New Zealand Food Safety
Haumaru Kai Aotearoa

Antibiotic Sales Analysis 2014 - 2016

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By the Agricultural Compounds and Veterinary Medicines team

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Further information is available on the MPI website:
Antimicrobial resistance: https://www.mpi.govt.nz/processing/agricultural-compounds-and-vet-medicines/antimicrobial-resistance/

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1 Summary

The Ministry for Primary Industries (MPI) has been collecting data on sales of antimicrobials of significance to human health used as agricultural compounds (veterinary medicines and agricultural chemicals) since 2004. These data are used to monitor trends in antimicrobial use by class, species, and route of administration on a kilogram of active ingredient basis.

Reporting period
The reporting period covers 1 January 2014 to 31 December 2016 and is part of the ongoing monitoring programme of antimicrobial sales by MPI. Interpretation of use is based on the sales data collected, along with feedback on antimicrobial use from the agricultural sectors and veterinarians in the field.

MPI has shifted the analysis of sales data and reporting to a calendar year cycle starting from 1 January and ending 31 December. For the year 2014, data collected from 1 January to 31 March was used in the previous report as well as this report. This is so the data will better represent trends occurring in seasonal industries, and to fulfil MPI's antimicrobial sales data reporting agreement with the World Organisation for Animal Health (OIE), which reports on a calendar year cycle. It is noted, however, that a shift in the reporting cycle may result in some disparity between this report and the previous, mainly due to the seasonal nature of certain products such as dry cow therapies.

Sales
Compared to the end of the previous April 2011 - March 2014 reporting period, total antimicrobial sales have increased by 8%. Despite an overall increase, this report identifies a reduction in the volumes of three classes of antibiotics sold in New Zealand that are considered by the World Health Organization (WHO)[1] to be of critical importance to human health: the third and fourth generation cephalosporins, the fluoroquinolones, and the macrolides. The sales of aminoglycosides, most of which are sold for use in horticulture, have continued to increase during this reporting period. Penicillin and bacitracin sales have also increased, while most other classes of antibiotics decreased in sales.

The majority of antibiotics sold continue to be those registered for use by administration in feed. Injectable products are the second most common type of product sold and, as with the previous report, sales have increased compared to the previous period. Almost half of the antibiotics sold are products registered for use in pigs/poultry, followed by products registered for use in multiple production animal species.

The rise in overall antimicrobial sales during this period may be offset by the increased biomass of animals in New Zealand, particularly due to the increase by 15% in poultry numbers.

Systems
This report highlights that the systems in place to manage animal health and encourage the prudent use of antimicrobials are working, although collectively New Zealand can continue to improve.

[1] WHO Advisory Group on Integrated Surveillance of Antimicrobial Resistance (AGISAR), (2016): Critically Important Antimicrobials for Human Medicine 5th revision. http://apps.who.int/iris/bitstream/10665/255027/1/9789241512220-eng.pdf

2 Introduction

Antimicrobial resistance (AMR) continues to be of global concern as it threatens the ability to prevent and treat infectious disease caused by microbes. While AMR is a natural consequence of antimicrobial use, inappropriate practices hasten its evolution and spread. Resistance is present throughout the world in pathogens that are known to cause common diseases. The information outlined in this report suggests that prudent use of antibiotics and good antibiotic stewardship is occurring in New Zealand, as can be seen by the reduction in use of those classes of antibiotic that are considered to be critically important to human health, as well as an increase in amounts sold, which is in line with the increase in animal numbers.

World Health Organization report

The most recent report outlining which antimicrobials are of greatest importance to human health was published by the WHO in 2016. The purpose of the reporting is to identify an up to date list of 'critically important' antimicrobials, and to ensure their prudent use in both human and veterinary medicine.

Three categories of antimicrobials are named in the report: critically important, highly important, and important. Antimicrobials **critically important** for human health meet both Criterion 1 and Criterion 2 below. Those antimicrobials that meet either Criterion 1 or Criterion 2 are categorised as **highly important**, while antimicrobials that meet neither Criterion are ranked as **important**. The two criteria are:

> Criterion 1: Antimicrobial agent which is the sole agent, or one of limited available therapy, to treat human disease.
>
> Criterion 2: Antimicrobial agent used to treat diseases caused by either (1) organisms that may be transmitted to humans from non-human sources or (2) human diseases caused by organisms that may acquire resistant genes from non-human sources.

The critically important antimicrobials have now been prioritised into **'highest priority critically important'** and **'critically important'**. Antimicrobial classes in the 'highest priority critically important' group that are registered for veterinary use in New Zealand include fluoroquinolones, polymyxins, macrolides and 3rd and 4th generation cephalosporins. Aminoglycosides, classified as 'critically important' by the WHO are registered in New Zealand for use in both horticulture and as veterinary medicines. Polymyxins have been newly added to the group of critically important antimicrobials due to their greater importance for the treatment of Gram negative infections. Some penicillins (natural, aminopenicillins and antipseudomonal) have also now been classified as critically important. The use of penicillins in this group is described separately in this report.

In future, we will use a classification system which takes into account those antimicrobials considered of importance to human, animal, and plant health, as well as being relevant to the New Zealand situation.

3 Background

This report is focused on antimicrobial products used in horticulture and those that are classed as restricted veterinary medicines (RVMs) and used in animals.

To manage the risks associated with the development of antimicrobial resistance, registrants of RVMs and horticultural products containing antimicrobials important to human medicine must provide an annual report of sales by month to MPI as a condition of registration. To further inform the final report, a preliminary sales data report is presented to industries that work directly with plants and animals in order to gather sector specific information. This allows industry to comment on the significance of the findings relevant to each sector, such as reporting disease outbreaks that could have contributed to an increase in sales of certain antibiotic classes. Industry comment is important to the evaluation of the sales data as it provides insight into specific disease challenges that might have occurred over the period, and highlights changes in management practices and the animal population for each species. These sales data, along with industry input, are used to monitor for significant trends that may indicate changes in antibiotic use in the field and thereby provide some insight into the potential for development of antimicrobial resistance.

Antimicrobial sales have been reported in units appropriate to each individual product, and converted to weight in kilograms using the active ingredient concentration expressed on the product label. Overages used in manufacturing and non-active salts are not included in the final mass.

Last public report

The last public report on antibiotic sales was a summary of the data collated from 1 April 2011 to 31 March 2014 (ref: https://www.mpi.govt.nz/dmsdocument/14497-2011-2014-antibiotic-sales-analysis).

Data limitations

Sales data as indicators of antibiotic use and thereby risk of the development of antimicrobial resistance are inherently limited due to a number of variables. The amount of antibiotic sold within the evaluated time period might not be used within that same time period and therefore may not be representative of current use patterns. In addition, sales data do not take into consideration the amount of product lost during administration or transport, non-compliance if owners do not administer a full course, or stock held for future use. While sales can approximate use over the nominated period, actual use can encompass product sold one or two years prior to and following that nominated period.

Data limitations are more pronounced in antibiotics used in animals than in plants. For example, there is more variability in approved uses of antibiotics in animals, and many products are approved for use in both food-producing and companion animal species. In addition, veterinarians have the authorisation to employ discretionary use for products not limited to 'on label' use patterns, target species, dose rates and treatment regimes. Because of the use of products 'off label', total antibiotic use cannot be accurately predicted by sales data.

Sales data also do not give any indication of the fluctuations of animal numbers within the New Zealand herd, the health of individual animals, or emergent disease trends. Increases and decreases of sales can therefore be representative of population changes and/or changes in disease prevalence within that population just as readily as they can be of changes in antibiotic use.

There is no direct monitoring of the sales of human preparations used as veterinary medicines, or the sale and use of compounded veterinary medicines, as their use is at the discretion of the attending veterinarian in specific cases. This is especially important when considering the impact of the sales of antibiotics on the emergence of antimicrobial resistance, as compounded and non-veterinary medicines are often used when available veterinary antibiotics either fail to cure the infection or when the veterinarian determines that multi-modal therapy incorporating non-veterinary medicines is indicated.

Sales data in kilograms does not take into account dose rates. Certain antimicrobial classes might require more or less active ingredient that amounts to one dose of product.

The analysis is based on the weight of antibiotic active ingredient sold, but the sales are reported to MPI in amount of product sold. Product sales are mathematically converted by MPI to active ingredient weights and evaluated based on the sum in kilograms of active ingredient, often from multiple products. MPI is still working with the registrants of antibiotic veterinary medicines to eliminate errors that creep in during the process of that conversion. While there may be some discrepancies in the statistics, MPI believes that any discrepancies that may occur are minor and are unlikely to alter the analysis significantly.

Finally, MPI is aware that a proportion of antibiotics sold in New Zealand may be used in other countries, including the Pacific islands. The information passed on from registrants does not specify how much product is sold for use in New Zealand and how much is supplied for use overseas.

4 Glossary

Species and administration definitions remain the same as in the previous report to ensure consistent reporting.

