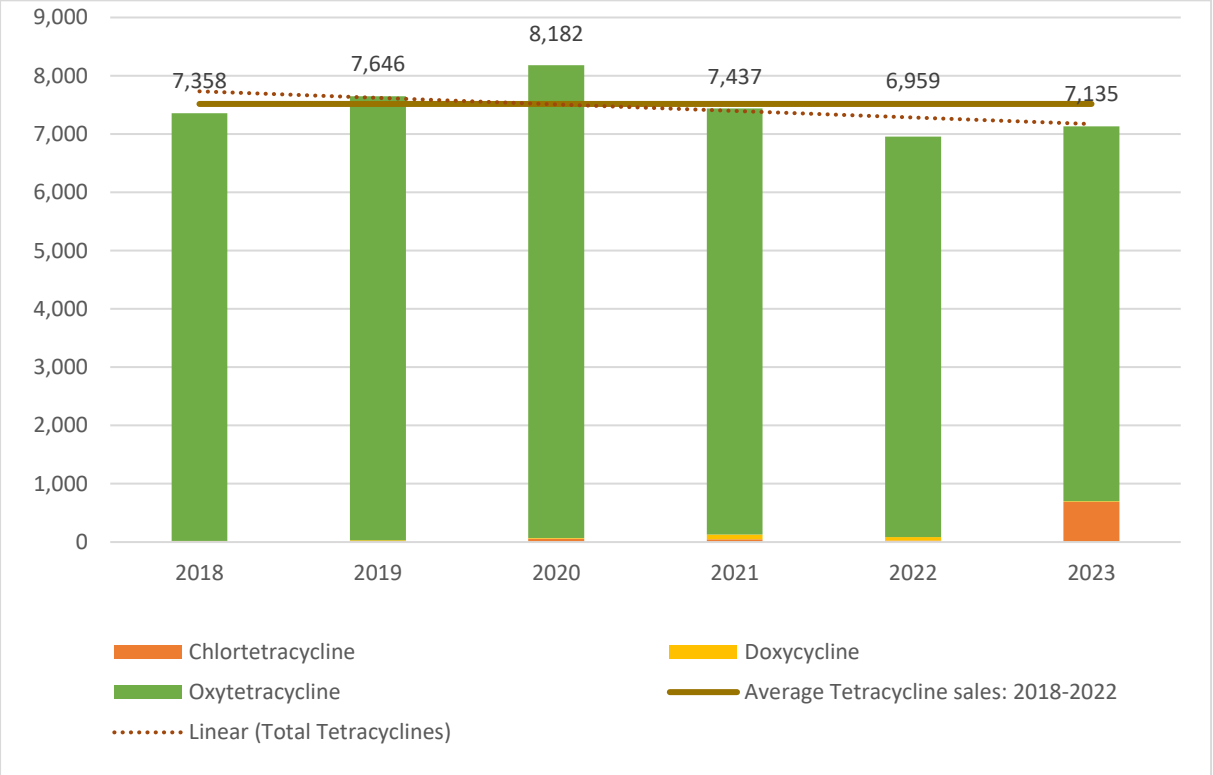


Figure 63: Total tetracyclines sales quantities 2018-2023 (in kilograms)



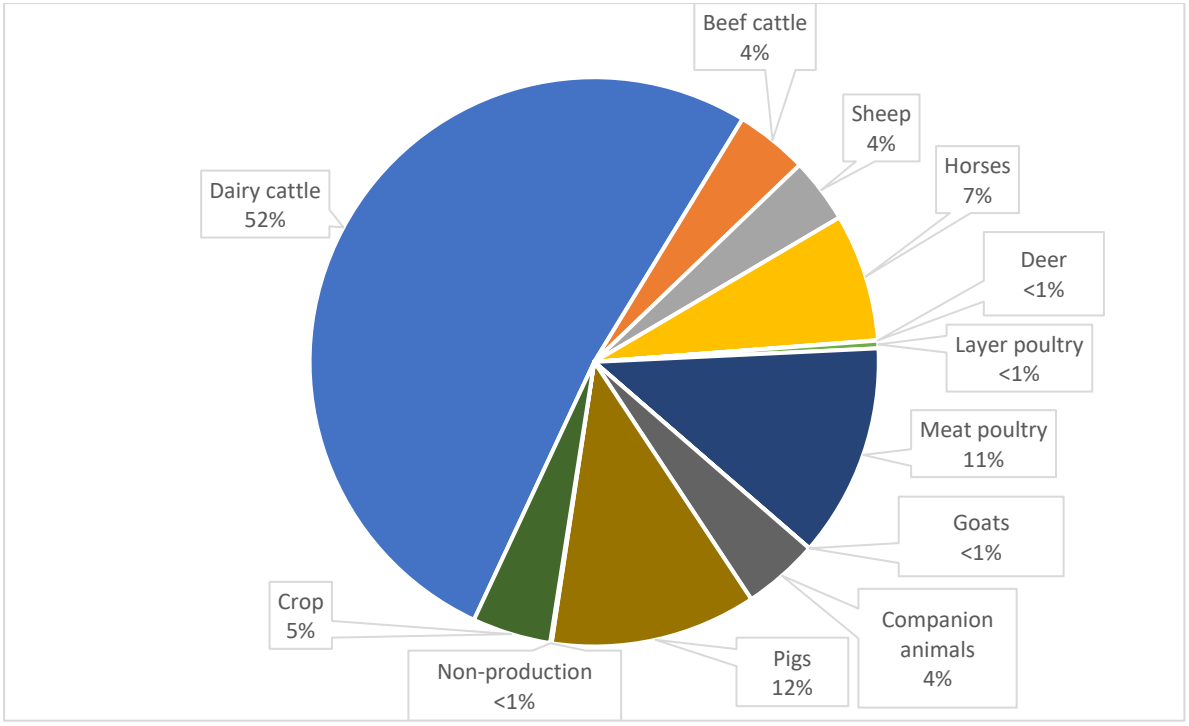
The amount of tetracyclines sold in 2023 was 5% below the average for the previous five years.

6 Veterinary antibiotic sales by species group or sector

6.1 General trends by species group or class

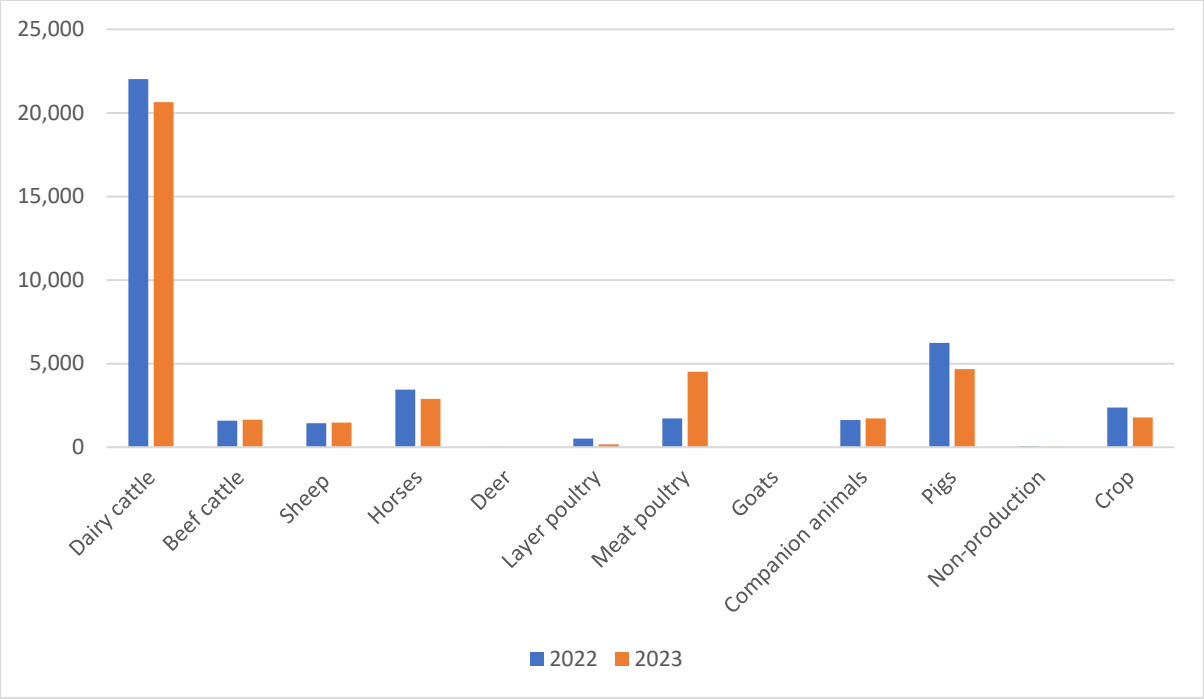
The proportions of sales for each species group in accordance with the approved uses and registrant estimates for each product are shown in Figure 65 below. Some products are approved for use in single species such as horse-specific products and others are sold for use in certain species or groups, such as pig- and poultry-specific products. There are however products approved for use in multi-species or multiple production species for which it is more difficult to discern intended use. For these products, veterinary medicine registrant companies have provided estimates of the proportions for each multi-species and multiple production species product to provide insight on how these products are likely to be used in practice. These estimates have been provided annually since 2020.

Figure 64: 2023 antibiotic sales quantities by species/sector including registrant estimates of use



Taking registrant estimates into consideration for multi-species and multi-production species products in addition to quantities sold in species-specific products, 52% of total sales were sold for use in dairy cattle, 12% sold for use in pigs, 7% sold for use in horses, 11% for use in meat poultry, 5% in crop protection, 4% in beef cattle, 4% in sheep, 4% in companion animals, with the remainder sold for use in layer poultry, goats, deer, and non-production animals.

Figure 65: Comparison of antibiotic sales quantities for 2022 and 2023 including registrant estimates of use (in kilograms)



The largest reductions in quantities for a particular species were observed for pigs 1,573 kg lower (25%) and dairy cattle 1,372 kg lower (6%). Total quantities also reduced for horses 543 kg lower (16%), layer poultry 338 kg lower (66%), and plant/crop use 591 kg lower (25%).

6.2 Dairy Cattle

6.2.1 Total antibiotic sales

The total quantity of antibiotics sold for use in dairy cattle was 20,647 kg, a reduction of 1,372 kg (6%) from 2022. The 2023 antimicrobial use (AMU) for dairy cattle was 6.49 mg/kg (mg of antibiotic per kg of liveweight biomass, see section 8 for AMU calculation and the appendix).

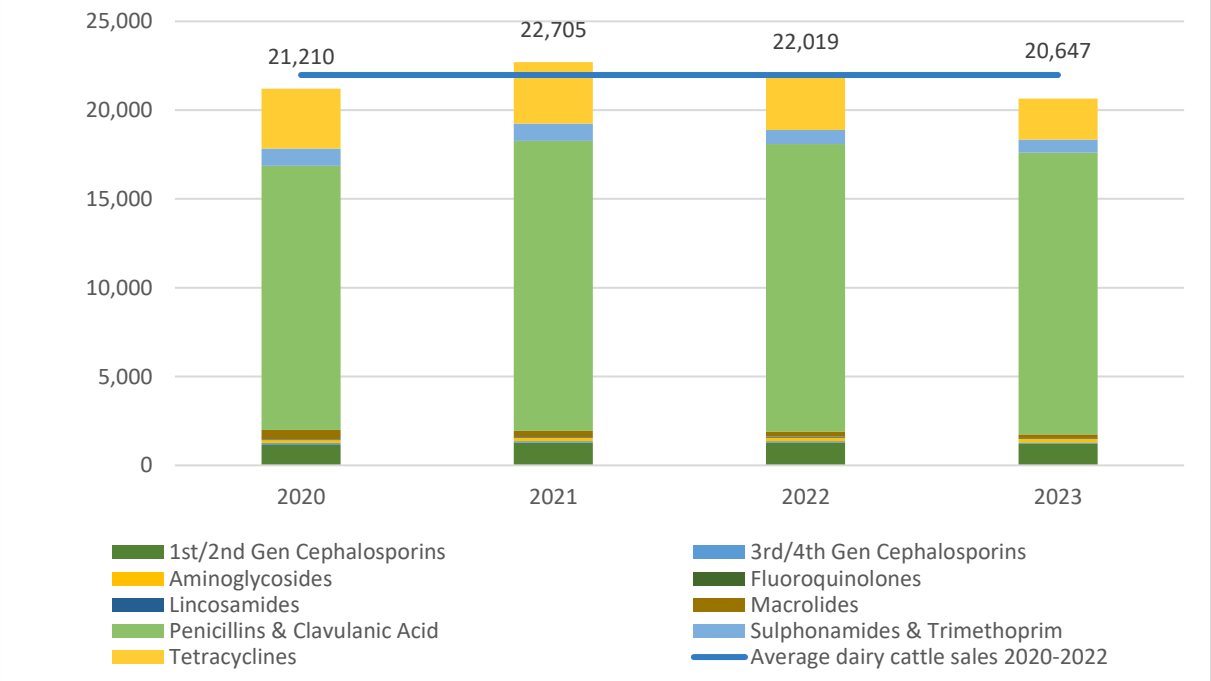
Total dairy antibiotic quantities are based on cattle specific products and registrants estimates of sales attributed to cattle in multiple production species products, and multi-species products.

