



Prevalence of Anthelmintic Resistance - the UK Situation

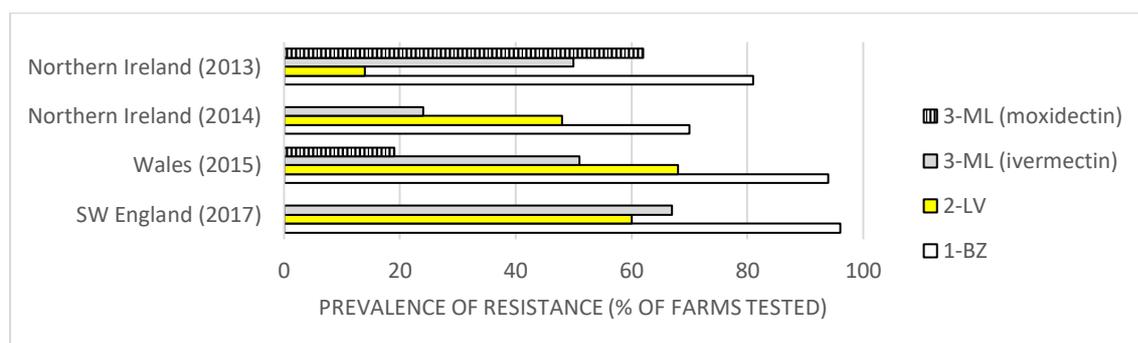
Since the introduction of the different broad-spectrum class in the UK and across all other major sheep producing countries of the world, anthelmintic resistance has been detected. The speed at which AR is developing is increasing. This may in part be due to better awareness of anthelmintic resistance and the reporting of suspected cases. There is also the increased pressure on the 3-ML group which are also used in injectable form for the control of sheep scab.

Chronological order of introduction of anthelmintic classes and the first reported cases of anthelmintic resistance in the UK in sheep

Class	Date of introduction in UK	Date of first case of resistance reported in UK
1-BZ	1960s	1984
2-LV	1970s	1996
3-ML ivermectin	1980s	2001
3-ML moxidectin	1990s	2007
4-AD	2010	2018
5-SI	2012	Unreported so far

Based on surveys conducted in Great Britain since 2000, a large proportion of lowland farms have 1-BZ resistance and a smaller, but a significant proportion has 2-LV resistance. The prevalence amongst hill farms may be lower than lowland farms. 3-ML (ivermectin and moxidectin) resistance is now being reported in many parts of GB, and further emphasizes the importance of exercising some control over its development and spread between flocks, before it becomes widespread throughout the country. 4-AD resistance is emerging in the UK.

Recent prevalence survey report findings of anthelmintic resistance from across the UK.





Anthelmintic resistance has been detected in a number of species of sheep roundworms. demonstrates the relative pathogenicity and likelihood of resistance development in different roundworm species seen in the UK.

Relative pathogenicity and likelihood of resistance development in different UK roundworm species. Red denotes high pathogenicity and high likelihood of anthelmintic resistance development; green denotes low pathogenicity and low likelihood of anthelmintic resistance development with amber in between.

Relative pathogenicity	Genus (common-name)	Relative likelihood to develop resistance
Red	<i>Haemonchus</i> (barber's pole worm)	Red
Red	<i>Teladorsagia</i> (Brown stomach worm)	Red
Amber	<i>Trichostrongylus</i> (Scour worm)	Amber
Amber	<i>Nematodirus</i> (thread-necked worm)	Green
Green	<i>Cooperia</i>	Green
Green	Large bowel worms	Green



Benzimidazole (1-BZ) resistance has been reported in *Teladorsagia circumcincta*, *Haemonchus contortus*, *Cooperia curticei* and *Trichostrongylus* spp.

Additionally 1-BZ resistant *Nematodirus battus* has been detected in a small number of flocks across the UK. A survey showed that the genes for resistance were found in around 1 in 4 flocks but generally at very low levels (on 2% of the individual parasites examined but at higher prevalence on some farms).