Species or **species group** are defined as:

- **Cattle** – dairy and /or beef cattle.
- **Companion** – cat and /or dog.
- **Horses and Sheep** – horses and sheep have been identified separately from those classed as 'other'.
- **Pigs/Poultry** – pigs and /or chickens, turkeys and game birds. Where possible, particular classes and active ingredients will be discussed as they pertain to either pigs or poultry.
- **Multiple Species** – all products registered for use in multiple species including companion animals. This category includes products with claims for deer as there are few examples of antibiotics registered with use claims specific to deer.
- **Multiple Production Species** – all products registered for use in multiple production species. This category has been added to gain insight into products used in food-producing species.
- **Other** – this category includes products used in caged birds, pigeons, ornamental fish and plants.
- **Plants** – products registered for use in plants.

Administration route:

- **Oral** – tablets, capsules, pastes, powders and suspensions for individual dosing.
- **Injectable** – intravenous, subcutaneous, and intramuscular preparations for individual dosing.
- **Feed** – in dedicated animal feed for the treatment of animals where other administration methods are not appropriate.
- **Water** – in dedicated animal water supply for the treatment of animals where other administration methods are not appropriate.
- **Intramammary** – lactating and dry cow products administered via the teat canal for individual dosing.
- **Topical** – superficially applied solutions, gels, ointments, creams and aerosols for individual dosing.
- **Other** – products for ophthalmic, intra-aural, intrauterine or spray–on (plant) use, or products where more than one administration route is possible.

5 Sales Trends between 2011/12 and 2016

Trending over the last 5 years has demonstrated an increase in overall sales of antibiotics where 59,350 kg was sold during 2011/12 compared to 68,350 kg in 2016. This increase can, at least in part, be attributed to the 39% increase in the poultry population and the 6.5% increase in the dairy population which occurred over the same period. These populations use a considerable amount of the antibiotics sold compared to other populations due to the more intensive farming practices.

Aminoglycoside sales increased by 23% over this 5 year period. Antibiotics in this class are almost entirely used in horticulture for treatment of *Pseudomonas syringae* pv*, actinidiae* (Psa) in kiwifruit. This increase will in part be due to increase in the land area used for kiwifruit production. The horticultural sector is actively replacing use of streptomycin with kasugamycin, an antibiotic not used in humans and animals due to inactivity of kasugamycin in pathogens in these species.

Sales of fluoroquinolones dropped in 2011/12 to 29 kg, then spiked in 2012/13 to 51 kg. Following the spike, sales declined to previous levels of approximately 40 kg sold annually.

Sales of third and fourth generation cephalosporins have decreased by 34% from 400kg in 2011-12 to 236.5 kg during 2016.

Macrolide/lincosamide sales spiked in 2013/14 with 8,150 kg sold. Since that time sales have reduced to levels seen prior to that reporting year and remain relatively stable at approximately 7000 kg sold annually. Most sales in this class are attributed to sales of products containing the active ingredient tylosin, the majority of which has previously been reported as being used in the dairy industry.

Summary

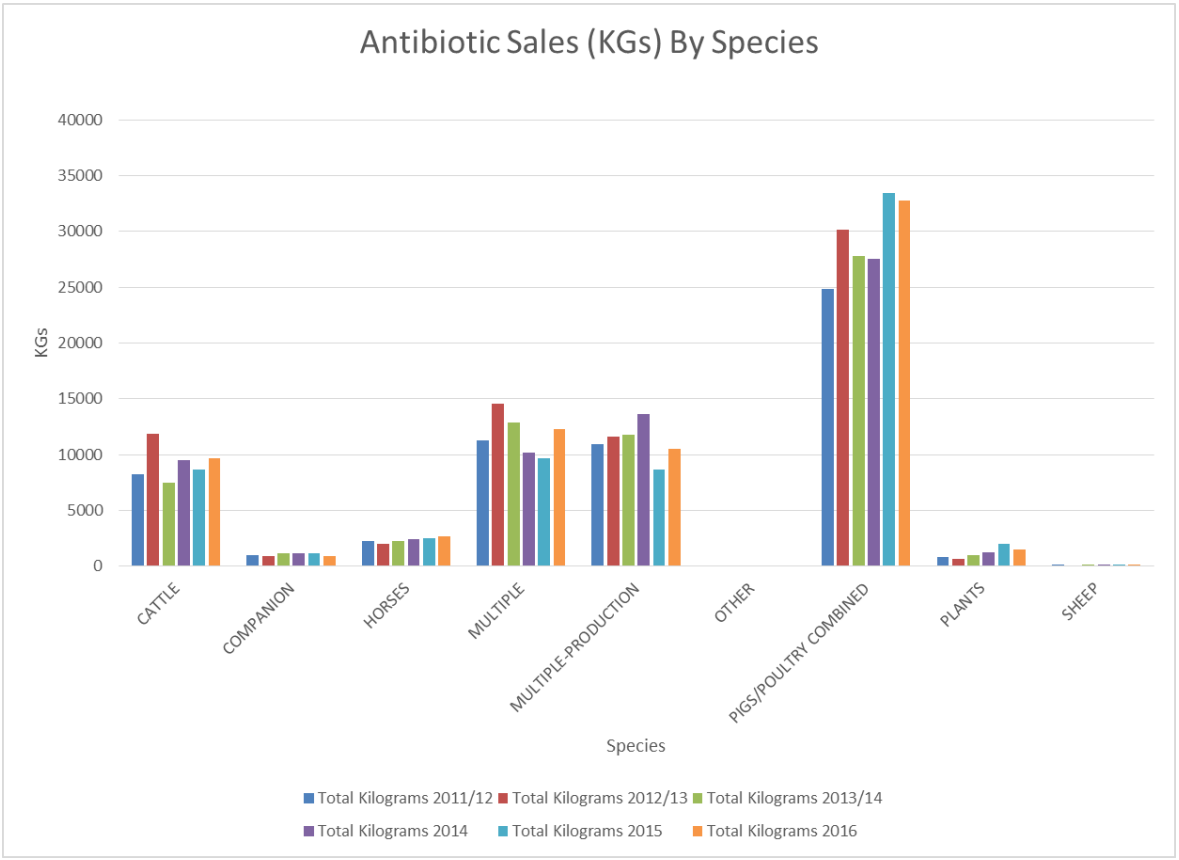
Compared to the end of the previous April 2011 - March 2014 reporting period, total antimicrobial sales have increased by 8%. This can in part be attributed to an increase in both plant and animal production. Sales of aminoglycosides increased over this period, which can be attributed to the need to treat Psa, a plant pathogen not reported in New Zealand until 2010. Macrolide sales remained stable during this period apart from a spike seen during 2013/14. Fluoroquinolone and cephalosporin sales decreased over the 5 year period.

6 Antibiotic sales by species

Products registered for use in pigs, poultry, or pigs and poultry accounted for 46% of all antimicrobials sales over this reporting period. The majority of these products contained the active ingredient zinc bacitracin. Sixteen percent of antibiotics sold were registered for use in multiple production species. The majority of products in this category were injectable products and included antimicrobials in the aminoglycoside, cephalosporin, fluoroquinolone, macrolide/lincosamide, penicillin, and tetracycline classes.

Another 16% of products sold over this time were registered for use in multiple species (including companion and production animals). Again, these were mostly injectable products and contained active ingredients in the aminoglycoside, cephalosporin, penicillin, and sulphonamide/trimethoprim antimicrobial classes.

Antibiotics registered for use specifically in cattle accounted for 14% of all products sold, and were mostly intramammary treatments which contained penicillins as the active ingredients. Antibiotics registered for horses comprised 4% of sales, followed by 2.5% that were registered for use in companion animals and 2.3% registered for use in horticulture.


Antibiotic Sales (KGs) By Species
40000
35000
30000
25000
20000
15000
10000
5000
0
KGs
CATTLE
COMPANION
HORSES
MULTIPLE
MULTIPLE-PRODUCTION
OTHER
PIGS/POULTRY COMBINED
PLANTS
SHEEP
Species
Total Kilograms 2011/12
Total Kilograms 2012/13
Total Kilograms 2013/14
Total Kilograms 2014
Total Kilograms 2015
Total Kilograms 2016

7 Production animals: population and antimicrobial use

The populations of sheep, beef cattle and dairy cattle have been taken from Statistics New Zealand[2] for this reporting period. Since a new source of animal numbers present in New Zealand is being used, the numbers may differ slightly from those in the previous report.

The national sheep population has decreased from 30.8 million wintered in 2013, to 27.6 million wintered in 2016. This is a reduction of 10%. The average sheep population for this reporting period was 28.8 million animals.

There has also been a steady decline in the number of New Zealand beef cattle during this time. In 2013, the beef cattle population was estimated by Statistics New Zealand to be 3.7 million. The population has declined every year since then to a total of 3.5 million in 2016. This is a decline of 4.5%.

The number of dairy cattle, including young stock and milking cows, in New Zealand has decreased since the end of the last reporting period from 6.7 million cows in 2014 to 6.6 million in 2016, a decrease of 1%. Numbers have fluctuated over this period with the largest population occurring in 2014 at 6.7 million, then declining in 2015 to just under 6.5 million before increasing again in 2016.