Figure 66: Sales quantities of antibiotic classes sold for use in dairy cattle 2022-2023

Dairy cattle	2022	2023	Net change	Percentage change
1st/2nd generation cephalosporins	1,285.1 kg	1,230.7 kg	↓ 54.4 kg	↓ 4%
3rd/4th generation cephalosporins	74.1 kg	56.3 kg	↓ 17.8 kg	↓ 24%
Aminoglycosides	189.5 kg	215.7 kg	↑ 26.2 kg	↑ 14%
Fluoroquinolones	13.4 kg	7.9 kg	↓ 5.5 kg	↓ 41%
Lincosamides	46.4 kg	32.8 kg	↓ 13.6 kg	↓ 29 %
Macrolides	288.8 kg	191.6 kg	↓ 97.2 kg	↓ 34%
Penicillins & clavulanic acid	16,192.4 kg	15,867.5kg	↓ 324.9 kg	↓ 2%
Sulphonamides & trimethoprim	787.5 kg	740.9 kg	↓ 46.6 kg	↓ 6 %
Tetracyclines	3,142.0 kg	2,303.6 kg	↓ 838.4 kg	↓ 27%
Total sales	22,019.2 kg	20,647.0 kg	↓ 1,372.2 kg	↓ 6%

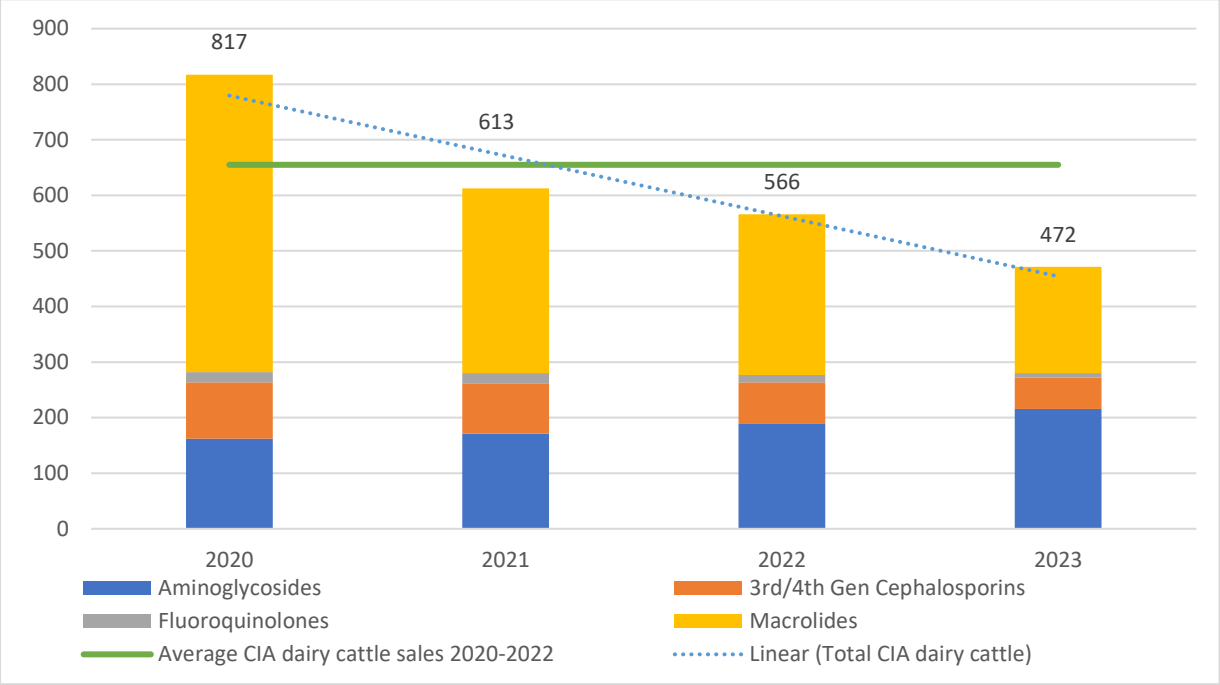
Sales quantities in 2023 were lower than the previous year for all classes except the aminoglycosides which had a 26 kg increase. The largest reductions in antibiotic sales quantities were for the tetracyclines (down 838 kg) and the penicillins and clavulanic acid (down 325 kg).

Figure 67: 2023 dairy cattle sales quantities compared to the previous three-year sales trends (in kilograms)



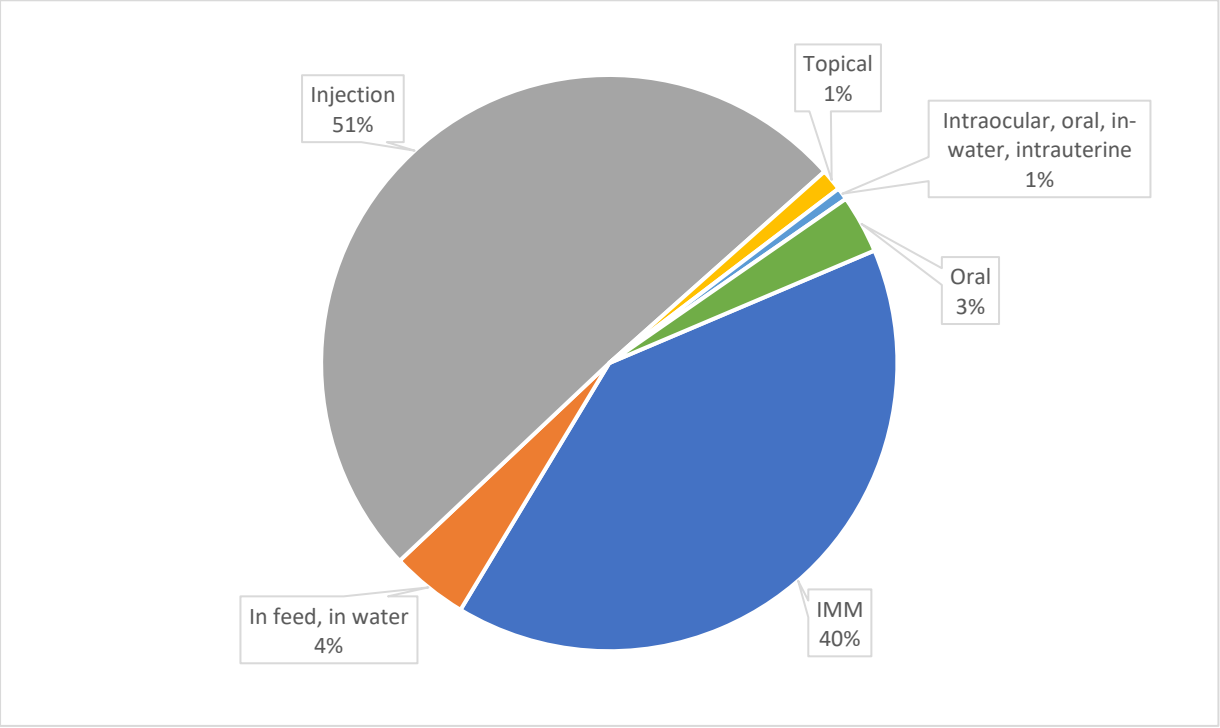
Total antibiotic sales quantities sold in dairy cattle were 6% below the average for the previous three years.

Figure 68: Critically important antibiotics used in dairy cattle 2020-2023



Total quantities of critically important antibiotics sold for use in dairy cattle were 28% below the average for the previous three years. The aminoglycoside class accounted for 46% and the macrolide class accounted for 40% of critically important antibiotics sold for use in dairy cattle in 2023.

Figure 69: Antibiotics sold for use in dairy cattle by administration method 2023

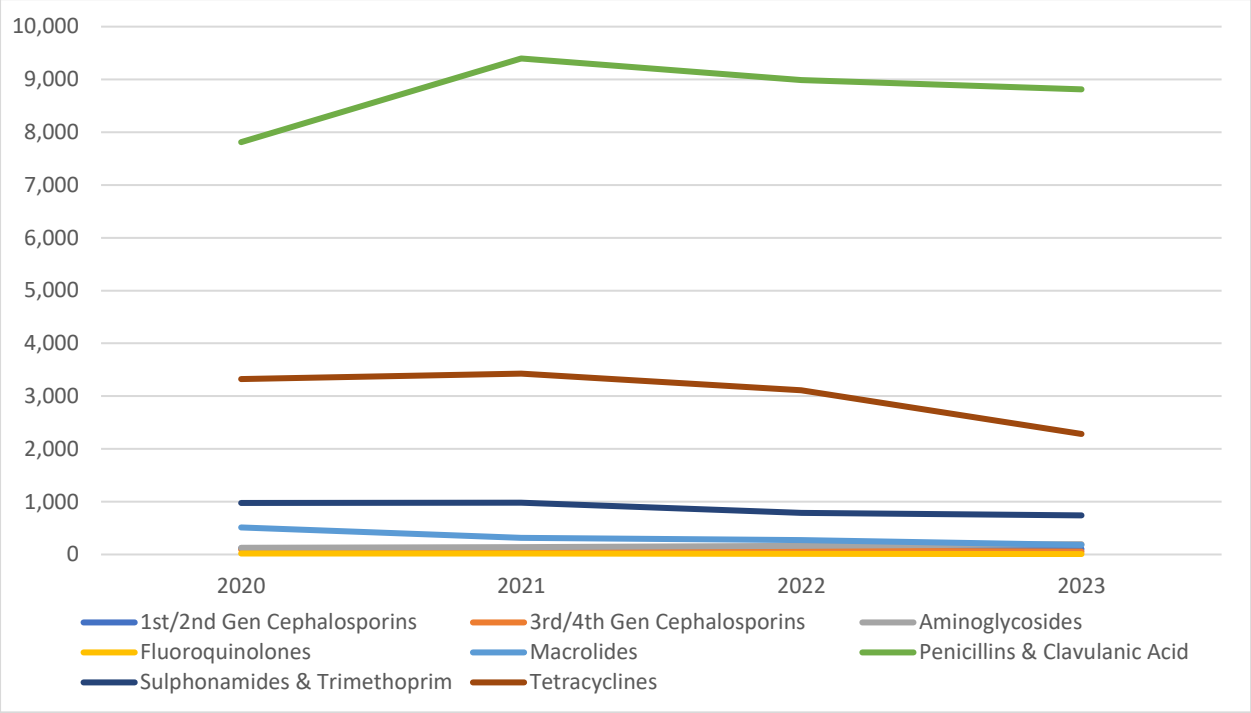


Forty percent of antibiotics sold for use in dairy cattle were administered by intramammary methods. The remainder were administered by injection (51%), orally, in feed, in water, topically, intrauterine, or intraocularly.

6.2.2 Cattle antibiotics (excluding intramammary products)

The total quantity of antibiotics contained in cattle products, excluding intramammary products, was 12,383 kg down 8% from 13,532 kg in 2022. Penicillins and clavulanic acid accounted for most of the quantity sold in 2023 with 8,814 kg. The tetracyclines accounted for 2,284 kg, the sulphonamide and trimethoprim class with 741 kg, aminoglycosides with 196 kg, first- and second-generation cephalosporins with 103 kg, macrolides with 182 kg (34% decrease from 2022), third- and fourth-generation cephalosporins with 56 kg, and the fluoroquinolones with 8 kg of sales.

Figure 70: Sales quantities of antibiotics used in cattle (excluding intramammary products) 2020-2023



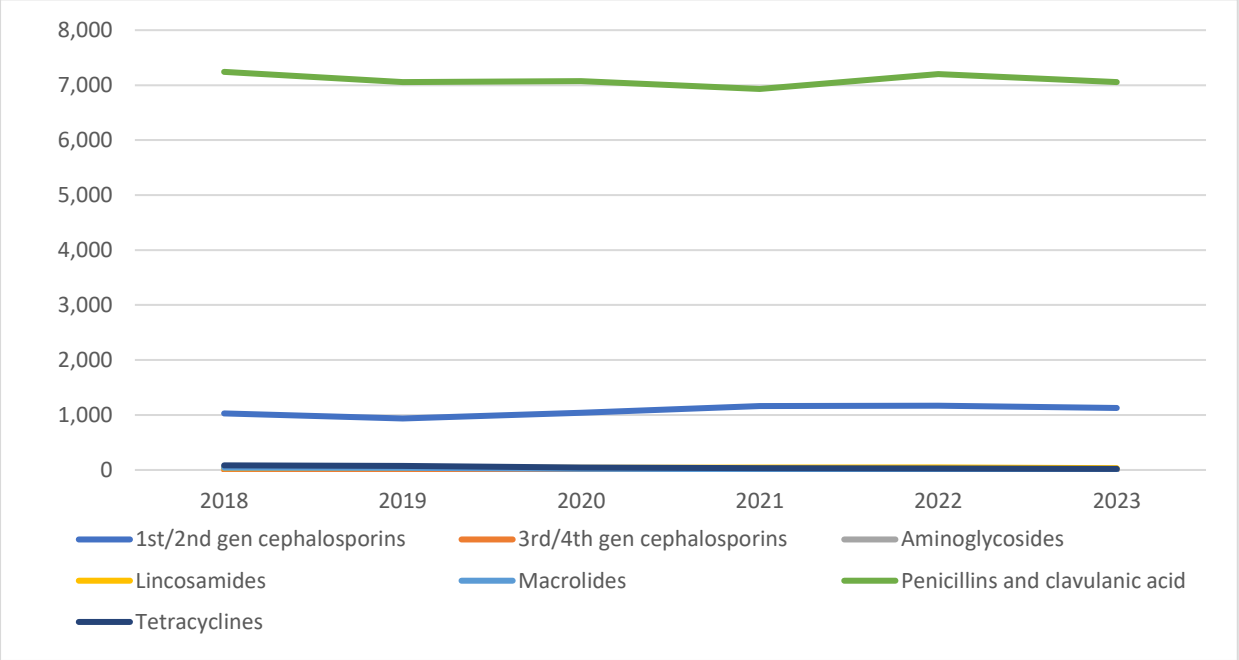
Sales quantities of all classes except aminoglycosides were lower in 2023 compared to the previous year, for dairy cattle (excluding intramammary products).