Levamisole resistance has been reported in *T. circumcincta*, *C. curticei* and *Trichostrongylus* spp.



Ivermectin (IVM) resistance has been reported in *T. circumcincta* and *Trichostrongylus* species in a number of sheep flocks in parts of Great Britain. There have also been a reports of moxidectin (MOX) resistance. In the early stages of selection this usually manifest as a reduced period of persistency.



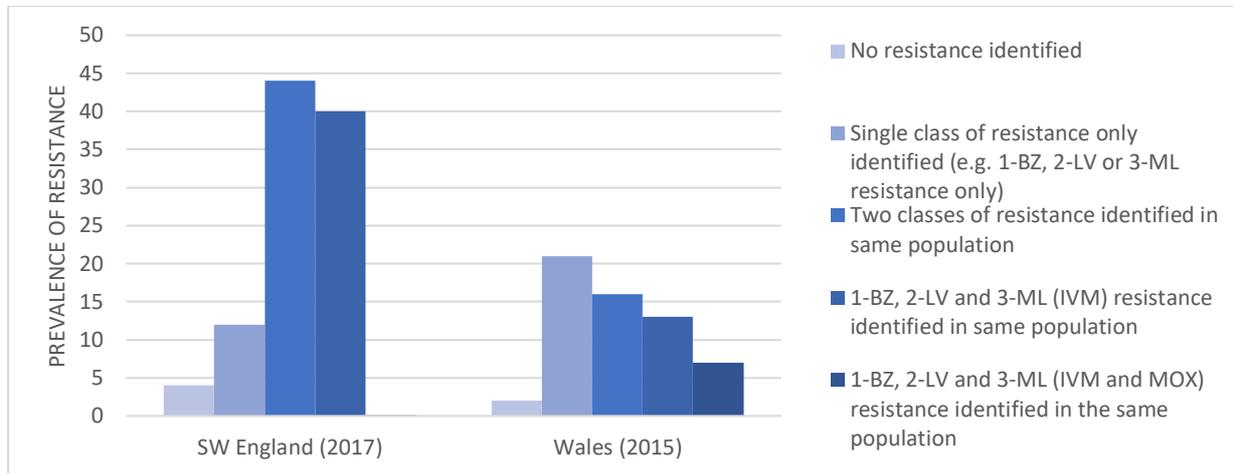
Monepantel resistance has been reported in *T. circumcincta*, *Trichostrongylus vitrinus* and *Oesophagostomum* on three farms in the UK.



Resistance has not currently been reported to 5-SI.



Multiple Resistance - The emergence of 'triple' resistance' is becoming a greater with the majority of farms examined in surveys containing parasite populations that are resistant to more than one anthelmintic class. These populations are a cause for concern and presents a challenge in terms of correct advice and management.



Findings of resistance to more than one class of anthelmintic in the same population

References McMahon *et al.*, 2013 *Veterinary parasitology*, 195(1-2), 122-130; Keane *et al.*, 2014. *Irish veterinary journal*, 67(1), 16; Mitchell, *et al.*, 2010 *Veterinary Record* (2010) 166, 650-652; Glover, *et al.*, 2017. *Veterinary Record* 180(15),378; Thomas *et al.*, 2015 *Wales Against Anthelmintic Resistance Development: Final Project Report*. Hybu Cig Cymru https://meatpromotion.wales/images/resources/WAARD_FINAL_PROJECT_REPORT_1_-_19-11-15.pdf

Knowledge of the resistance status to the different anthelmintic groups, the worm species involved and at what stage in the season, can greatly influence the advice given to maintain effective control and manage resistance development.

Spread of anthelmintic resistance between farms

Undoubtedly the spread of AR between farms has been a significant factor contributing to the introduction of AR worms to many farms in the UK and worldwide. Frequent importations of sheep, often from multiple sources and usually without effective quarantine treatments on arrival are a major risk factor. Effective quarantine and treatment of all new and/or returning animals is essential to minimize the risk of importing resistant parasites and those which may not be present on the home farm for example *Haemonchus contortus*, sheep scab or liver fluke.