The poultry industry continued to grow between 2014 and 2016. There was an increase in the poultry population from 107.4 million in 2014 to 123.8 million in 2016, which is an increase of 15.3%. All of this increase results from greater numbers of broiler chickens. The numbers of caged layer hens has remained steady at 3.6 million birds. It is estimated that the population of free range broilers has increased from ~13 million in 2014 to ~21 million in 2016. A similar increase in free range chickens producing eggs has occurred from ~ 650,000 in 2014 to 1 million in 2016.

The national pig herd continued to decline with the number of pigs slaughtered at commercial premises decreasing from 672,108 in September 2014 to 625,890 in 2015 and 625,498 in September 2016. This is an overall decrease of 7% during the reporting period.

As with previous reports, the pig, poultry, and dairy cattle industries use the greatest mass of antibiotics in New Zealand agriculture. These production systems are far more intensive compared to beef cattle and sheep farming, with animals generally in much closer proximity. This results in a greater incidence of disease and a need for more antibiotic use. Dairy cattle also have a greater biomass and therefore need more antibiotic per animal during treatment when compared to smaller species like sheep.

This population data is used when interpreting the trends in sales volumes over time.

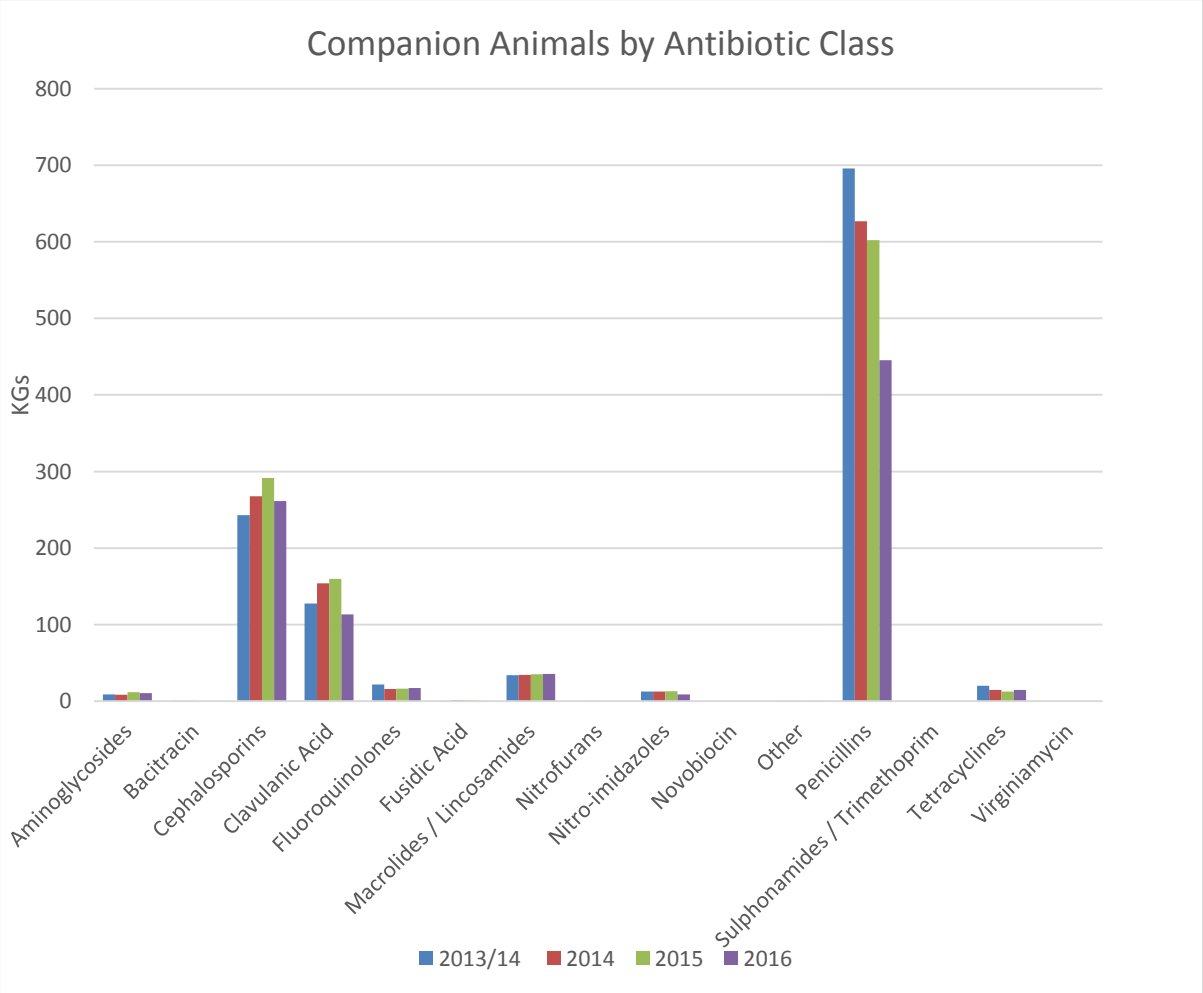
[2] Statistics New Zealand https://www.stats.govt.nz/information-releases/agricultural-production-statistics-june-2017-provisional

8 Companion animals: population and antimicrobial use

The companion animal population has decreased since the last reporting period. In 2015 the cat population decreased by 20% to 1.134 million. The population of dogs is reported to have decreased by 2% to 683,000 in 2015. The population of companion animal rabbits on the other hand has increased by 32% from 88,000 in 2011 to 116,000 in 2015[3]. Estimates of companion animal numbers are not available on an annual basis -- the most recent data is from 2015.

The total amount of antibiotics sold for use in the companion animal space remains low at 1% to 2% of total sales throughout this reporting period. Sales numbers in terms of mass were very stable apart from 2016 when sales decreased by 21% compared to 2015.The decrease in sales during 2016 is attributed to a 26% decrease in the sales of penicillin-based products and clavulanic acid.

The majority of antibiotics sold for use in companion animals are penicillins, followed by first generation cephalosporins, then clavulanic acid/penicillin combinations. Small amounts of aminoglycosides, fluoroquinolones, macrolides/lincosamides and tetracyclines are sold.



[3] The New Zealand Companion Animal Council Inc. Companion Animals in New Zealand 2016, Auckland, New Zealand. http://nzcac.org.nz/images/downloads/Companion%20Animals_in_New_Zealand_2016_Report_web.pdf

9 Antibiotic use in horticulture

Two antibiotics are registered for use in the horticultural industry: kasugamycin and streptomycin, both of which belong to the aminoglycoside class of antimicrobials. Kasugamycin is registered for use in kiwifruit to treat *Pseudomonas syringae PV. actinidiae* (Psa) infections, while streptomycin is registered for use in pip fruit, stone fruit, tomatoes, and kiwifruit to treat fireblight and other bacterial diseases. Psa, which was first detected in New Zealand kiwifruit in 2010, has continued to be an issue with this crop. The majority of use for these two products is likely to be in kiwifruit for the treatment of Psa.

Compared to overall sales, the amount sold that is registered for use in the horticultural industry was small at 2% to 3%. Since the previous reporting period, sales of antimicrobial products registered for use in horticulture have increased by 55%. By changing to calendar year, the difference in sales from April 2013 - March 2014 to January 2014 - December 2014 increased from 942 kg to 1212 kg, an increase of 9%. From 2014 to 2015 sales increased by 61% to 1955 kg, then decreased in 2016 by 25% to 1459 kg.

During this period, sales of products containing the active kasugamycin have steadily increased while sales of streptomycin-based products have decreased. This is likely to be because the kiwifruit industry now restricts use of streptomycin due to concerns that its use is more likely to result in resistance. Increase in sales in the kiwifruit industry will in part be due to an increase by 11% in the amount of land now planted with this crop.