6.2.3 Overall intramammary sales

The total quantity of antibiotics contained in intramammary products decreased by 3% to 8,264 kg in 2023 compared to 8,487 kg in the previous year. The main contributors to lower sales were the penicillins and clavulanic acids which decreased by 2% from 7,202 kg to 7,053 kg and a 3% decrease in first- and second-generation cephalosporins from 1,169 kg to 1,128 kg. Both classes are found in DCT (dry cow therapy) and in LCT (lactating cow therapy) intramammary products.

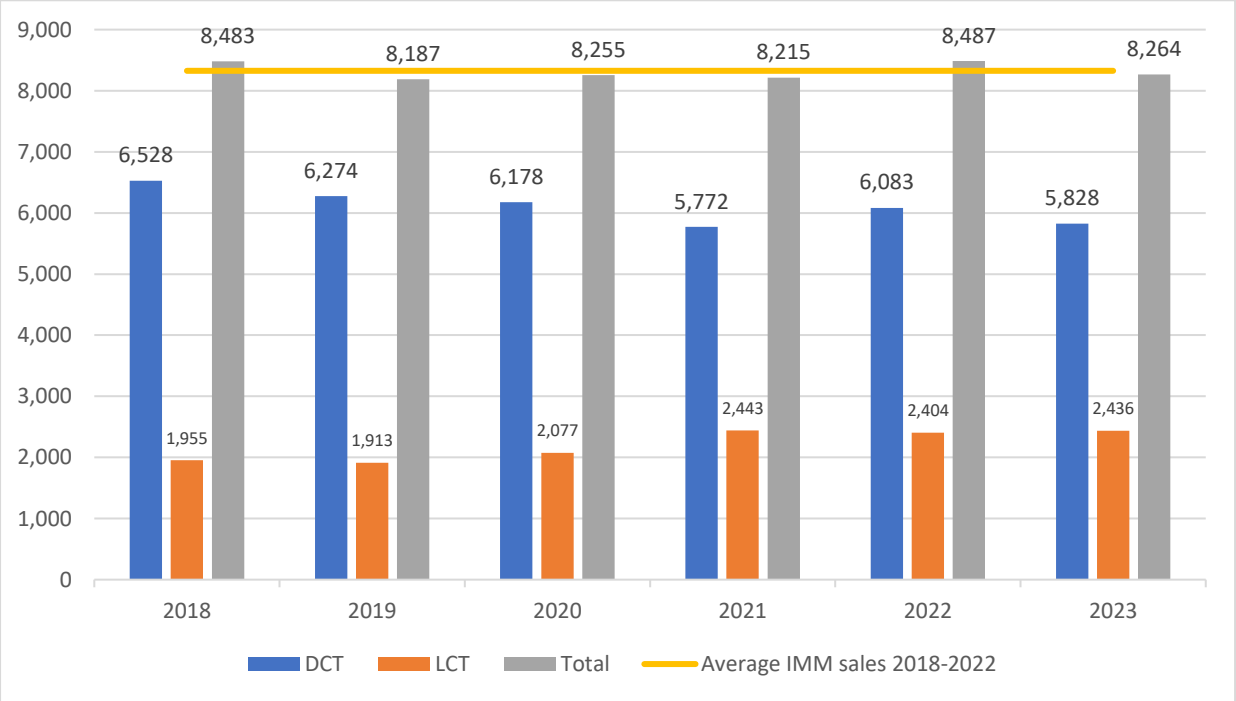
The total quantity of critically important antibiotics in intramammary products decreased to 30 kg from 42 kg in the previous year.

Figure 71: 2023 intramammary sales quantities compared to the previous five-year sales trends (in kilograms)



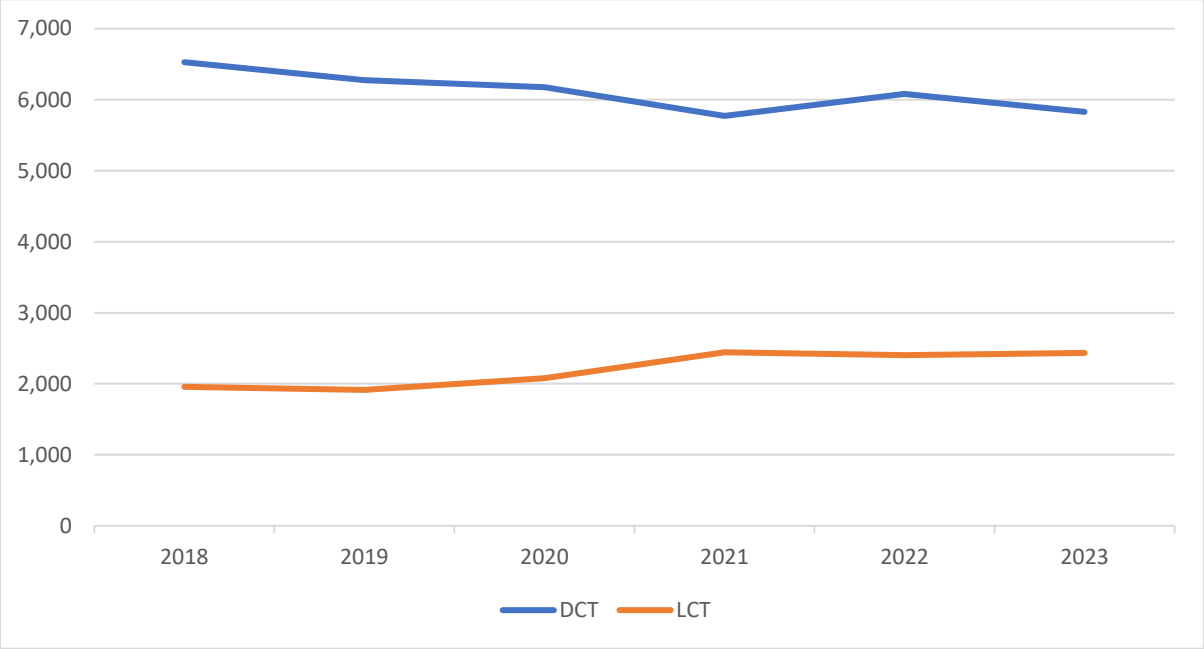
There were no intramammary products registered containing amphenicols, fluoroquinolones, fusidic acid, nitrofurans, nitroimidazoles, pleuromutilins, polypeptides, streptogramins, or sulphonamides and trimethoprim.

Figure 72: Total IMM sales quantities over time (in kilograms)



Total antibiotic sales in intramammary products were 0.7% less than the sales average for the previous five years.

Figure 73: DCT and LCT sales quantities (in kilograms) 2018-2023

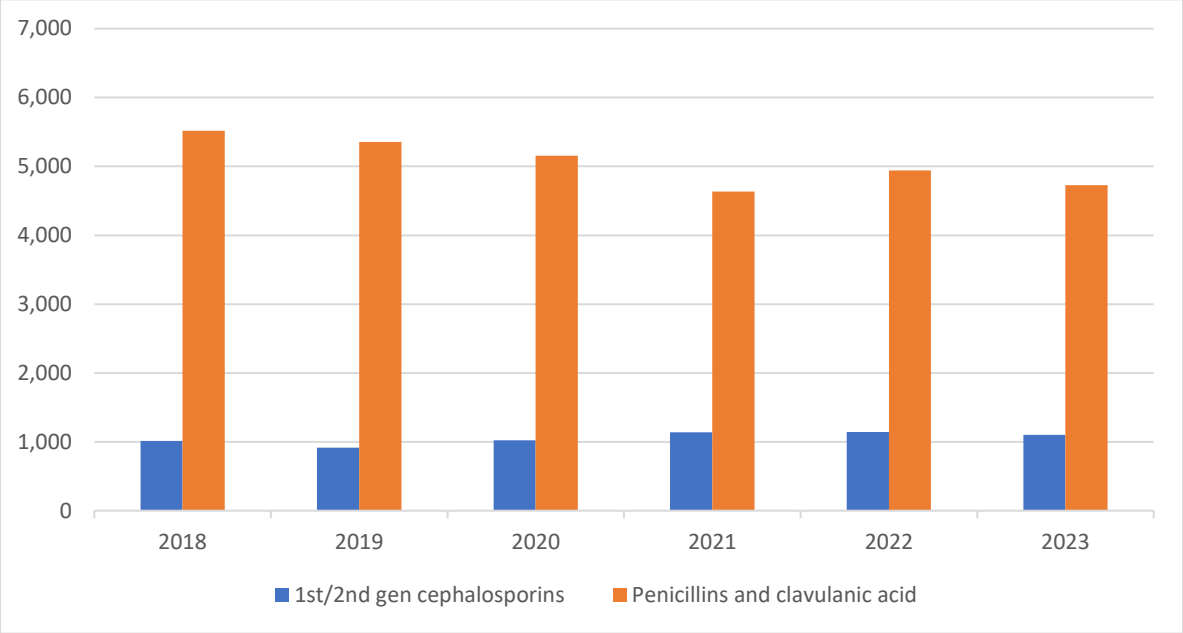


Dry cow therapy (DCT) treatments are used through the non-lactation period, whereas lactating cow therapy (LCT) treatments are administered during lactation. DCT accounted for 71% of the intramammary sales with LCT accounting for the remaining 29%. The proportion of DCT to LCT remained relatively unchanged from 2022 values of 72% DCT to 28% LCT.

6.2.4 Dry cow therapies (DCT)

Quantities of antibiotic contained in DCT products were 4% lower in 2023 at 5,828 kg with the main contributor being the penicillins and clavulanic acids which decreased by 215 kg (4%) to 4,726 kg following a 7% increase in the previous year. The penicillins and clavulanic acids accounted for 81% of sales in this group with an 5% decrease in ampicillin to 1,371 kg and a 4% decrease in cloxacillin to 3,355 kg. Sales of the first- and second-generation cephalosporins in DCT products decreased with quantities 41 kg (4%) lower at 1,101 kg. Cephalonium sales decreased by 4% to 904 kg and cephapirin remained relatively unchanged at 198 kg. There were no critically important antibiotics contained in DCT products.

Figure 74: DCT antibiotic sales quantities over time (in kilograms)

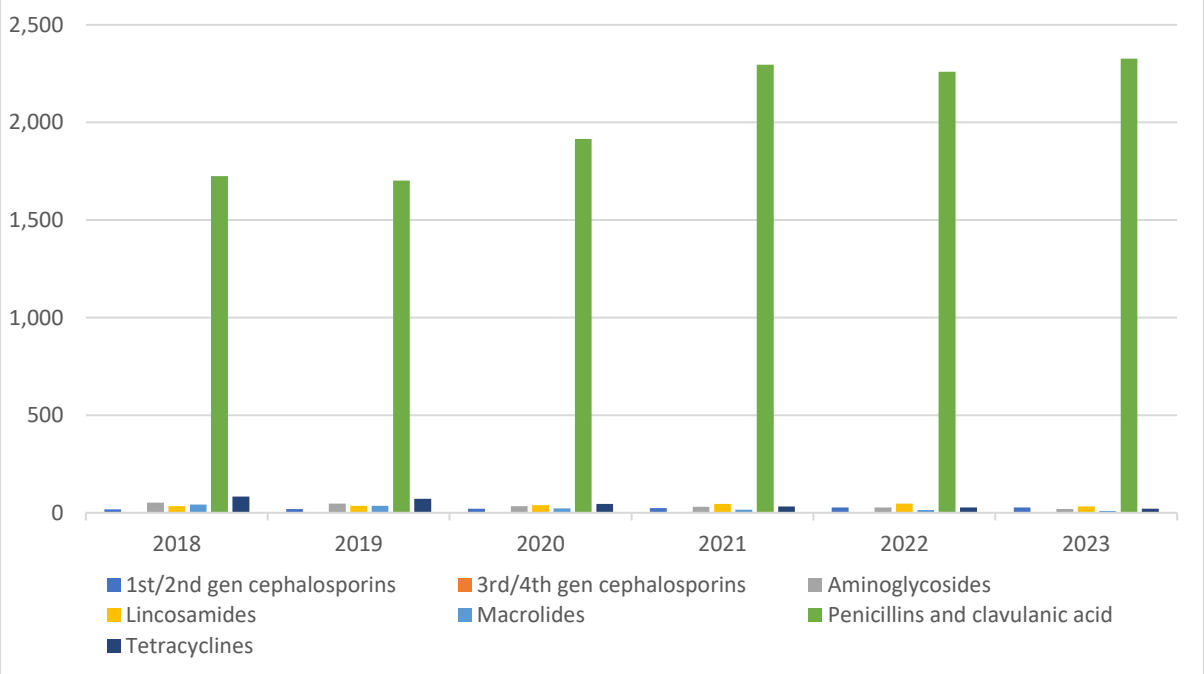


Sales of the penicillins and clavulanic acids were 14% less than the average for the previous five years whereas for the first- and second-generation cephalosporins volumes were 5% above the average.

6.2.5 Lactating cow therapies (LCT)

Overall LCT antibiotic quantities were 1% higher in 2023 at 2,436 kg largely due to a 67 kg increase in amounts of the penicillins and clavulanic acids to 2,327kg. Sales of the aminoglycosides decreased by 8 kg to 20kg, first- and second-generation cephalosporins remained unchanged at 27 kg, third- and fourth-generation cephalosporins decreased by 0.1 kg to 0.12 kg, lincosamides decreased by 14 kg to 33 kg, macrolides decreased by 4 kg to 10 kg, and tetracyclines decreased by 8 kg to 20 kg.

Figure 75: LCT sales quantities 2018-2023 (in kilograms)



6.3 Pigs

There were seven classes of antibiotics sold for use in pigs with a total sales quantity of 4,667 kg in 2023, down from 6,239 kg in 2022 representing a 25% decrease. Sales were again dominated by the tetracyclines and macrolides as in previous years. The 2023 AMU for pigs was 99.84 mg/kg (mg of antibiotic per kg of liveweight biomass, see section 8 for AMU calculation and the appendix).

Total pig antibiotic quantities are based on registrants estimates of sales attributed to pigs in pig- and poultry-specific products, multiple production species products, and multi-species products.

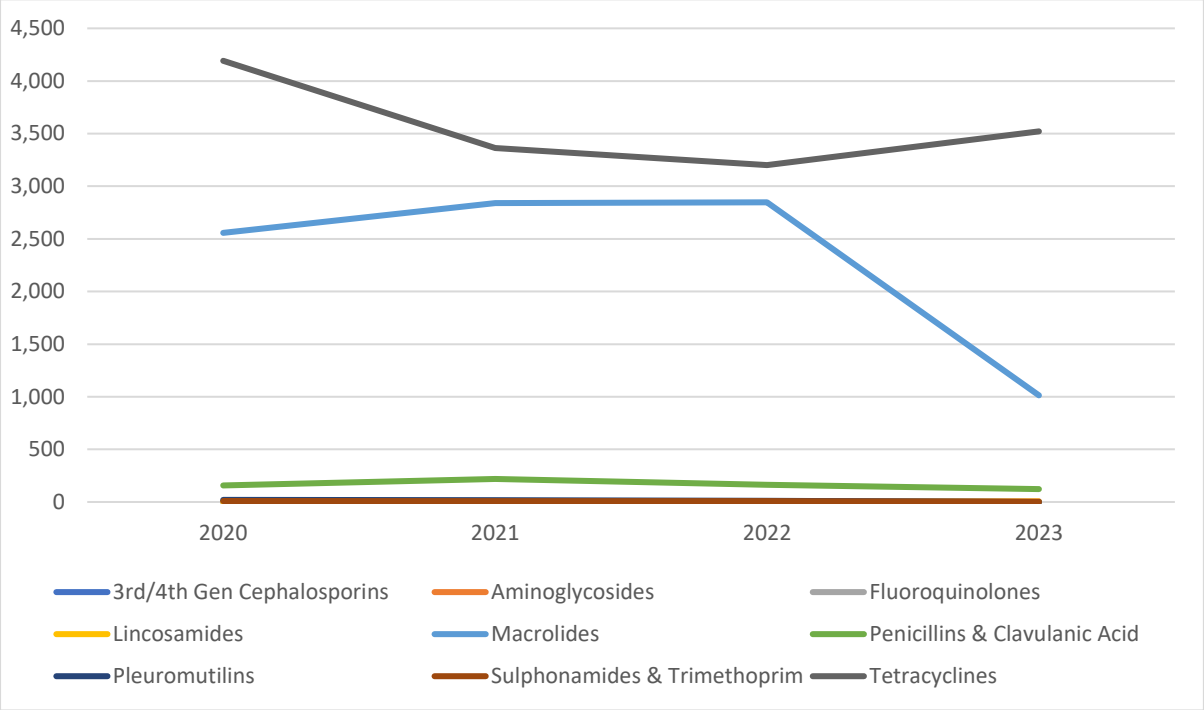
Figure 76: Sales quantities of antibiotic classes sold for use in pigs 2022-2023

Pigs	2022	2023	Net change	Percentage change
3rd/4th generation cephalosporins	2.3 kg	0.1 kg	↓ 2.2 kg	↓ 94
Aminoglycosides	6.5 kg	6.7 kg	↑ 0.2 kg	↑ 3%
Fluoroquinolones	0.005kg	0.008 kg	↑ 0.003 kg	N/A
Lincosamides	3.2 kg	3.3 kg	↑ 0.1 kg	↑ 3 %
Macrolides	2,847.2 kg	1,013.0 kg	↓ 1,834.2 kg	↓ 64%
Penicillins & clavulanic acid	161.8 kg	122.7 kg	↓ 39.1 kg	↓ 24%
Pleuromutilins	10.2 kg	0.0 kg	↓ 10.2 kg	N/A
Sulphonamides & trimethoprim	7.4 kg	0.0 kg	↓ 7.4 kg	N/A
Tetracyclines	3,200.7 kg	3,520.7 kg	↑ 320.0 kg	↑ 10%
Total sales	6,239.3 kg	4,666.5 kg	↓ 1,572.8 kg	↓ 25%

The largest changes in pig antibiotic sales quantities in 2023 were due to a 64% decrease in macrolide sales (specifically tylosin), and a 10% increase in tetracycline sales. Ninety nine percent of critically important antibiotics used in pigs were in the macrolide class, with small quantities of third- and fourth-generation cephalosporins, aminoglycosides, and fluoroquinolones attributed for use in pigs based on registrant estimates. There were no sales for the pleuromutilins or sulphonamide and trimethoprim classes attributed for use in pigs based on registrant estimates in 2023.

New Zealand Pork commented that the reduction in tylosin sales was due to lesser disease challenges experienced on-farm in 2023. A small amount of the combination of sulphonamides and trimethoprim was probably used as an injectable treatment for scours in piglets and foot infections in sows during 2023, despite no sales of these products attributed to pigs based on registrant estimates. New Zealand Pork was not aware of any third- and fourth-generation cephalosporins used in pigs during 2023.

Figure 77: Total pig antibiotic sales quantities compared to the previous three-year sales trends (in kilograms)



Following the overall decrease in total antibiotics sold for use in pigs, the percentage share for the tetracyclines increased from 51% to 75% while macrolides decreased from 46% to 22% compared to the previous year.

Figure 78: Sales quantities of antibiotic classes sold for use in pigs 2023

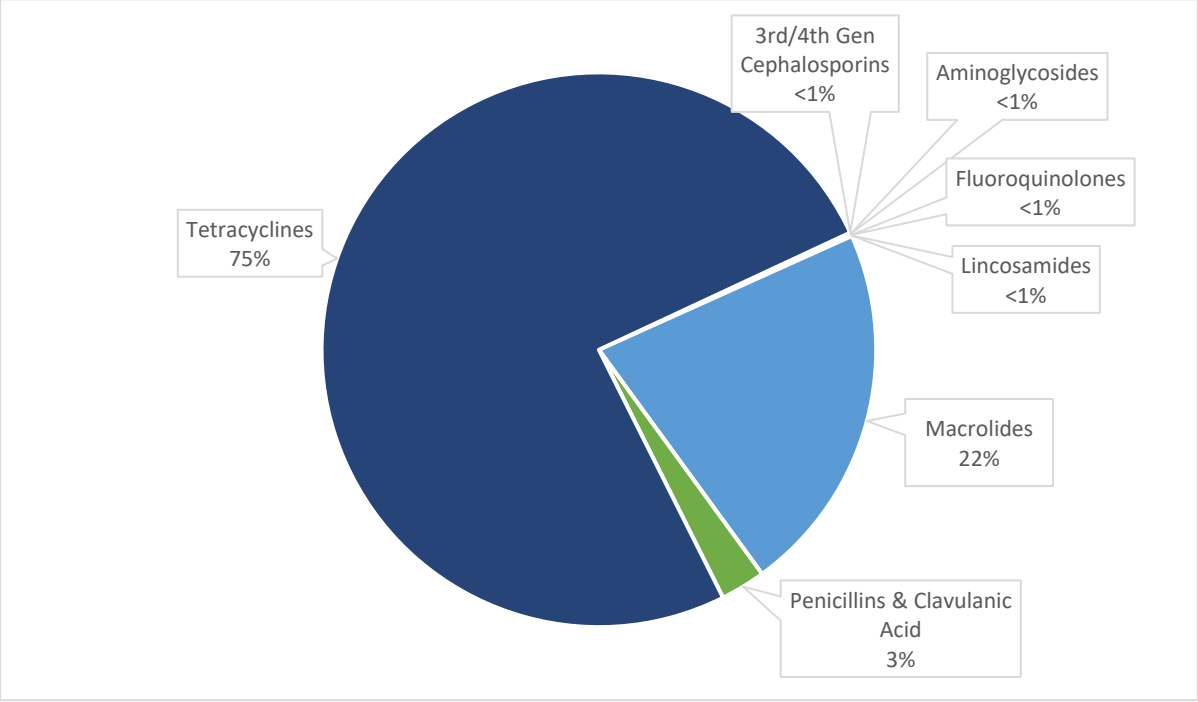
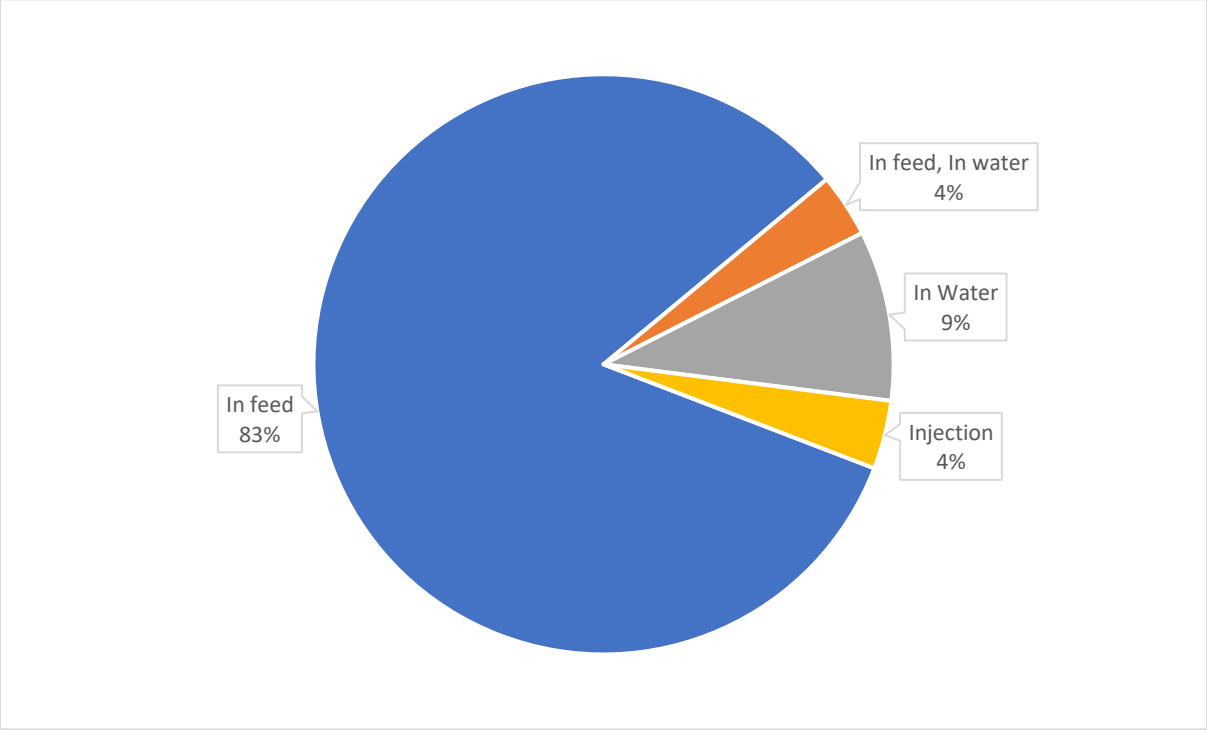
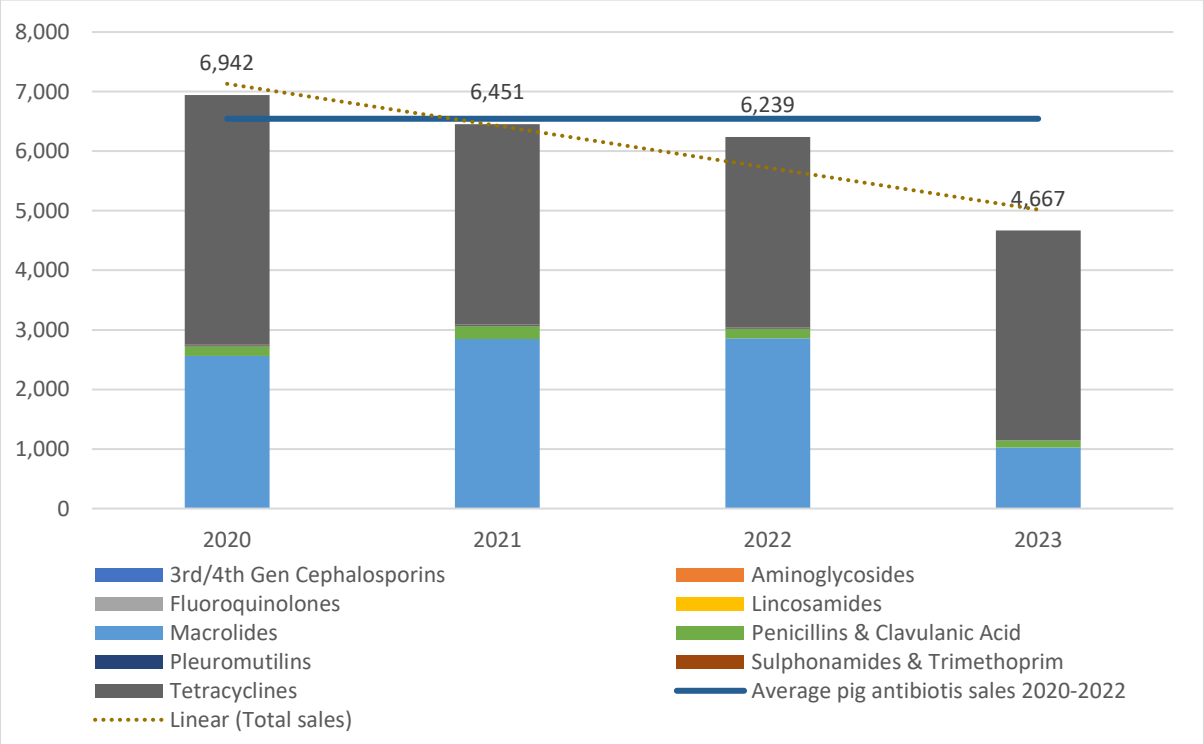


Figure 79: Antibiotics sold for use in pigs by administration method 2023



In-feed was the most common route of administration in pigs increasing to 83% in 2023, from 74% in 2022.