10 Sales analysis by administration route

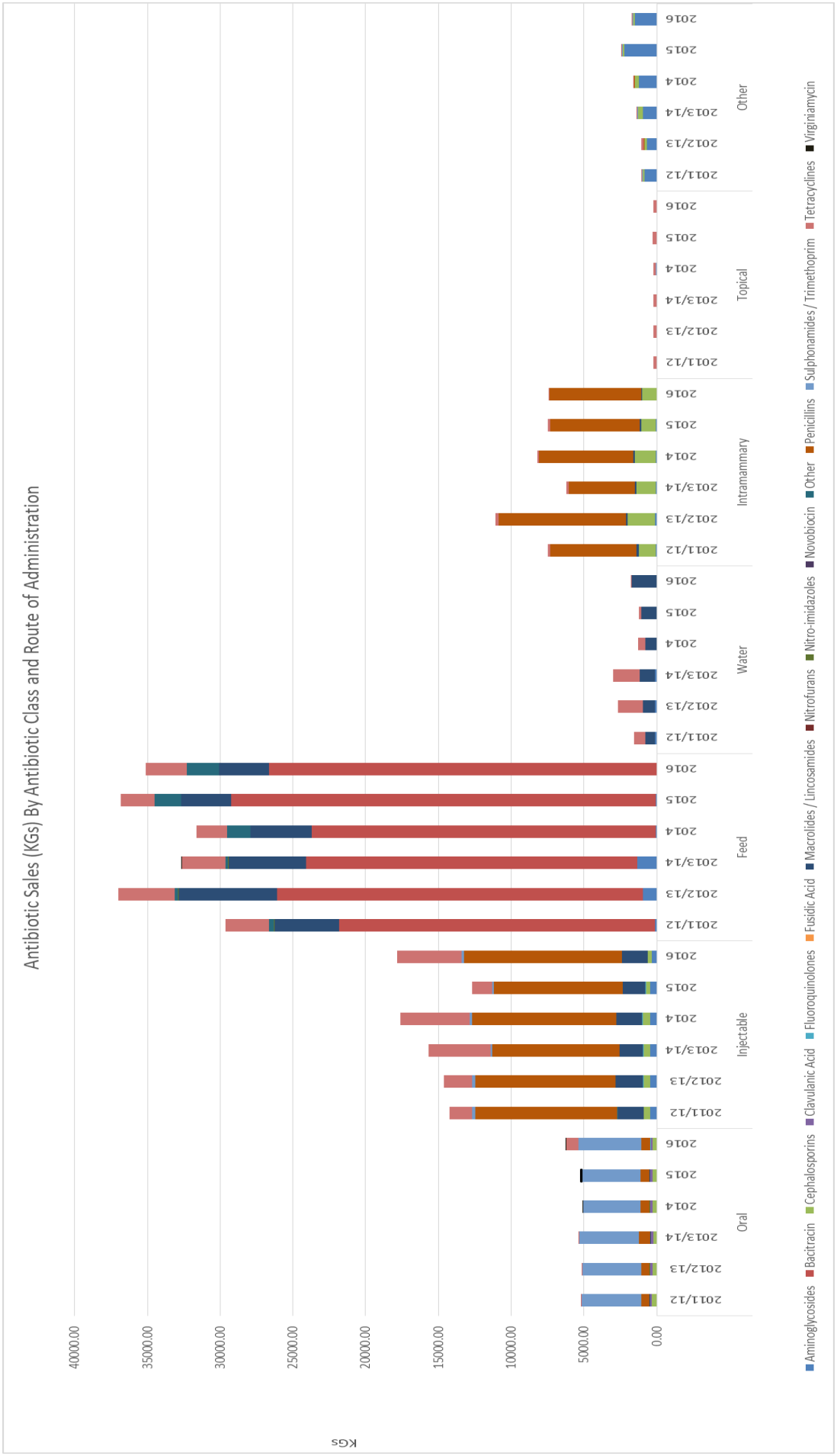
Antimicrobials sold to be used in feed accounted for 43% to 53% (on an annual basis) of all antimicrobials sold during this reporting period. Comparing the end of the previous sales period with the end of this sales period, antibiotics sold for use in feed increased by 6% from 31,305 kg in 2013/14 to 33,053 kg in 2016. Between 2014 and 2015 sales increased by 16% from 30,294 kg to 35,183 kg, then decreased in 2016 by 6% to 33,053 kg. The majority of in feed antibiotic sold was registered for use in pigs and poultry, and accounted for 84% to 87% of sales in this category. Most of these products contained the active ingredient zinc bacitracin. The remainder of the products administered in feed were registered for use in multiple or multiple production species and contained macrolides, tetracyclines or aminoglycosides. All of the tetracycline-based products were registered for use in pigs and poultry. The sales of in-feed antibiotic can be difficult to correlate to use since they may be stored for a period of time prior to use. In-feed antibiotics should be trended over a reasonable timeframe, potentially longer than a year, before a true indication of an increase or decrease in use can be seen.

Injectable products were the next largest mass of antimicrobials sold, and accounted for 19% to 27% of total sales. Except for a decrease in sales of injectable products noted in 2015, sales rose annually with a 15% increase when comparing the end of the previous sales period with the end of this reporting period. The majority of injectable products sold were registered for use in multiple species, followed by products registered for use in multiple production species, then products registered for use in cattle. Registered products sold specifically for use in cattle are mostly penicillin-based as were those products sold for use in multiple species. Those registered for use in multiple production species mostly contained tetracyclines, followed by macrolides, then penicillin.

Antibiotics for intramammary administration continue to be the third highest mass of antibiotics sold during this reporting period. These accounted for 9% to 11% of all antibiotics sold. Further discussion can be found later in this report.

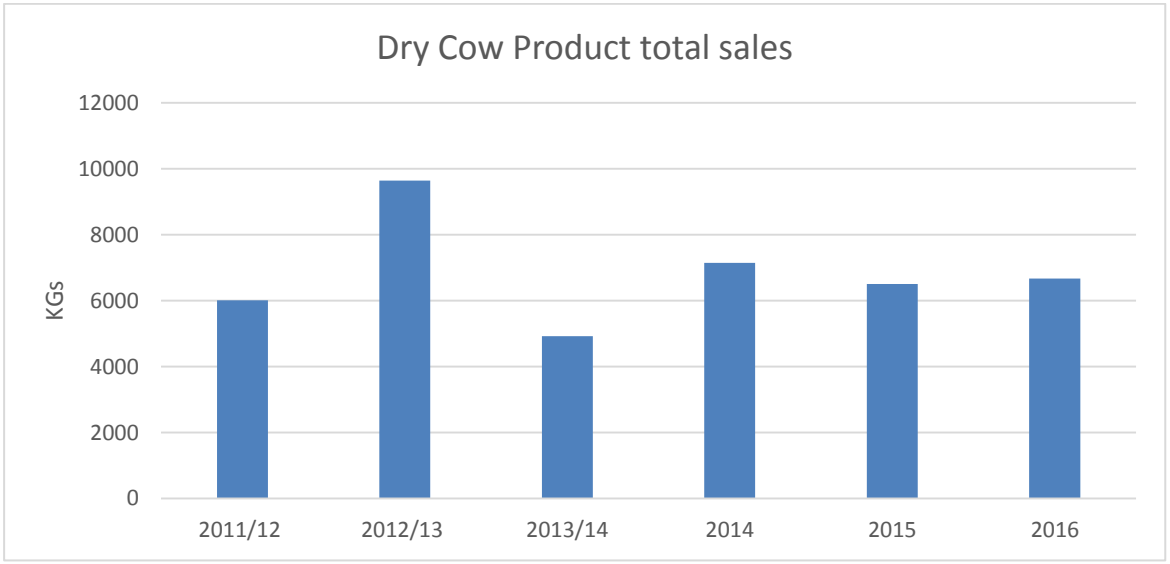
Oral administration remained the fourth most common route of antimicrobial administration over this reporting period, apart from 2016 when a greater mass of oral antibiotics were sold than intramammary antibiotic. These products are primarily registered for use in horses (all of which are sulphonamide/trimethoprim products except for a small amount of virginiamycin), followed by multiple or multiple production species products (all containing the active ingredients sulphonamides/trimethoprim), then companion animal products (approximately half the products sold for use in companion animals were penicillin-based, and approximately 20% were products containing first generation cephalosporins). Of the total antibiotics sold during this reporting period, 8% to 11% were for oral administration.

The remaining antibiotics are those administered in water, by topical application, or other administration routes such as intra-aural or intrauterine administration, or horticultural application. These groups comprised 5% to 6% of all antibiotics sold throughout this reporting period. Antibiotics administered in water were comprised of almost half tetracycline used in multiple or multiple production species and half tylosin product for use in pigs and poultry at the beginning of the reporting period. This changed in 2016 when the antimicrobials sold for in water administration were mostly macrolides for use in pigs and poultry. Products for topical use were a small percentage of these three groups at 6% to 8%, and were comprised of product containing tetracycline-based antibiotics for use in multiple species. The majority of antibiotics sold in the ‘other’ group were aminoglycosides used to treat Psa in the kiwifruit industry, where they made up 76% to 87% of product sold within that group during the reporting period.