Figure 80: Total antibiotic sales quantities in pigs 2020-2023 (in kilograms)



Total antibiotic sales in pigs were 29% below the average for the previous three years.

6.4 Poultry

The quantity of antibiotics sold for layer poultry declined by 66% in 2023 to a total of 173 kg. The quantity of antibiotics sold for meat poultry was 4,507 kg, an increase of 161% compared to 2022. No sales data was provided for dimetridazole, a nitroimidazole used in meat poultry.

The 2023 AMU for layer poultry was 16.31 mg/kg, AMU for meat poultry was 37.71 mg/kg. (mg of antibiotic per kilogram of liveweight biomass, see section 8 for AMU calculation and the appendix).

Total poultry antibiotic quantities are based on registrants estimates of sales attributed to poultry in pig- and poultry-specific products, multiple production species products, and multi-species products.

In 2023 tylosin (macrolide) and spectinomycin (aminoglycoside) were the only critically important antibiotics attributed by registrant estimates for use in layer poultry. There were no critically important antibiotics attributed by registrant estimates for use in meat poultry.

Figure 81: Sales quantities of antibiotic classes sold for use in layer poultry 2022-2023

Layer poultry	2022	2023	Net change	Percentage change
Aminoglycosides	6.5 kg	6.7 kg	↑ 0.2 kg	↑ 3%
Lincosamides	3.2 kg	3.3 kg	↑ 0.1 kg	↑ 3 %
Macrolides	397.5 kg	33.8 kg	↓ 363.7 kg	↓ 92%
Pleuromutilins	91.4 kg	79.5 kg	↓ 11.9 kg	↓ 13%
Tetracyclines	12.0 kg	49.2 kg	↑ 37.2 kg	↑ 309%
Total sales	510.6 kg	172.5 kg	↓ 338.1 kg	↓ 66%

The main contributor to the decrease of total antibiotics used in layer poultry was due to a reduction in sales quantities for macrolides.

Figure 82: Sales quantities of antibiotic classes sold for use in meat poultry 2022-2023

Meat poultry	2022	2023	Net change	Percentage change
Macrolides	169.8 kg	0.0 kg	↓ 169.8 kg	↓ 100%
Nitroimidazoles	8.4 kg	N/A	N/A	N/A
Polypeptides	1,485 kg	3,882.2 kg	↑ 2,397.2 kg	↑ 161%
Tetracyclines	60.2 kg	625.1 kg	↑ 564.9 kg	↑ 938%
Total sales	1,723.4 kg	4,507.3 kg	↑ 2,783.9 kg	↑ 161%

Most of the increase in meat poultry sales quantities was due to an increase in zinc bacitracin. Zinc bacitracin volumes may fluctuate year to year due to varying quantities of stock carried over from the previous sales period, or due to disease outbreaks in breeder flocks.

Poultry Industry Association New Zealand (PIANZ) commented that infection with *Enterococcus cecorum* was an emerging issue in meat poultry in 2023, which may have required an increase in antibiotic use.

PIANZ commented that small amounts of tylosin may have been used in meat poultry in 2023, despite no sales attributed to meat poultry based on registrant estimates.

Figure 83: Comparison of sales totals for layer poultry and meat poultry 2020-2023

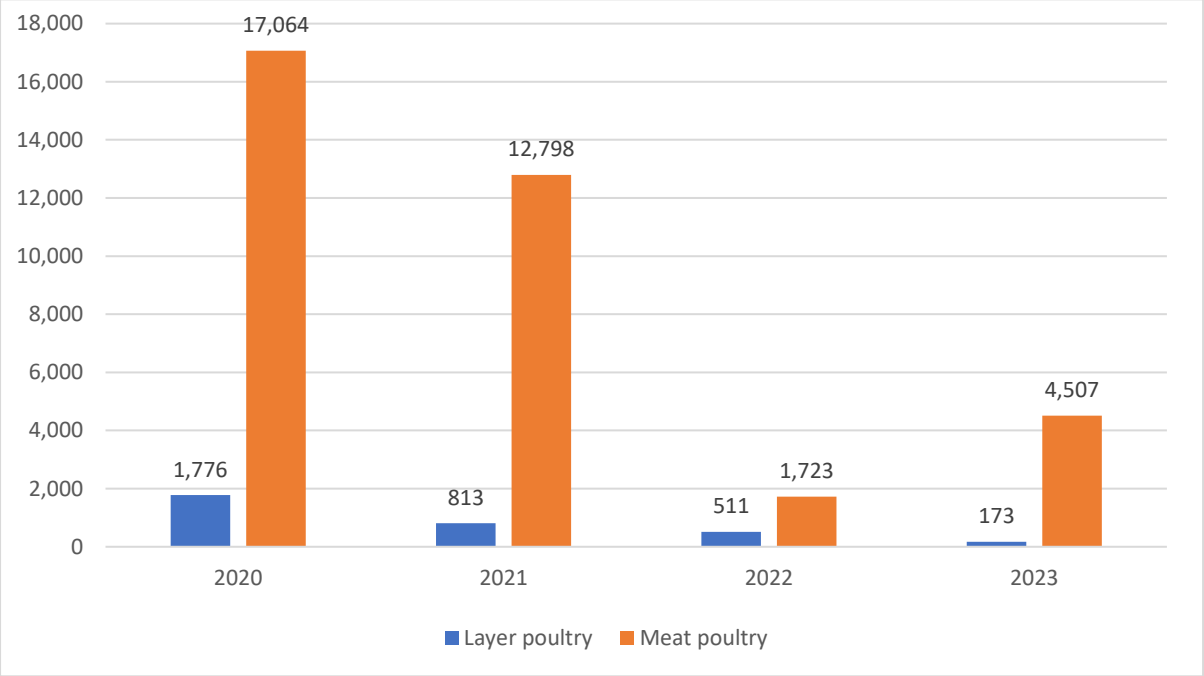
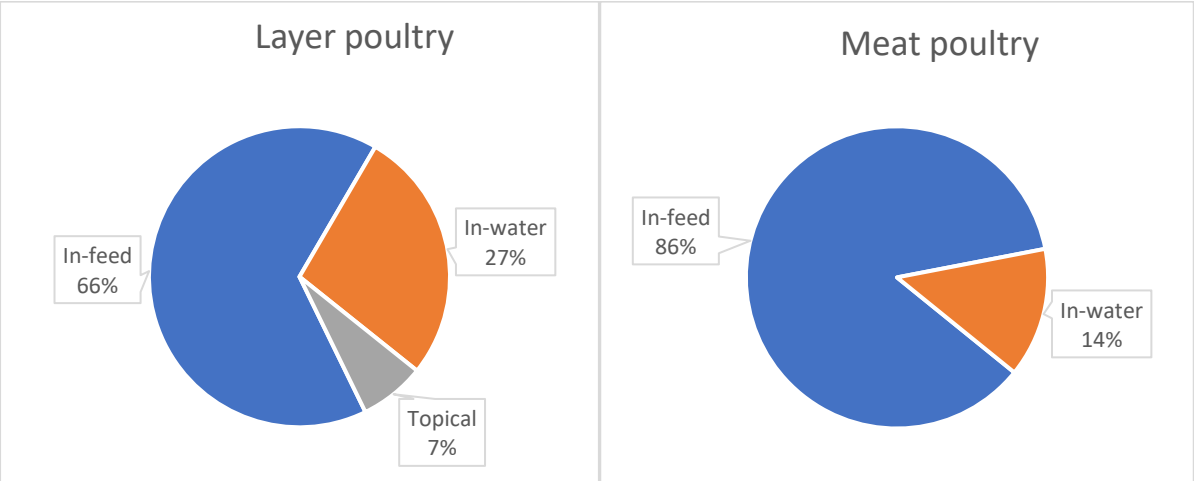


Figure 84: Antibiotic administration methods for layer poultry and meat poultry 2023



6.5 Horses

Overall sales of antibiotics for use in horses decreased by 16% to 2,893 kg in 2023 down from 3,436 kg in 2022. The contribution to total antibiotic sales decreased from 8% to 7%. The 2023 AMU for horses was 42.66 mg/kg (mg of antibiotic per kg of liveweight biomass, see section 8 for AMU calculation and the appendix).

Total horse antibiotic sales are based on totals of horse-specific products and registrants estimates of sales attributed to horses in multiple production species products or multi-species products.

Figure 85: Sales quantities of antibiotic classes sold for use in horses 2022-2023

Horses	2022	2023	Net change	Percentage change
Aminoglycosides	53.7 kg	54.9kg	↑ 1.2 kg	↑ 2 %
3rd/4th generation cephalosporins	21.2 kg	17.5 kg	↓ 3.7 kg	↓ 18%
Penicillins & clavulanic acid	291.0 kg	294.4 kg	↑ 3.4 kg	↑ 1%
Polypeptides	0.03 kg	0.0 kg	↓ 0.03 kg	↓ 100%
Streptogramins	6.8 kg	6.6 kg	↓ 0.2 kg	↓ 3%
Sulphonamides & trimethoprim	3,035.9 kg	2,476.0 kg	↓ 559.9 kg	↓ 18%
Tetracyclines	27.3 kg	43.3 kg	↑ 16.0 kg	↑ 59%
Total sales	3,435.9 kg	2,892.7 kg	↓ 543.2 kg	↓ 16%

Ceftiofur, gentamicin, and neomycin were the only critically important antibiotics sold for use in horses in 2023, with no sales for polymyxin.

Figure 86: Critically important antibiotics sold for use in horses 2020-2023

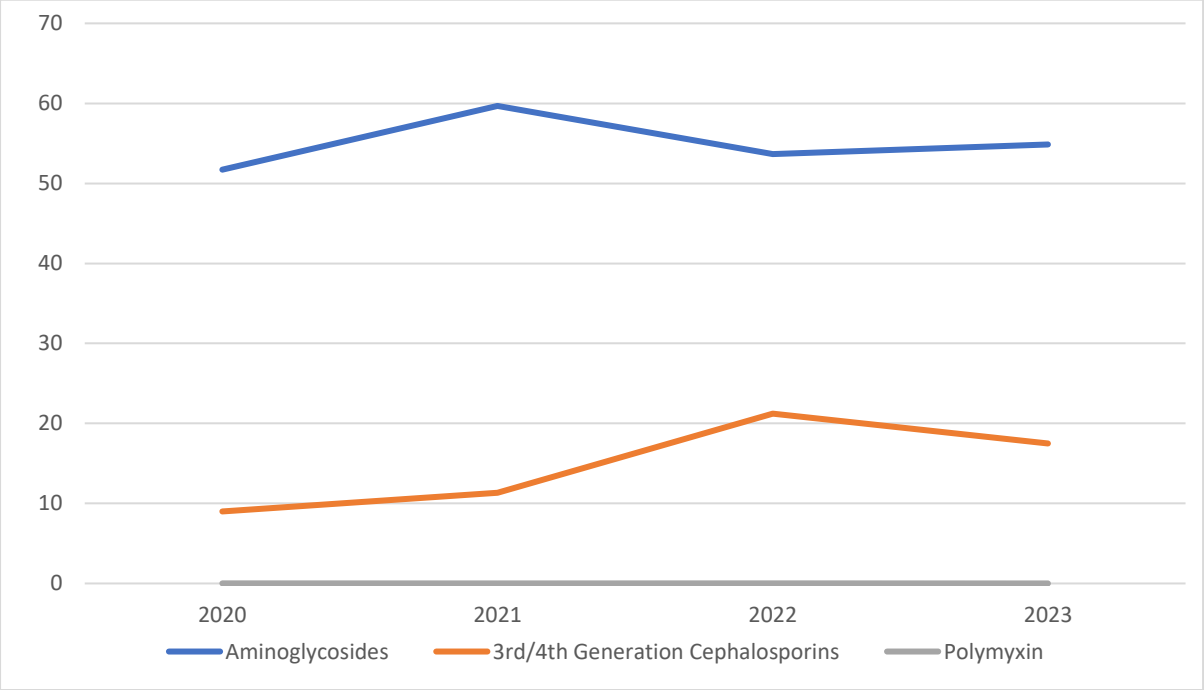


Figure 87: Antibiotics sold for use in horses by administration methods 2023

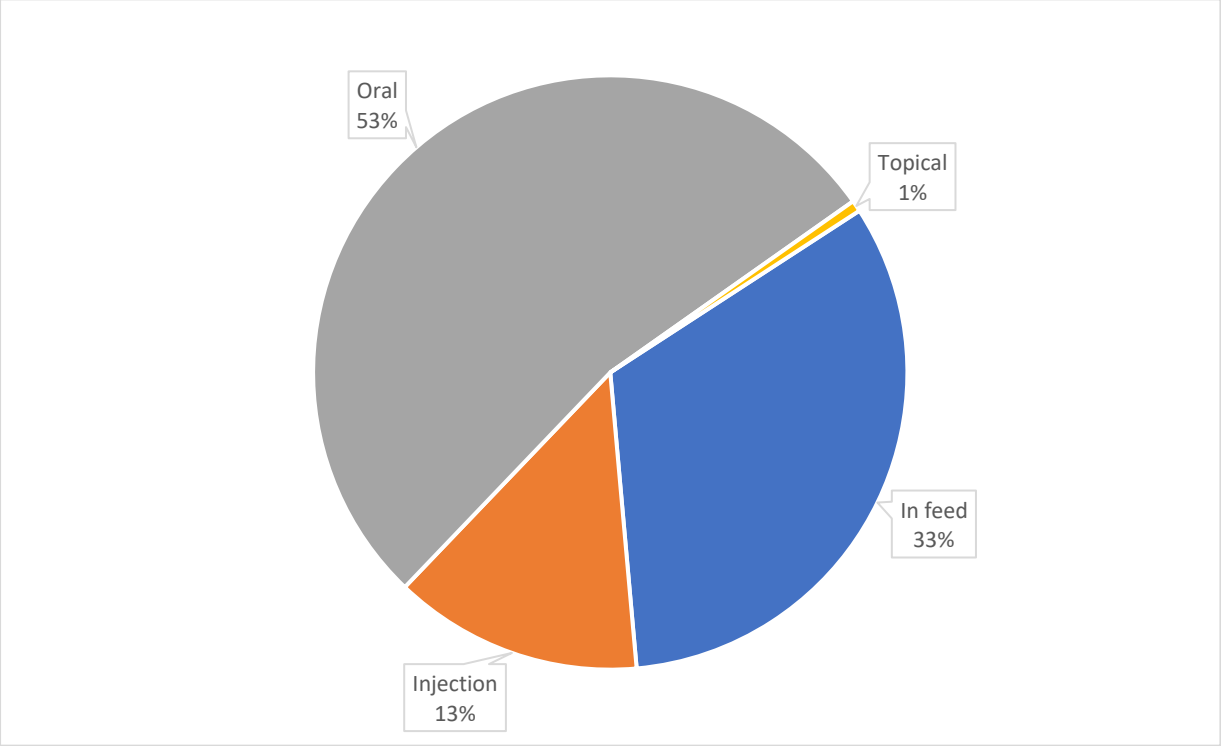
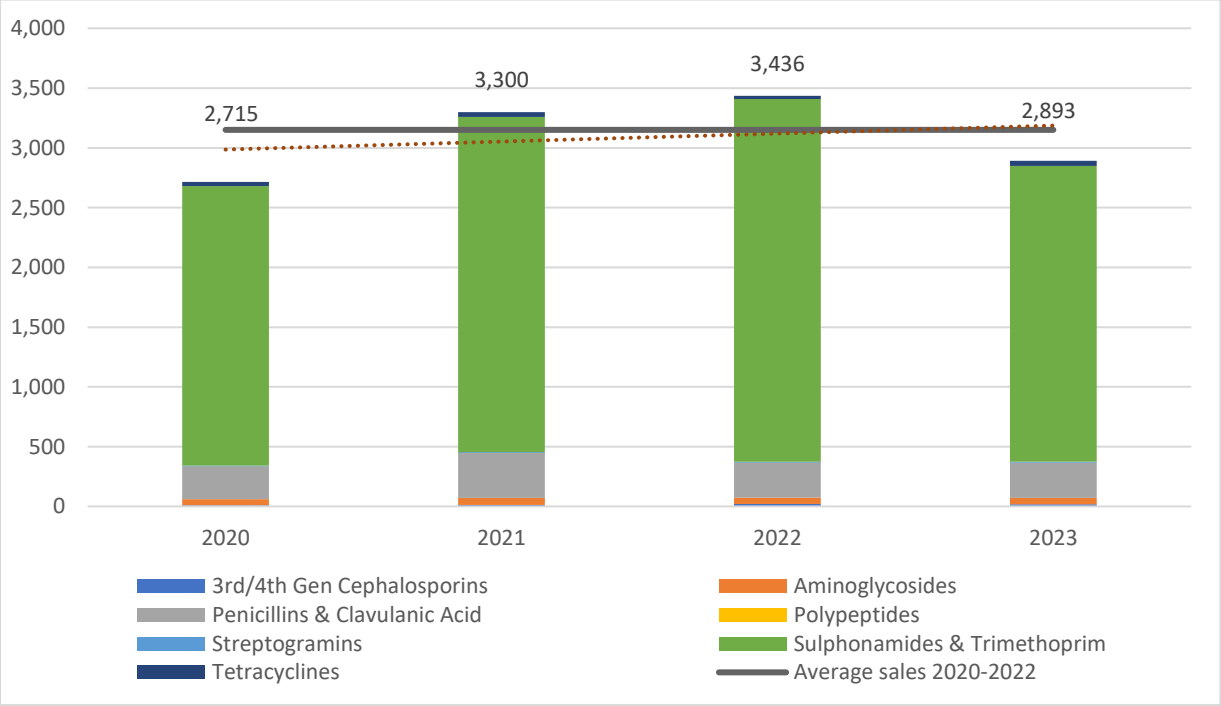


Figure 88: Total antibiotic sales in horses 2020-2023 (in kilograms)



Total sales of antibiotics used in horses were 8% below the average for the previous three years.

6.6 Beef cattle and sheep

The reported sales total for beef cattle was 1,639 kg, an increase of 3% since 2022. The total sales quantity for sheep was 1,472 kg, an increase of 3% since 2022.

The 2023 antimicrobial use (AMU) for beef cattle was 1.10 mg antibiotic per kg of liveweight biomass. The 2023 antimicrobial use (AMU) for sheep was 1.04 mg antibiotic per kg of liveweight biomass (See section 8 for AMU calculation and appendix 1).

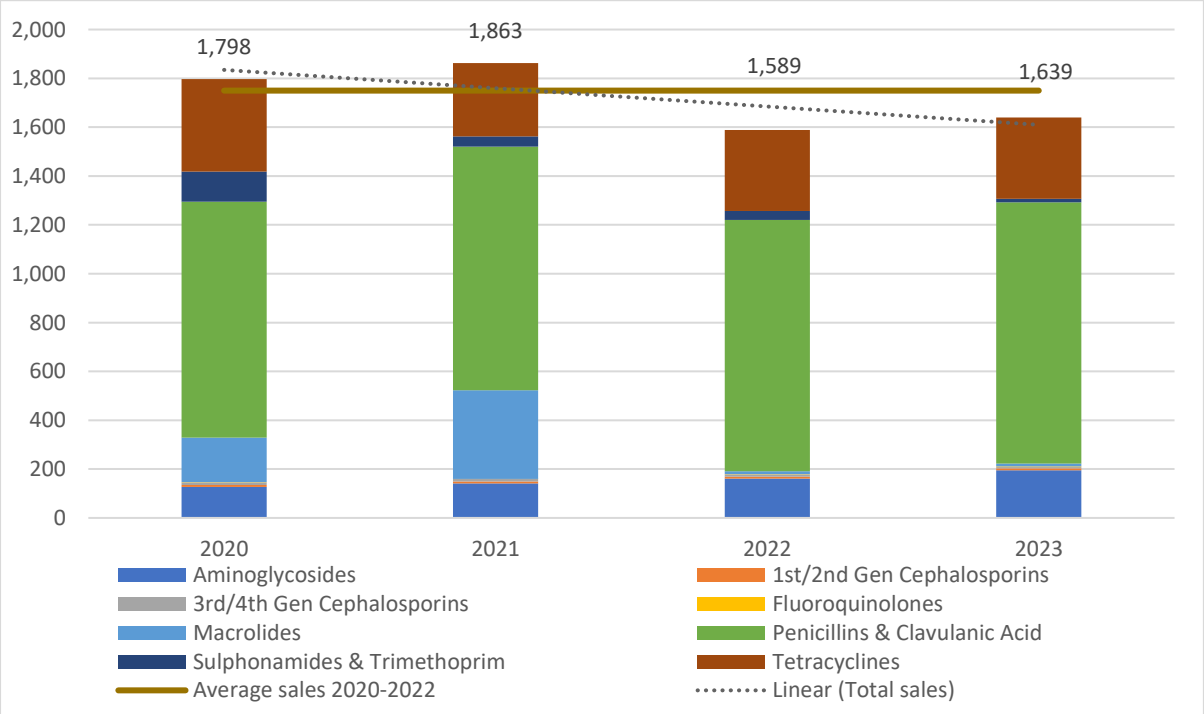
The total sales of antibiotics for cattle and sheep are based on sales of cattle and sheep only products, and registrants estimates of sales attributed in cattle and sheep in multiple production species products and multi- species products.

Figure 89: Sales quantities of antibiotic classes sold for use in beef cattle 2022-2023

Beef cattle	2022	2023	Net change	Percentage change
Aminoglycosides	161.4 kg	195.8 kg	↑ 34.4 kg	↑ 21%
1st/2nd Gen Cephalosporins	8.1 kg	6.8 kg	↓ 1.3 kg	↓ 17%
3rd/4th Gen Cephalosporins	8.5 kg	5.9 kg	↓ 2.6 kg	↓ 31%
Fluoroquinolones	1.8 kg	1.8 kg	0.0 kg	0%
Macrolides	11.3 kg	12.4 kg	↑ 1.1 kg	↑ 10%
Penicillins & Clavulanic Acid	1,028.5 kg	1,070.1 kg	↑ 41.6 kg	↑ 4%
Sulphonamides & Trimethoprim	37.4 kg	14.6 kg	↓ 22.8 kg	↓ 61%
Tetracyclines	331.9 kg	331.8 kg	↓ 0.1 kg	↓ 0.03%
Total sales	1,588.9 kg	1,639.2 kg	↑ 50.3 kg	↑ 3%

The sales quantity of critically important antibiotics in beef cattle increased by 18% to 216 kg in 2023.

Figure 90: Sales quantities of antibiotics sold for use in beef cattle 2020-2023



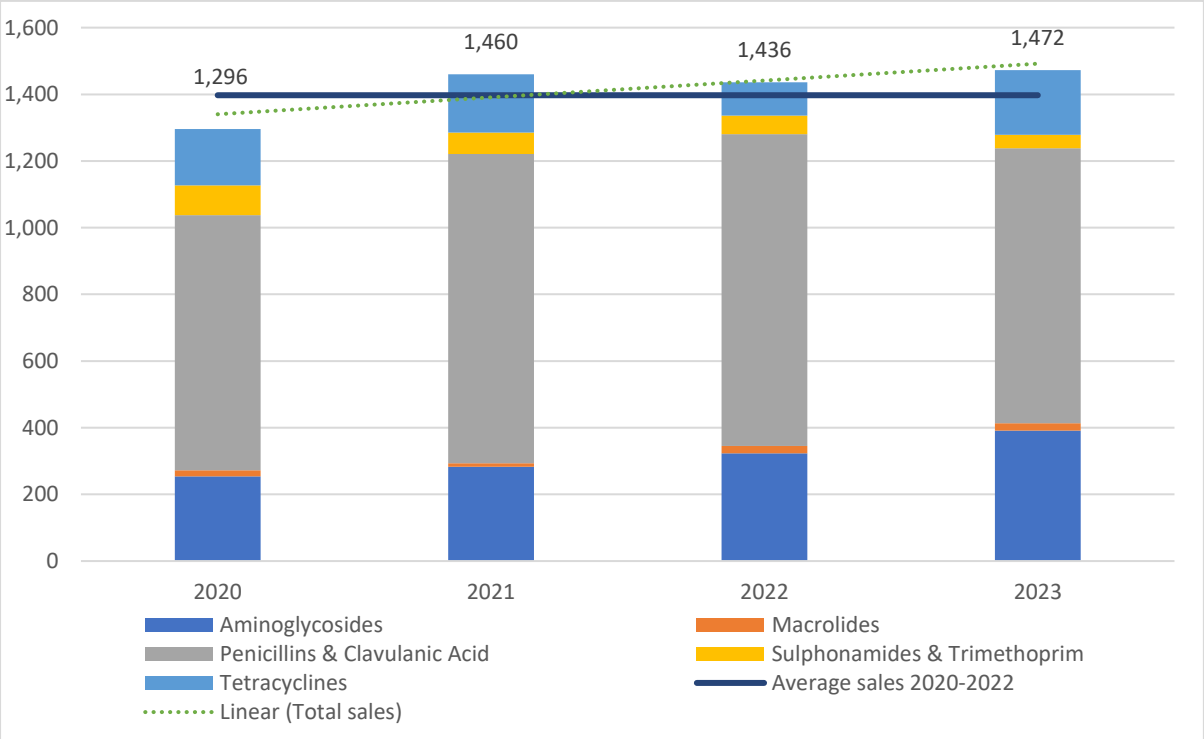
Total sales of antibiotics used in beef cattle were 6% below the average for the previous three years.

Figure 91: Sales quantities of antibiotic classes sold for use in sheep 2022-2023

Sheep	2022	2023	Net change	Percentage change
Aminoglycosides	322.8 kg	391.5 kg	↑ 68.7 kg	↑ 21%
Macrolides	22.6 kg	22.0 kg	↓ 0.6 kg	↓ 3%
Penicillins & Clavulanic Acid	935.4 kg	824.4 kg	↓ 111.0 kg	↓ 12%
Sulphonamides & Trimethoprim	55.8 kg	40.1 kg	↓ 15.7 kg	↓ 28%
Tetracyclines	99.4 kg	194.3 kg	↑ 94.9 kg	↑ 96%
Total sales	1,436.0 kg	1,472.3 kg	↑ 36.3 kg	↑ 3%

The sales quantity of critically important antibiotics sold for use in sheep increased by 20% to 414 kg mainly due to an increase in the sales of aminoglycosides.

Figure 92: Sales quantities of antibiotics sold for use in sheep 2020-2023



Total sales of antibiotics used in sheep were 5% above the average for the previous three years.