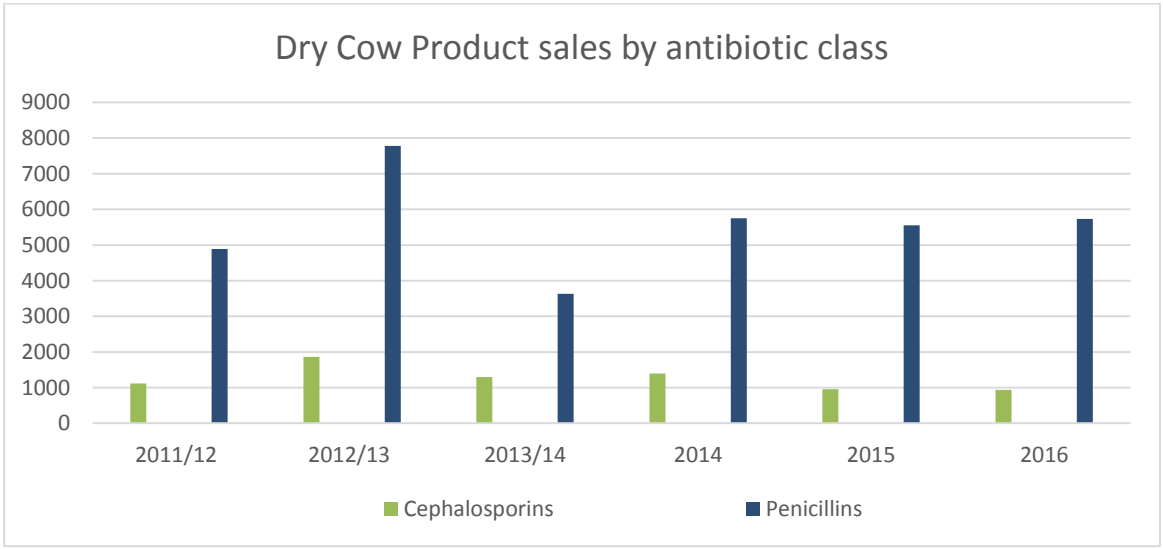

Antibiotic Sales (KGs) By Antibiotic Class and Route of Administration
KGs
40000.00
35000.00
30000.00
25000.00
20000.00
15000.00
10000.00
5000.00
0.00
Oral
Injectable
Feed
Water
Intramammary
Topical
Other
2011/12
2012/13
2013/14
2014
2015
2016
Aminoglycosides
Bacitracin
Cephalosporins
Clavulanic Acid
Fluoroquinolones
Fusidic Acid
Macrolides / Lincosamides
Nitrofurans
Nitro-imidazoles
Novobiocin
Other
Penicillins
Sulphonamides / Trimethoprim
Tetracyclines
Virginiamycin

11 Dry cow therapies

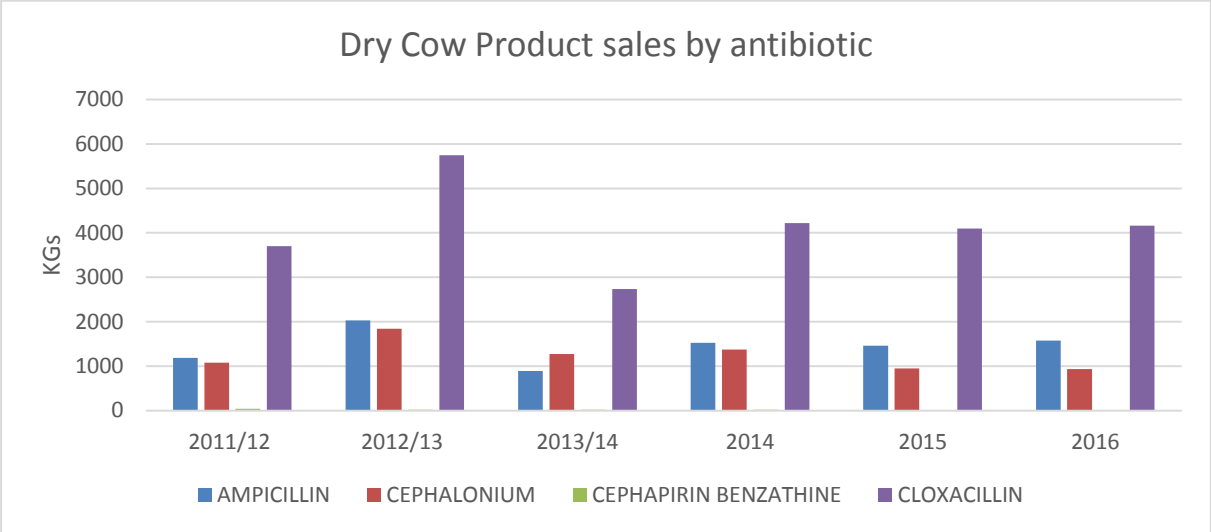
Dry cow therapy (DCT) sales are known to fluctuate from year to year with their use being somewhat dependant on farm finances, on-farm practices, environmental conditions, and clinical requirements. Comparing the end of the last sales period with the end of this sales period, an increase of 36% in DCT sales occurred. During 2014, sales peaked at 7,143 kg, an increase of 45% compared to the previous 2013/14 period. Because DCT sales are seasonal, this peak is likely to be due at least in part to a change in the reporting period from financial to calendar year. In 2015, sales decreased by 9%, then increased slightly in 2016 by 2.5 %. Sales of DCTs accounted for 10% to 11% of all antibiotic sales during this reporting period.



Two new DCTs that contained penicillins were registered in 2015. While sales numbers for these two products were relatively high, it did not result in an increase in the overall sales of penicillins of DCTs.



All DCTs registered contain either penicillins (cloxacillin ±ampicillin) or first generation cephalosporins (cephalonium or cephapirin). Each year, sales have included 70% to 86% penicillins, with all of penicillin DCTs sold containing the active ingredient cloxacillin ± ampicillin. Sales of penicillin-based DCTs increased between 2013/14 and 2014, but then remained relatively stable annually.

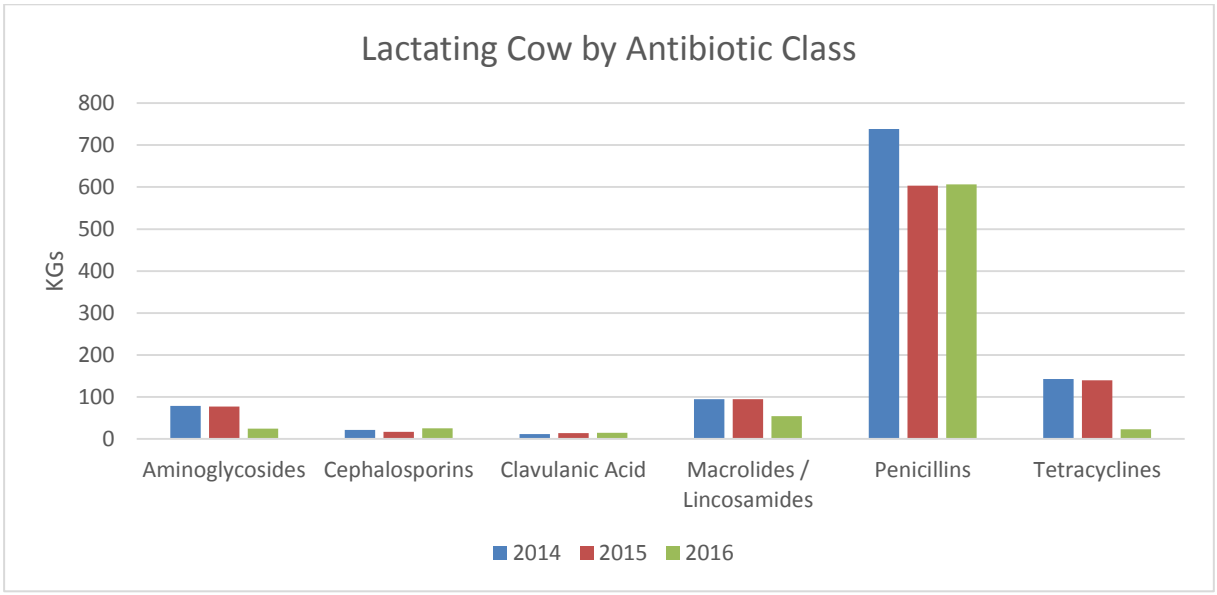


12 Lactating intramammary therapies

These antibiotics are used in the treatment of mastitis during lactation. While most of these products are registered for use in cows only, some are registered for use in other dairy species. Lactating intramammary therapies account for a small amount of antibiotic sold on an annual basis, approximately 1% to 2% of all antibiotics sold. Active ingredients in this group include aminoglycosides, cephalosporins, clavulanic acid, macrolides/lincosamides, penicillins, and tetracyclines.

Penicillin-based products make up by far the majority of lactating intramammary products sold and accounted for 64% to 81% of sales in this group during the reporting period. Tetracyclines have accounted for approximately 14% of lactating intramammary therapies throughout during 2014 and 2015, but sales decreased significantly in 2016 to 3%. Aminoglycosides comprised approximately 7% of sales in the first year of the reporting period, then decreased to 3% in 2016. The reduction in sales during 2016 of lactating intramammaries containing aminoglycosides and tetracyclines is due to a short supply of one product containing these two active ingredients.

Only small amounts of cephalosporin-based lactating intramammary treatments specifically for use in cows are sold on an annual basis. Throughout the end of the last reporting period and during this reporting period, they have accounted for less than 2% of sales for use in cattle, with a very small amount of those sold containing the fourth generation cephalosporin cefquinome.



13 Sales trends 2014 - 2016

When changing to calendar year, the sales from April 2013 - March 2014 to January 2014 - December 2014 increased from 63,099 kg to 64,352 kg (↑2%).

Compared to the 2013/2014 reporting year, sales increased in 2016 by 8% from 63,099 kg to 68,350 kg. Within this reporting period, sales decreased annually from 64,352 kg in 2014 to 64,183 kg in 2015 (↓0.3%), and then increased to 68,350 kg (↑ 6.5%) over 2016. Overall, this is an increase in 6% of antibiotic sales between 2014 and 2016. As with previous years, sales of some antibiotic classes increased while others decreased.