6.7 Companion animal and non-production species products

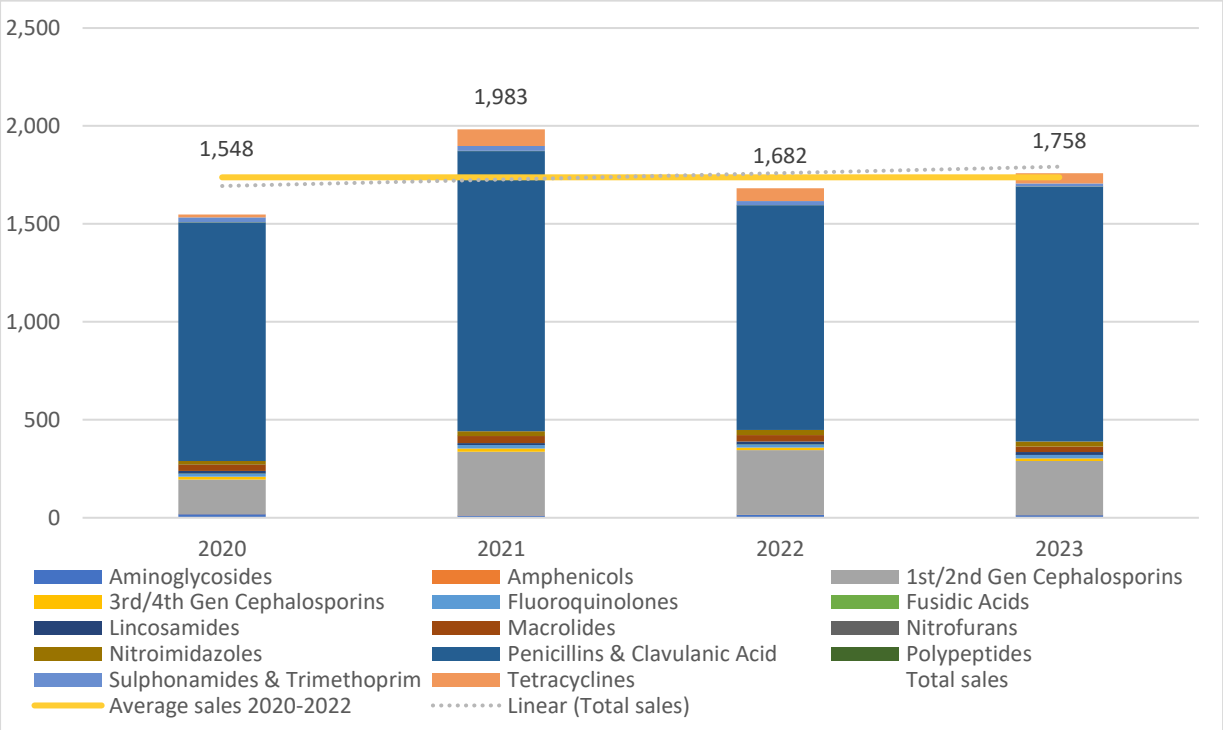
Sales quantities of antibiotics in companion and non-production animal products increased by 76 kg (5%) to 1,758 kg in 2023. Companion and non-production animal products are intended to treat dogs, cats, cage birds, and pigeons, and represented 4% of the total sales volume.

Total sales of companion animal and non-production products are based on companion animal specific products and registrants estimates of sales attributed to companion animals and non-production animals in multi-species products.

Figure 93: Companion animal and non-production animal antibiotics sales quantities 2022-2023

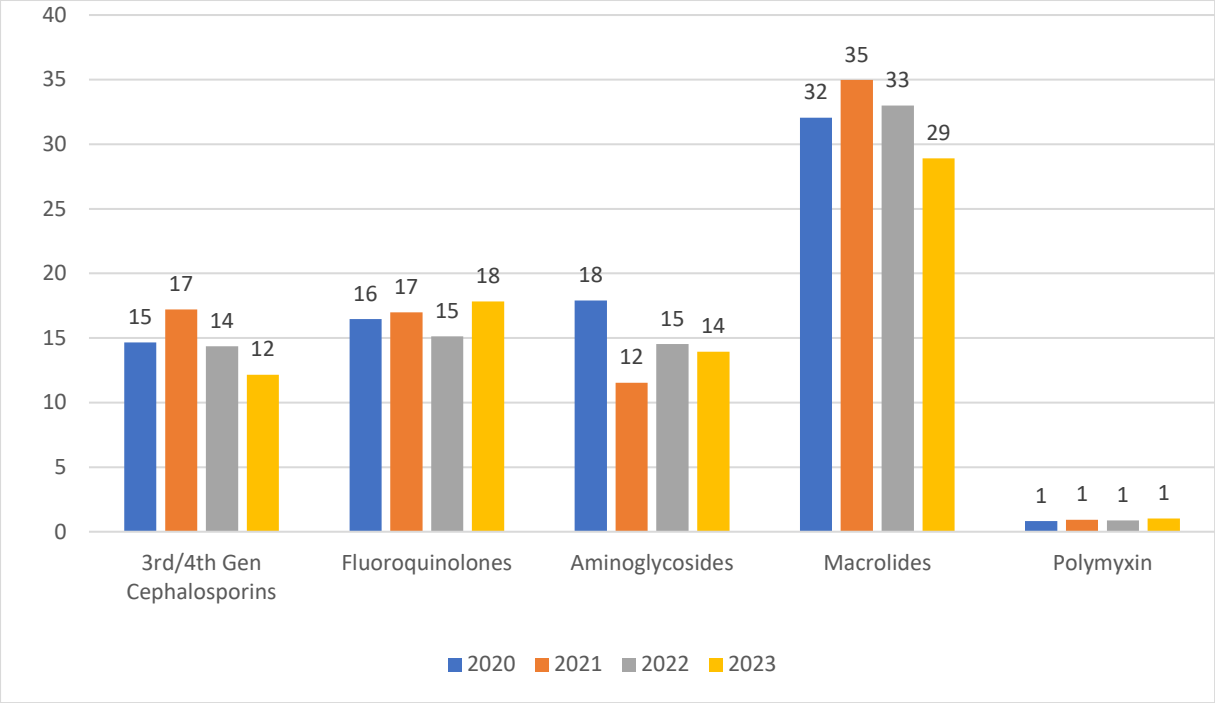
Companion animals and non-production	2022	2023	Net change	Percentage change
Aminoglycosides	14.5 kg	13.9 kg	↓ 0.6 kg	↓ 4%
Amphenicols	0.4 kg	0.30 kg	↓ 0.10 kg	↓ 21%
1st/2nd Gen Cephalosporins	329.8 kg	276.4 kg	↓ 53.4 kg	↓ 16%
3rd/4th Gen Cephalosporins	14.4 kg	12.2 kg	↓ 2.2 kg	↓ 15%
Fluoroquinolones	15.1 kg	17.8 kg	↑ 2.7 kg	↑ 18%
Fusidic acid	1.1 kg	1.0 kg	↓ 0.1 kg	↓ 9%
Lincosamides	13.5 kg	13.2 kg	↓ 0.3 kg	↓ 3%
Macrolides	33.0 kg	28.9 kg	↓ 4.1 kg	↓ 12%
Nitroimidazoles	25.8 kg	26.4 kg	↑ 0.6 kg	↑ 2%
Penicillins & Clavulanic Acid	1147.2 kg	1301.0 kg	↑ 153.8 kg	↑ 13%
Polypeptides	1.3 kg	1.5 kg	↑ 0.2 kg	↑ 12%
Sulphonamides & Trimethoprim	21.1 kg	13.4 kg	↓ 7.7 kg	↓ 36%
Tetracyclines	65.1 kg	52.3 kg	↓ 12.8 kg	↓ 20%
Total sales	1,682.3 kg	1,758.3 kg	↑ 76.0 kg	↑ 5%

Figure 94: Total sales quantities for companion animal and non-production species products 2018-2023 (in kilograms)



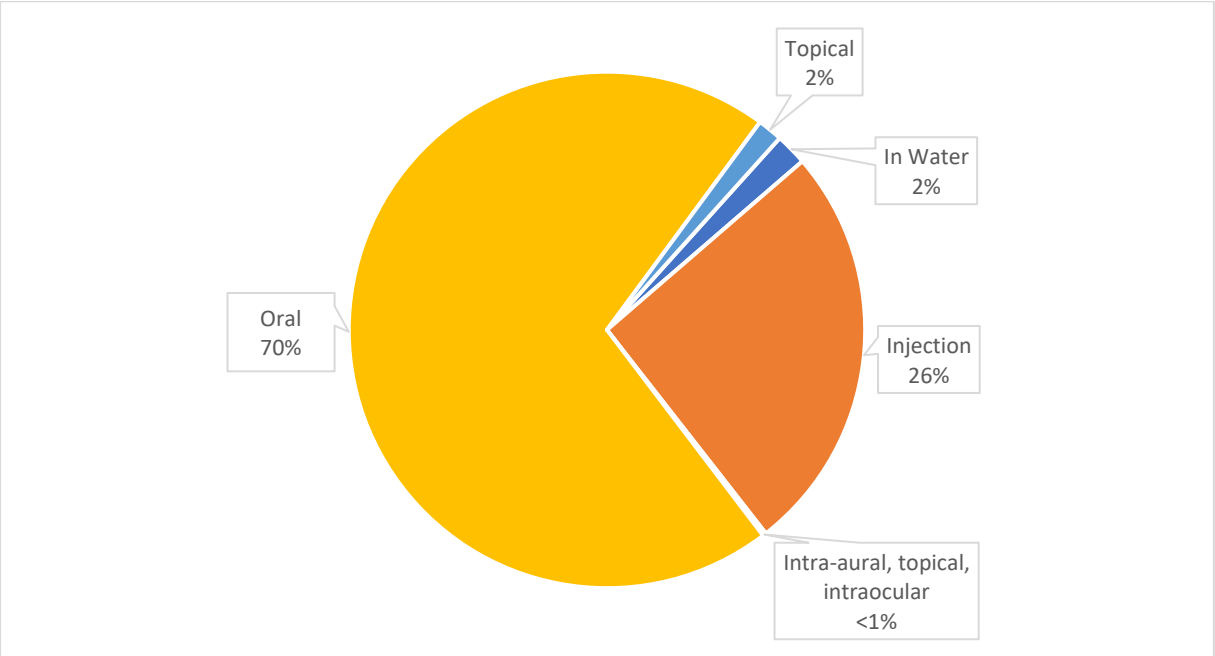
Total sales of companion animal and non-production species products were 1% above the average for the previous three years.

Figure 95: Critically important antibiotic sales for companion and non-production animal products 2020-2023 (in kilograms)



Sales of critically important antibiotics in companion animal and non-production species products decreased by 5% to 74 kg with a total decrease of 4 kg.

Figure 96: Companion animal and non-production animal antibiotics by administration methods 2023



Most companion animal and non-production antibiotic products are sold as oral treatments (70%) with 26% administered by injection and the remainder by topical, intra-aural, or intra-ocular methods.

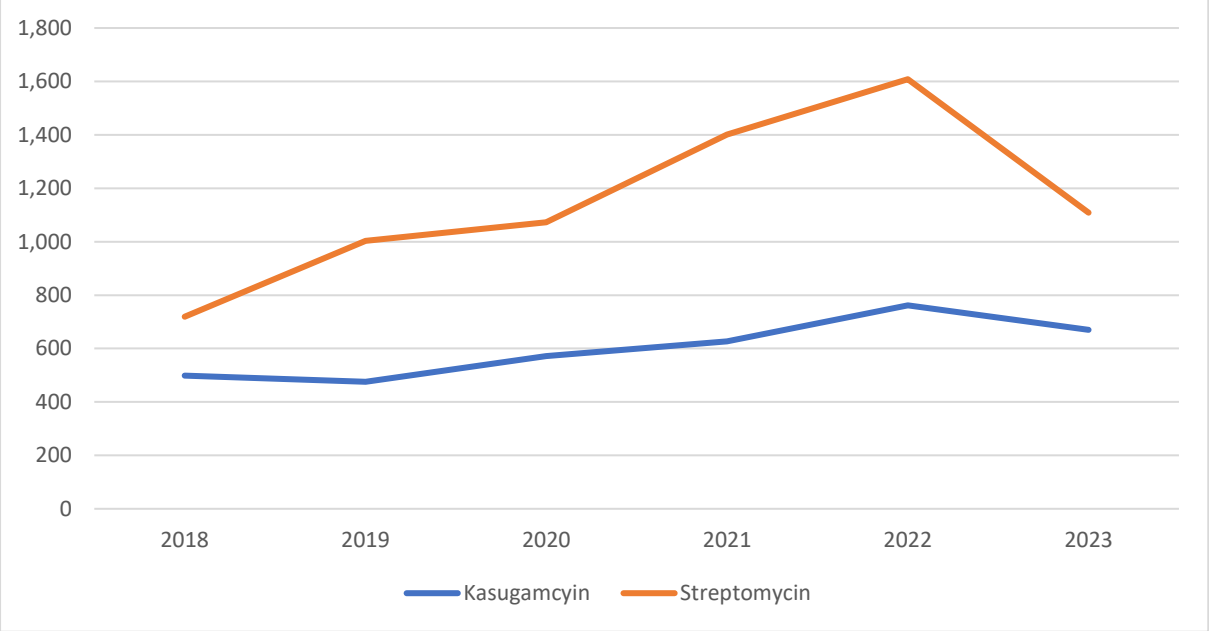
6.8 Crop protection antibiotics

Sales of antibiotics for crop protection decreased by 25% to 1,779 kg from 2,370 kg in the previous year. Quantities of streptomycin and kasugamycin decreased by 31% and 12%, respectively. Streptomycin accounted for 62% of the 2023 sales total for antibiotics used in crop protection and is used in kiwifruit, pome fruit and stone fruit. Kasugamycin accounted for the other 38% and is used only in kiwifruit.