Total antibiotic sales by class (in kilograms active ingredient)

Antibiotic Class	2013/14	2014	2015	Difference (%) 2014-2015	2016	Difference (%) 2015-2016	Difference (%) 2013/14-2016
Aminocoumarins (Novobiocin)	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Aminoglycosides	1,651	1, 911	2,611	↑ 37	1,870	↓28	↑13
Amphenicols (Florfenicol)	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Cephalosporins	2,325	2,457	1,662	↓ 32	1,614	↓ 3	↓31
Clavulanic Acid	158	170	178	↑ 5	169	↓5	↑7
Fluoroquinolones	47	40	37	↓ 8	38	↑ 3	↓19
Fusidic Acid	1.4	1.4	1.4	Nil	1.4	Nil	Nil
Macrolides/ Lincosamides	8,150	6,946	6,188	↓11	6,994	↑ 13.0	↓14
Nitrofurans	0.6	0.1	Nil	↓ 100.0	Nil	Nil	↓100
Nitroimidazoles	52	14.5	33	↑ 3	39	↓ 32	↓25
Penicillins	14,032	17047	15,646	↓ 8	17,803	↑ 14	↑27
Pleuromutilin (Tiamulin)	0.5	Nil	Nil	Nil	Nil	Nil	↓100
Polypeptides (Bacitracin)	22,726	23,599	29,172	↑ 24	26,637	↓ 9	↑17
Polypeptides (Polymyxin)	0.4	0.4	0.5	↑ 25	0.5	Nil	↑25
Quinoxalines (Carbadox)	200	263	175	↓ 33	194	↑ 11	↓3
Streptogramins (Virginiamycin)	11	13	10	↓ 23	7.5	↓ 25	↓32
Sulphonamides / Trimethoprim	4,309	4,153	4,203	↑ 1	4,544	↑ 8	↑5
Tetracyclines	9,435	7,737	4,267	↓ 45	8441	↑ 98	↓11
Total	**63,099**	**64,352**	**64,183**	**↑ 0.3**	**68,350**	**↑6**	**↑8**

13.1 AMINOGLYCOSIDES

The WHO classification of aminoglycosides remains in the 'high priority critically important' category. This is because of certain human medical conditions for which aminoglycosides are the only treatment and because cross-resistance occurs across this class. Aminoglycosides, however, are not widely used in human medicine.

Overall there has been an increase in sales of aminoglycosides of 13% compared to the end of the previous reporting period. When changing to calendar year, the difference in sales of aminoglycoside-based products from April 2013 - March 2014 to January 2014 - December 2014 increased from 1,651 kg to 1,911 kg, an increase of 16%. Comparing calendar years 2014 with 2015, aminoglycoside sales increased by 37% from 1,911 kg to 2,611 kg then decreased in 2016 to 1,870 kg, a reduction of 28%. Aminoglycoside sales accounted for 3% to 4% of total antibiotics sold during this reporting period.

Over the three reporting years an average of 70% of all aminoglycosides sold were registered for use in plants. Sales of products for use in plants increased from 1,212 kg during 2014 to 1,955 kg in 2015, an increase in 61%. Sales of these products then decreased to 1,459 kg in 2016, a reduction of 25%.

The second highest category of aminoglycoside sales, which accounted for an average of 20%, was products registered for use in multiple production species. Products in this category are registered for use in cattle, poultry, and pigs. In 2014, 525 kg was sold. This decreased to 507 kg in 2015, a 3% reduction followed by a further decrease to 320 kg in 2016, a reduction of 37%.

The third highest species category of aminoglycosides sold were products registered for use in multiple species and accounted for less than 5% of aminoglycosides sold over this period.

Products registered for use in cattle only or companion animal only made up the remaining sales (~5%). There are no products in this class specifically registered for use in sheep or horses.

The majority of aminoglycoside actives sold included streptomycin and kasugamycin (kasugamycin became available in 2015), which results mostly from sales of products for use in plants. Dihydrostreptomycin sales decreased during the reporting period by 30% while neomycin sales decreased by 75%. Sales of neomycin have mostly decreased in intramammary products for use in cattle and in water products for use in multiple species. Gentamycin sales remained steady throughout this period with most products sold being for use in multiple species.

13.2 CEPHALOSPORINS

Third, fourth and fifth generation cephalosporins are classified by the WHO as 'highest priority critically important', while first and second generation cephalosporins continue to be classified as 'highly important' human medicines. There are no fifth generation cephalosporins registered for use in animals in New Zealand.

Sales of this class of antibiotic have always fluctuated between years due to their inclusion in intramammary products, which tend to differ in sales depending on the year as their use is somewhat dependant on farm finances, on-farm practices, environmental conditions, and clinical requirements.

A change from financial year 2013/14 to calendar year 2014 showed a 5% increase in sales of cephalosporins from 2,325 kg to 2,457 kg. Overall, however, a 31% decrease of cephalosporin sales has occurred since the end of the previous reporting period. Sales from 2014 to 2015 decreased by 32% from 2,457 kg to 1,662 kg. Between 2015 and 2016 sales reduced marginally by 3% from 1,662 kg to 1,614 kg. Cephalosporins sales accounted for 2% to 4% of overall sales. In terms of overall percentages, sales of cephalosporins decreased annually by 1% during this period.

Products containing the first generation active ingredient cephalonium are all dry cow products and account for 55% of all cephalosporins sold in the 2013/14 financial year. This percentage steadily increased on an annual basis to 69% of overall cephalosporins by 2016. On the opposite end of the scale, sales of all third generation cephalosporins accounted for 25% of all cephalosporin sales in 2013/14 but decreased to approximately 19% of sales in the class from 2014 to 2016. Sales of products containing cephalonium compared to the end of the previous reporting period have decreased by 27%.

Second generation cephalosporins are the only generation in this class to increase in sales (by 6%) compared to the previous reporting period. All products registered for use in this class are lactating cow intramammary products and account for a small percentage of overall cephalosporin sales.

Sales of third generation cephalosporins have decreased by 42% compared to the end of the previous reporting period. Most of the decrease in sales has occurred in ceftiofur containing products, which decreased by 45%. These are registered as injectable products for use in multiple production species, although most is reported to be used in dairy cattle.

Compared to the end of the previous reporting period, sales of fourth generation cephalosporins have decreased by 51%. Products in this group include lactating cow intramammary and injectable products registered for use in multiple production species. Sales of these products account for a very small percentage of all cephalosporins sold.

13.3 FLUOROQUINOLONES

Quinolones continue to be classified by WHO as 'highest priority critically important'. This classification is due to the high number of people affected by diseases for which this class of antibiotic is the only therapy or one of a few therapies available, and due to the high frequency of use in human medicine. Quinolones are also classed as 'highest priority critically important' because this class is used to treat infections including *Enterococcus* spp., *Enterobacteriaceae* (including *E. coli*) and *Mycobacterium* spp. for which there is evidence of transmission of resistance from non-human sources.

Changing from financial year when 47 kg was sold in 2013/14, to calendar year when 40 kg was sold in 2014, the mass of fluoroquinolones sold reduced by 15%. Fluoroquinolones accounted for less than 0.1% of all antibiotics sold during this sales period.

Overall there has been a decrease by 19% of fluoroquinolones sold since the end of the previous reporting period. Sales from 2014 to 2015 decreased by 8% from 40 kg to 37 kg, then increased in 2016 marginally by 3% to 38 kg. The decrease is sales has occurred across all species that have fluoroquinolones registered for use including companion animals, cattle and multiple production animals. Of note is that although the mass of antibiotics registered for use in companion animals decreased compared to the end of the previous reporting period, sales increased by 7% between 2014 and 2016.

Antibiotics registered for use in this class currently include enrofloxacin, pradofloxacin and marbofloxacin. As previously reported, most products containing enrofloxacin are registered as tablets for use in companion animals, and most products containing marbofloxacin are registered for use as injectable products for cattle and pigs. Around 60% of antibiotic sold in this class were of products registered for use in production animals, with the rest registered for use in the companion animal space.

13.4 MACROLIDES AND LINCOSAMIDES

Macrolides continue to be classified by the WHO as 'highest priority critically important' due to the high number of people affected with disease for which these antibiotics are the only or one of a few therapies available. This classification is also because of their high use in human medicine. Lincosamides are included in this class because their use is known to select for macrolide-resistant bacteria.

Overall sales of antibiotics in this class decreased by 14% compared to the previous reporting period with 8,150 kg sold in 2013/14 compared to 6,946 kg sold in 2016. Sales from 2014 to 2015 decreased by 11% from 6,946 kg to 6,188 kg, then increased in 2016 by 13% to 6,994 kg. This class of antibiotics accounted for 10% to 11% of all antibiotics sold during this reporting period.

Antibiotics sold in this class during this reporting period include tylosin, tilmicosin, tulathromycin, spiramycin oleandomycin, lincomycin, erythromycin and clindamycin. The lincosamide group, which includes lincomycin and clindamycin, is monitored with macrolides due to the similar mode of action and spectrum of activity, which means cross-resistance can develop against active ingredients in both classes if it develops against a compound

in either class. Lincosamide sales are historically low and have remained low during this reporting period where between 44 kg and 59 kg were sold annually.

Three products in this class have been registered since the previous reporting period. These include two products containing the active clindamycin and one product containing tylosin.