Figure 97: Crop protection antibiotic sales quantities 2022-2023

Crop protection antibiotics	2022	2023	Net change	Percentage change
Kasugamycin	761.6 kg	670.6 kg	↓ 91 kg	↓ 12%
Streptomycin	1,608.3 kg	1,108.5 kg	↓ 499.8 kg	↓ 31%
Total sales	2,369.9 kg	1,779.1 kg	↓ 590.8 kg	↓ 25%

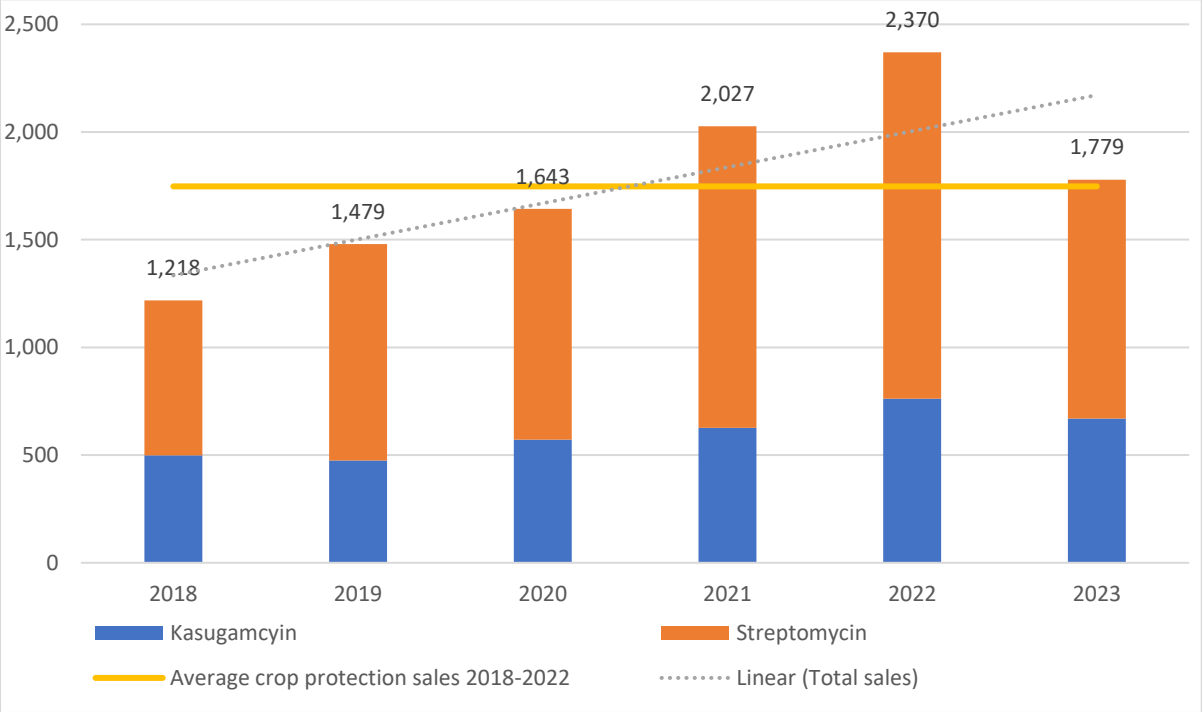
Figure 98: Sales trends for antibiotics sold for use in crop protection 2018-2023 (in kilograms)



Zespri and New Zealand Apples and Pears report usage of antibiotics for crop protection will vary over time, however these lower sales quantities may relate to warmer weather conditions in 2023.

New Zealand Apples and Pears expect reliance on streptomycin for the treatment of fire blight to continue for some time. New Zealand Apples and Pears continue to invest in research and development projects for alternative options for the control of fire blight including biological, alternative crop protection products, and plant breeding. Replacement of trees currently in the ground with fire blight resistant options is a long-term strategy, both through the breeding process and as trees remain in the ground for 10-20 years.

Figure 99: Total sales quantities for crop protection antibiotics 2018-2023 (in kilograms)



Total crop protection antibiotic sales were 2% above the average for the previous five years.

7 Conclusions

Antibiotic sales quantities decreased by 1,484 kg (3.6%) to 39,549 kg. Excluding the polypeptides from the 2023 sales total, the quantity reported for the other 14 classes decreased by 10% to 35,665 kg compared to 39,547 kg in the previous year. The largest decreases in sales quantities were for the macrolides, the sulphonamide and trimethoprim class, and the aminoglycosides. These decreases were offset by increases in sales of polypeptides and tetracyclines.

Based on registrant estimates of use for multiple production species products, multi-species products, and species-specific products 52% (20,647 kg) of antibiotics were sold for use in dairy cattle, of which 8,264 kg were for intramammary treatments. Dry cow therapy (DCT) accounted for 71% of intramammary product sales and lactating cow therapy (LCT) for 29%, representing a 1% shift from DCT to LCT compared to 2022. The antimicrobial use (AMU) for dairy cattle was 6.49 mg/kg.

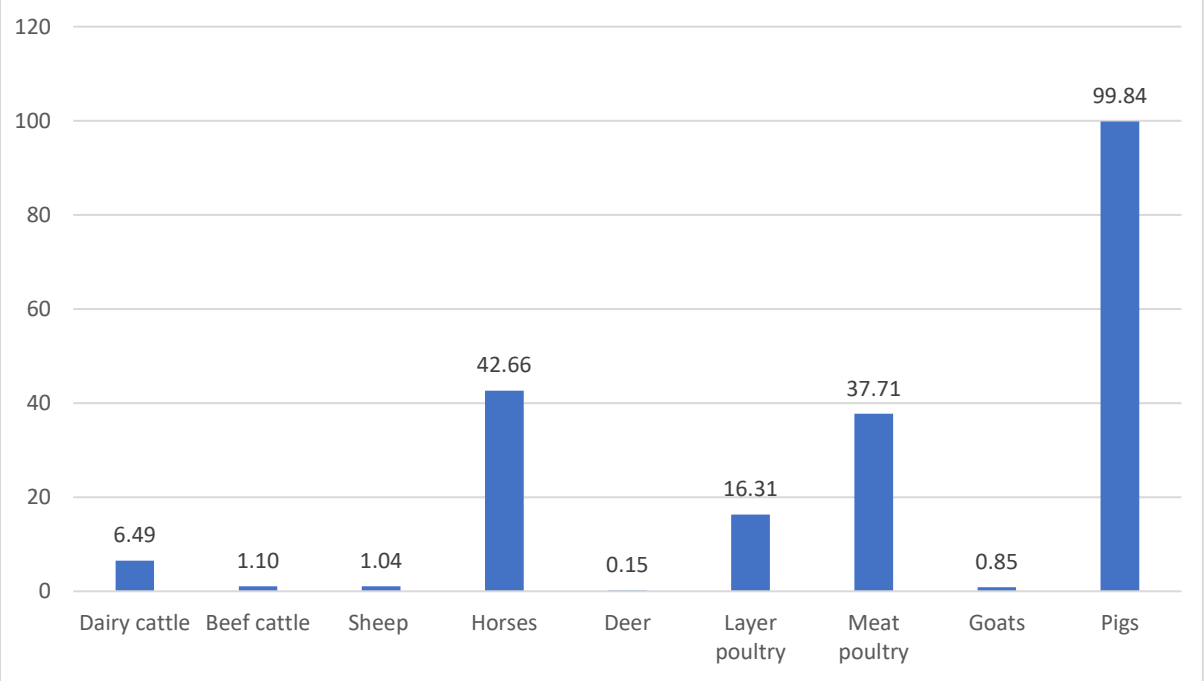
The total antibiotics sold for use in pigs declined by 25% to 4,667 kg. Most of the decrease was due to reduced macrolide sales. The AMU for pigs was 99.84 mg/kg. Layer poultry sales declined by 66% to a total of 173 kg. Most of the decrease was due to a reduction in sales quantities for macrolides. The meat poultry sales total was 4,507 kg, an increase of 161% compared to 2022, mostly due to an increase in zinc bacitracin. The AMU for layer poultry was 16.31 mg/kg; the AMU for meat poultry was 37.71 mg/kg.

The volume attributed by registrants for use in beef cattle increased by 3% to 1,639 kg and accounted for 4% of the total sales volume. For sheep, the volume was relatively unchanged at 1,472 kg. The AMU for beef cattle was 1.10 mg/kg and the AMU for sheep was 1.04 mg/kg. As per previous years, sales of antibiotics intended for use in the sheep and beef sectors remain very low, likely attributable to lower disease pressures in pastoral farming systems.

Antibiotics sold or attributed for use in horses decreased by 16% to a total of 2,893 kg. The AMU for horses was 42.66 mg/kg. The sales quantity for companion and non-production animals increased by 5% to 1,758 kg and represented 4% of the total sales volume.

The volume of critically important antibiotics decreased by 46% to 3,416 kg in 2023 mainly due to a decrease in macrolide sales. There were also decreases for the aminoglycosides, third- and fourth-generation cephalosporins, and the fluoroquinolones.

Figure 100: Antimicrobial use per species in mg of antibiotics per kg of liveweight biomass



8 Calculated antimicrobial use

Use of sales data to approximate use by species has several limitations including products approved for use with multiple species, products purchased in advance, and the impact of sales patterns being subject to variability associated with supply chain issues. Products may also be subject to loss or expiry before they can be used or owners not completing a full course of treatment. Some of this variability may be mitigated by use of registrant estimates concerning multi-species products, however other issues such as product loss or incomplete treatment would require farm usage to be directly monitored which is not currently feasible in New Zealand.

To aid understanding of approximate antibiotic use, MPI introduced an antimicrobial use (AMU) calculation for antibiotics used in production animals in the 2020 antibiotic sales report. Production animal species are the primary target for this type of calculation because they are by far the dominant users of veterinary antibiotics, with sales in production animals comprising 91% of the 2023 antibiotic sales volume.

The methodology used aligns with that employed by the European Medicines Agency (EMA), utilising standardised liveweights for each food-producing species representing the most likely age and weight at which animals will be treated. The weight estimate is then multiplied by population data for the target year to provide a population correction unit (PCU) for each class, and the class-level PCUs are summed to produce a New Zealand PCU for all species in the reporting year. This number is then divided by the total mass of antibiotics sold in that year, minus those known to be used solely in horticulture, companion animals, and non-production animals, to estimate the AMU.

To establish the New Zealand PCU for 2023, Statistics New Zealand population data has been used to provide for raw population numbers for the reporting year for beef, dairy, sheep, deer, and goats. Statistics New Zealand data for horses typically includes racehorses and working farms and these figures have been augmented with numbers of horses used in sport and other equestrian and recreational purposes. For pigs and poultry, the data is an estimate of numbers that were present (and potentially treated) in the annual period based on the annual kill of growers, rather than “point in time” census data. The breeding herd/flock is then stratified into different class groups and average weights previously consulted with beef, dairy, deer, sheep, goat, horse, pig, and poultry industry representatives. The complete list of values used for all species can be found in the Appendix.

Based on a total production animal New Zealand PCU of **6,407,297,294** kg and the veterinary antibiotic sales total of 36,012 kg, the 2023 New Zealand AMU is **5.6 mg antibiotic per kg liveweight biomass.**

In 2022 the respective numbers were 6,695,340,714 (PCU) and 5.5 mg antibiotic per kg liveweight biomass (AMU) with a veterinary sales total of 36,981 kg.

Although there are no 2023 AMU estimates published at this time, New Zealand’s estimate is well below the most recently published international estimates. The most recent data available from the World Organisation for Animal Health estimated a global AMU of 109.7 mg antibiotic per kg biomass for 2021.[1]

[1] (World Organisation for Animal Health: Annual Report on Antimicrobial Agents Intended for Use in Animals, 8th Edition, 2024)

9 Appendix:

Antimicrobial Use Data 2023

	Beef			Dairy			Sheep		Deer		Pigs[1]		Poultry[1]			Goats[2]	Horses[2]
	0-1yr 30%	1-2yrs 30%	>2yrs 40%	0-1yr 10%	1-2yrs 10%	>2yrs 80%	Hoggets 70%	Ewes 30%	<1yr 45%	Mature 55%	Growers	Breeders	Layers	Broilers	Turkeys		
Standardised Weights (Kg)	200	470	520	180	430	600	55	65	60	110	70	210	2.3	1	2	60	457
2023 Population - Raw	3,654,000	3,654,000	3,654,000	5,885,000	5,885,000	5,885,000	24,359,000	24,359,000	742,000	742,000	577,750	30,000	4,600,000	119,539,000	500,000	93,606	148,362
2023 Population - Stratified	1,096,200	1,096,200	1,461,600	588,500	588,500	4,708,000	17,051,300	7,307,700	333,900	408,100	577,750	30,000	4,600,000	119,539,000	500,000	93,606	148,362
PCU (subset class)	219,240,000	515,214,000	760,032,000	105,930,000	253,055,000	2,824,800,000	937,821,500	475,000,500	20,034,000	44,891,000	40,442,500	6,300,000	10,580,000	119,539,000	1,000,000	5,616,360	67,801,434

Total PCU (kilograms)	6,407,297,294
Total 2023 Sales (kilograms)	36,012
AMU (kg)	0.00000562
AMU (mg antibiotic/kg)	5.6205

Population Data Sources

Populations for food-producing animals reflect commercial industry populations only. It is recognised that there are also non-commercial populations that use a proportion of overall antibiotic volumes sold.

- Beef, Dairy, Sheep, and Deer: Statistics NZ Population data (June 2023)
- Pigs: Direct communication with NZ Pork
- Poultry: Direct communication with PIANZ
- Goats: Beef + Lamb NZ Compendium of New Zealand Farm Facts 2023 (note: quoted number was a 2019 population value)
- Horses, population data provided by Massey University

- No stratification has been applied to pigs or poultry (class specific population data provided by NZ Pork and PIANZ)
- No stratification has been applied to goat and horse populations as all animals are likely to be treated with antibiotics

Agricultural production statistics: Year to June 2023 (final) | Stats NZ