Macrolides registered for use in cattle increased significantly compared to the previous reporting period. In 2013/14 sales were 25kg, compared to 272 kg in 2014, 240 kg in 2015 and 285 kg in 2016 (an increase of 19%). This increase is likely due to the registration of three injectable tylosin products specifically for use in cattle between 2012 and 2016.

A 57% increase in sales of macrolides registered specifically for use in pigs/poultry occurred between 2015 and 2016. By contrast, sales for use in companion animals were small and relatively stable during this reporting period. The main overall reduction in sales in this class are from sales of products containing tylosin with a 13% decrease, followed by a reduction in sales of tilmicosin, which decreased by 35% over this period. Of note is that while the decrease in percentage of tilmicosin sold appears large, the actual mass sold is a lot smaller than tylosin products sold. Products containing oleandomycin also reduced from 82 kg in 2013/14 to 11.4 kg in 2016, a reduction of 86%.

13.5 NITROFURANS

There has been a decrease of 100% in sales of products containing nitrofurans since the previous report, with nil reported sales beyond 2014. Products containing this active ingredient were registered for use in horses and companion animals for wound care and for use in tropical fish. Only the tropical fish product remains registered.

13.6 NITROIMIDAZOLES

Nitroimidazoles are classified by the WHO as 'important' because the class may contain a limited number of treatments available for anaerobic infections such as *Clostridium difficile*.

A change from financial year to calendar year reporting demonstrated a reduction in sales of nitroimidazoles by 72%. A reduction in sales of 25% has occurred since the end of the previous reporting period. The large reduction in sales is attributed to de-registration of one product along with a change in registrant of a second product. Sales data for this product are not available for nine months of 2015 due to loss of contact with the previous registrant.

The majority of sales in this class are for products registered for use in pigs and poultry, and contain the active ingredient dimetridazole, while the remainder of sales are for products registered for use in companion animals, containing the active ingredient metronidazole. A small quantity of product that contains the active ingredient ronidazole was sold for use in pigeons. Compared to the overall mass of antibiotics, the amount of nitroimidazoles sold is very small.

13.7 NOVOBIOCIN

While products that contain novobiocin are registered for use in New Zealand, zero sales have occurred during this reporting period. This is the same as the previous reporting period.

13.8 OTHER

This category contains antibiotics that cannot be attributed to other classes of antibiotic and includes carbadox, tiamulin, florfenicol and fusidic acid.

The change to calendar year from financial year showed an increase by 31% of sales in this category from 201 kg sold in 2013/14 to 263 kg sold in 2014. Overall, comparing the end of the previous reporting period to the end of this reporting period, sales decreased by 3.5% from 201 kg to 194 kg. Sales from 2014 to 2015 decreased by 33% from 263 kg to 176 kg, then increased in 2016 by 10.5% to 194 kg. Sales in this category accounted for 0.3% to 0.4% of all antibiotics sold.

Carbadox sales accounted for less than 1% of all antibiotic sales during this period. However, it remains the dominant active ingredient in this category. Between 2014 and 2015 sales reduced by 33%, then increased in 2016 by 11%. Overall, there has been a reduction in sales of carbadox by 3% when comparing the end of this reporting period to the end of the previous reporting period. This active ingredient is registered exclusively for use in weaner pigs to prevent swine dysentery and as an antiparasitic.

During this reporting period there were no sales of products containing florfenicol or tiamulin. Fusidic acid is registered for use only in companion animals as a topical medication. Sales of fusidic acid during this period were reported at 1.4 kg for each year.

13.9 POLYMYXINS

Polymyxins have been added to the WHO list of 'critically important highest priority' antibiotics. This is to reflect the greater importance of this group for the treatment of Gram negative bacilli. Colistin usage is increasing in many parts of the world to treat serious infections in humans. Colistin is an old drug that fell out of favour as a human medicine due to renal toxicity. Two resistant genes that confer transmissible resistance to colistin have also been discovered, and the latest WHO report on critically important antimicrobials for human medicine suggests that evidence exists that these resistant genes have been transferred to humans from non-human sources. No products containing colistin are registered for use in New Zealand.

Products containing polymyxin are registered for use in cats, dogs and horses as a topical medication. Sales in this group are very small compared to the total amounts of antibiotic sold. In 2014, 0.43 kg was sold. This increased by 21.6% to 0.47 kg in 2015. Between 2015 and 2016, sales increased 2.1% to 0.48 kg.

Due to the difference in relative importance to AMR, the polypeptide zinc bacitracin is considered separately.

13.10 PENICILLINS

The WHO classification has changed for penicillins in the most recent revision of their antimicrobial rankings. Natural penicillins, amino-penicillins and anti-pseudomonal penicillins are now classified as 'critically important'. The active ingredients in this critically important penicillin class registered for veterinary use in New Zealand include penicillin G, ampicillin, amoxicillin, and penethamate (a prodrug of penicillin G).

These drugs have been moved to the critically important category of antibiotics due to the high frequency of use in humans and because they are used to treat infections where transmission of resistant bacteria is known to occur, though the WHO recognises that penethamate is a veterinary-only active ingredient. Anti-staphylococcal penicillins remain categorised as 'highly important'. The only active ingredient included in this group that is registered for veterinary use in New Zealand is cloxacillin.

Changing from financial year, when 14,032 kg was sold during 2013/14, to calendar year when 17,047 kg was sold during 2014, demonstrates an increase in sales of 21%. Overall there was an increase of 27% in sales of penicillins since the end of the previous reporting period. Sales from 2014 to 2015 decreased by 8% from 17,047 kg to 15,646 kg, then increased in 2016 by 14% to 17,802 kg. Sales of penicillins accounted for 24% to 26% of all antibiotics sold during this period.

To reflect the WHO classification of penicillins, sales have been split into 'critically important' and 'important' penicillins. Critically important penicillin sales were 12,528 kg in 2014, 11,237 kg in 2015 and 13,245 kg in 2016. Most sales in this category were composed of injectable products containing the active ingredient penicillin G (64%), registered for use in multiple species, followed by products registered for use in cattle, which include mostly intramammary and injectable products (25%).

There were no sales of penicillin-containing products specifically registered for use in pigs and poultry, plants, or other species categories.

It is important to remember that this report covers antibiotic sales from 2014 to 2016, and the addition of some penicillin actives to the 'critically important' category of antibiotics for human medicine by the WHO did not occur until 2016.This highlights the importance of producing sales reports on an annual basis as well as keeping the veterinary industry informed of changes in classification of antibiotics that are considered critically important so appropriate alterations can be made in prescribing choices.

13.11 SULPHONAMIDES

Sulphonamides continue to be classified by the WHO as 'highly important' as they may be one of a limited number of therapies for the treatment of bacterial meningitis and Salmonella, as well as for other infections.

A change from financial year to calendar year reporting demonstrates an apparent reduction in sales of this class by 4% from 4,309 kg during 2013/14 to 4,153 kg in 2014. Overall there was an increase of 5% in sales of sulphonamides since the end of the previous reporting period. Sales from 2014 to 2015 increased by 1% from 4,153 kg to 4,203 kg, then increased further in 2016 by 8% to 4,544 kg.

During this reporting period, sulphonamides accounted for around 6% of overall antibiotic sales. Approximately 60% of sales in this class were antibiotics registered for use as oral medications in horses. The majority of the remainder is registered for use in multiple species and about 5% sold is registered for use in multiple production species. Sales of sulphonamides registered for use in horses and multiple species, increased during this reporting period while sales registered for use in multiple production species decreased.

13.12 TETRACYCLINES

The WHO continues to class tetracyclines as 'highly important' for those regions where Brucella infections do not occur in food-producing animals, which includes New Zealand. This class accounted for approximately 12% of all antibiotic sales over this reporting period apart from in 2015 when sales almost halved. A change from financial year to calendar year reporting has demonstrated a reduction in sales of tetracyclines by 18%. The trend of a reduction in sales is also reflected when comparing the end of the previous reporting period with the end of this reporting period, when a decrease of 11% occurred. Sales from 2014 to 2015 decreased by 45% from 7,737 kg to 4,267 kg, then increased in 2016 by 98% to 8,441 kg. The decrease in sales in 2015 relates to a reduction in sales of several injectable products registered for use in multiple production species.

Approximately 75% of the tetracyclines sold are registered for use in multiple production species and, of these, the majority are injectable products. The next highest mass of tetracyclines sold are registered for use in pigs/poultry. Sales of these products increased by 64% during 2016. Only small amounts of tetracyclines sold are registered for use in companion animals.

13.13 VIRGINIAMYCIN

Virginiamycin belongs to the streptogramin class of antibiotics. Streptogramins continue to be considered 'highly important' by the WHO because this class is used to treat infections that could be transmitted from non-human sources including MRSA and *Enterococcus* spp.

All sales in this class are for products registered for oral use in horses to reduce risk of laminitis. Products containing virginiamycin are also registered for use in poultry, but none of these products were sold during this reporting period. Virginiamycin products account for a very small amount of overall antibiotic sales.

A change from financial year to calendar year shows an apparent increase in sales of this class by 11%. However, an overall decrease of 32% has occurred since the end of the previous reporting period. Sales from 2014 to 2015 decreased by 23% from 13 kg to 10 kg, then decreased in 2016 by 25% to 7.5 kg.

13.14 ZINC BACITRACIN

Bacitracins belong to the antibiotic class of cyclic polypeptides. The WHO continues to classify cyclic polypeptides as 'important' to human health as they fit neither criterion 1 or 2.

Overall, there was an increase of 17% in sales of zinc bacitracin since the end of the previous reporting period. Sales from 2014 to 2015 increased by 24% from 23,599 kg to 29,172 kg, then decreased in 2016 by 9% to 26,637 kg. A change in reporting from financial year to calendar year demonstrated an increase in sales by 4%.

Sales of this active ingredient have fluctuated from year to year, representing 40% of the total amount of antibiotics sold in 2014, 44% in 2015 and 37% of all antibiotics sold in 2016.

Zinc bacitracin is registered for use in the pig and poultry industries to prevent necrotic enteritis caused by *Clostridium perfringens*. A very small number of products containing bacitracin are registered for use in companion animal and multiple species as ocular and aural medications. Sales of these products represented less than 1kg of active sold annually. In 2016, a shift of sales occurred from products sold registered for use in pigs and poultry, to products sold that were registered for use in poultry only. This suggests that in previous years, all products registered for use in pigs and poultry containing zinc bacitracin were used in poultry exclusively.

The poultry industry continued to grow during this reporting period with an increase in numbers of 15.3%. The increase in poultry numbers is in line with the increase of bacitracin products sold. However, industry has commented that approximately 10% of the reported quantity of zinc bacitracin sold during this reporting period was exported for use in the Pacific islands.

14 Conclusion

This report highlights that the systems in place to manage animal health and encourage the prudent use of antimicrobials is working, although collectively New Zealand can continue to improve. While there has been an overall increase in the quantities of antimicrobials sold, it is clear that practises of antimicrobial use are changing to reflect concerns with AMR. These changes in practices are reflected in the reduction in sales of products containing the critically important classes including third and fourth generation cephalosporins, macrolides and fluoroquinolones.

Ongoing reporting of antibiotic sales

MPI will continue to seek registrant and industry input regarding the use of antimicrobials to provide context and inform the data analysis. The resultant report will continue to provide a reliable indication of actual antibiotic use rather than sales data alone, and the shift to annual reporting will make the information a more accurate reflection of industry trends.

It is recognised globally that collecting use information per species adds considerable value in the establishment of trends that can be used to inform resistance strategies. While a move to recording use per species rather than sales is problematic, it will give a clearer picture of which species these products are being used in and why. MPI will continue to look at methods for collecting use per species data for future reports.

Acknowledgement

The antibiotic sales data analysis was completed with input from industry representatives and practicing veterinarians on the use of antibiotics in New Zealand's production and companion animals.

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Animal Remedy and Plant Protection Association (ARPPA)

Beef and Lamb NZ

Dairy NZ

Horticulture NZ

National Mastitis Advisory Committee (NMAC)

New Zealand Feed Manufacturers

New Zealand Veterinary Association (NZVA) and NZVA member veterinarians

NZ Pork

Pipfruit NZ

Poultry Industry of New Zealand (PIANZ)

Registrants of antibiotic trade name products in New Zealand.

Antimicrobial Products Registered in New Zealand under the ACVM Act (2011 - 2016)

DATE REGISTERED		REGISTRATION NUMBER	PRODUCT NAME	REGISTRANT	ACTIVE INGREDIENT(S)	CLASS
2016	17/02/2016	A011142	Forcyl	Ethical Agents Veterinary Marketing Limited	Marbofloxacin	Fluoroquinolones
	14/03/2016	A011140	Oridermyl	Ethical Agents Veterinary Marketing Limited	Neomycin	Aminoglycosides
	4/11/2016	A011314	Excenel Flow	Zoetis	Ceftiofur	Cephalosporins
	27/04/2016	A011216	Cephalexin 600 Tablets with Beef Flavouring	Apex Laboratories Pty Limited	Cephalexin	Cephalosporins
2015	11/02/2015	A011126	Dryclox Xtra	Bayer NZ Ltd	Cloxacillin + Ampicillin	Penicillins
	11/02/2015	A011125	Dryclox DC	Bayer NZ Ltd	Cloxacillin + Ampicillin	Penicillins
	28/07/2015	A011156	Veraflox 25mg/mL Oral Suspension for Cats	Bayer NZ Ltd	Pradofloxacin	Fluoroquinolones
	18/08/2015	A011069	Furan - 2	Brooklands Aquarium Ltd	Nitrofurazone	Nitrofurans
	24/08/2015	A011195	TilmoVet 300 Injection	Agrihealth NZ Limited	Tilmicosin	Macrolides/Lincosamides
	21/09/2015	A010991	Clinicin	Chanelle Pharmaceuticals Manufacturing Ltd	Clindamycin	Macrolides/Lincosamides
	29/09/2015	A011182	Neotopic H Lotion	Ceva Animal Health (NZ) Ltd	Neomycin	Aminoglycosides
	3/11/2015	A011173	CloxaSeal 600	Norbrook NZ Ltd	Cloxacillin	Penicillins
	13/11/2015	A011130	Apex PMP Ear Suspension for Dogs and Cats	Apex Laboratories NZ Ltd	Polymyxin	Polypeptides
	19/11/2015	A011232	Enro 100 Injectable Solution	Randlab Australia Pty Ltd	Enrofloxacin	Fluoroquinolones

	10/12/2015	A011249	Clindacure	Chanelle Pharmaceuticals Manufacturing Ltd	Clindamycin	Macrolides/Lincosamides
2014	10/01/2014	A010984	Neove 200 Tylosin Injection	Neove Pharma Australia Pty Ltd	Tylosin	Macrolides/Lincosamides
	30/01/2014	A010848	Kelacef	Kela N.V.	Ceftiofur	Cephalosporins
	24/02/2014	A010920	Penethaject RTU	Bayer NZ Ltd	Penethemate	Penicillins
	18/3/20104	A011026	Norocef RTU	Norbrook NZ Ltd	Ceftiofur	Cephalosporins
	8/04/2014	A011025	DC Duo	Bayer NZ Ltd	Cloxcillin + Ampicillin	Penicillins
	29/04/2014	A010792	Ultraclox 24	Bayer NZ Ltd	Cloxacillin	Penicillins
2013-2014	18/03/2014	A011026	Norocef RTU	Norbrook NZ Ltd	Ceftiofur	Cephalosporins
	30/01/2014	A010848	Kelacef	Phoenix Pharm	Ceftiofur	Cephalosporins
	10/01/2014	A010984	Neove 200 Tylosin Injection	Neove Pharma Australia Pty Ltd	Tylosin	Macrolides/Lincosamides
	23/10/2013	P008603	Kasumin	Etec	Kasugamycin	Aminoglycosides
	17/10/2013	A010814	Draxxin Injectable Antibiotic Solution	Zoetis NZ Ltd	Tulathromycin	Sulphonamides/Trimethoprim
	20/08/2013	A010927	Veraflox Tablets for Dogs and Cats	Bayer NZ Ltd	Pradofloxacin	Fluoroquinolones
	20/09/2013	A010735	Metricycline	Kela NV	Chlortetracycline	Tetracyclines
2012-2013	21/03/2013	A010884	PenClox 1200 High Potency Milking Cow	Virbac New Zealand Ltd	Penicillin + Cloxacillin	Penicillins
	17/12/2012	A010555	Genta 100	Phoenix Pharm	Gentamicin	Aminoglycosides
	4/12/2012	A010742	BaciMax 150 Granular	Agrihealth NZ Limited	Zinc Bacitracin	Bacitracin
	18/11/2012	A010714	Tylosin 300 Injection	Bayer NZ Ltd	Tylosin	Macrolides/Lincosamides
	15/08/2012	A010672	TMPS Powder	Caledonian Holdings Ltd	Trimethoprim + Sulphamethazine	Sulphonamides/Trimethoprim
	20/07/2012	A010807	TyloVet Injection	Agrihealth NZ Limited	Tylosin	Macrolides/Lincosamides
	10/07/2012	A010772	Tylofen	Bayer NZ Ltd	Tylosin	Macrolides/Lincosamides

2011-2012	17/11/2011	A010667	Furan-2	Brooklands Aquarium Ltd	Nitrofurazone + Furazolidone	Nitrofurans
	4/11/2011	A010727	Romagel VS	Merial NZ Ltd	Cephalonium	Cephalosporins
	3/10/2011	A010691	Eficur	Hipra NZ Ltd	Ceftiofur	Cephalosporins
	8/08/2011	A010697	Cefaject	Bayer NZ Ltd	Ceftiofur	Cephalosporins
	8/08/2011	A010685	Pharmasin 10% Granular Premix	Agrihealth NZ Limited	Tylosin	Macrolides/Lincosamides
	11/04/2011	A010637	Tylomix 250	Bayer NZ Ltd	Tylosin	Macrolides/Lincosamides