Anthelmintic resistance on dairy calf-to-beef farms in Ireland

While anthelmintic resistance has been reported to be common on sheep farms, TEAGASC research has also found resistance in Irish dairy calf-to-beef systems.

Irish beef production is pasture based, with grazing animals naturally exposed to gastrointestinal nematodes (GINs; roundworms). GIN infection in calves can result in ill-thrift, with subclinical infection resulting in reduced growth rate. After their first grazing season cattle generally develop sufficient immunity to prevent clinical disease. Cattle in Ireland are usually infected with a number of GIN species, the most common being *Ostertagia ostertagi* (found in the abomasum) and *Cooperia oncophora* (found in the small intestine) (Murphy *et al.*, 2006). *Ostertagia* is considered more pathogenic than *Cooperia*.

Most cattle GIN have a similar life cycle, with free-living and parasitic stages. Eggs laid by mature female worms in the gastrointestinal tract pass out with the faeces. The eggs embryonate and larvae hatch and feed on microbes in the dung. The larvae develop into infective third-stage larvae after approximately four to ten days, depending on weather conditions. The infective L3 larvae migrate out of the faecal pat onto the pasture where they can persist for extended periods. Once ingested by grazing cattle the larvae pass to the gastrointestinal tract, where they develop into adults, mate and lay eggs within approximately three weeks. The level of GIN infection in a herd can be ascertained by counting the number of worm eggs per gram (epg) of faeces (faecal egg count or FEC).

Anthelmintic resistance

Control of GIN in cattle is usually achieved by the administration of broad-spectrum anthelmintics. There are currently three classes of anthelmintic licensed for the control of GIN in cattle: benzimidazole; levamisole; and, macrocyclic lactone. These products have been highly effective in controlling GIN infection in ruminants for over 50 years; however, in recent years there have been a number of reports of anthelmintic resistance worldwide. Anthelmintic resistance is defined as the inherited ability of worms to survive doses of drugs that would normally kill them. Anthelmintic resistance has been reported to be common on sheep farms internationally and recent research in Ireland has shown widespread anthelmintic treatment failure on sheep farms, with 49% of anthelmintic treatments administered to lambs considered ineffective (Keegan *et al.*, 2017). However, the prevalence of anthelmintic resistance on cattle farms was unknown. Anthelmintic resistance is detected by a FEC reduction test (FECRT), with resistance declared if the reduction in egg count is <95% and the lower confidence limit is <90%. If only one of these criteria is met, resistance is suspected (Coles *et al.*, 2006). The objective of this study was to determine if resistance to benzimidazole and macrocyclic lactone was present on dairy calf-to-beef farms in Ireland.

Research on 16 farms

Sixteen dairy calf-to-beef farms, geographically spread around the country, were recruited for the study. These farms were required to have a minimum of 40 co-grazing first-season calves. The FEC of the herd was monitored fortnightly from the beginning of May to determine the level of GIN infection by collecting fresh faecal samples from 10 calves in the herd. A composite faecal sample was subsequently generated by mixing 5g from each individual sample, and the egg count of the composite sample determined using the mini-FLOTAC method with a sensitivity of 5epg. Once the herd egg count exceeded 100epg, the FEC reduction test was conducted.

Table 1: Anthelmintic resistance in 16 Irish dairy calf-to-beef farms.

Farm	Reduction in egg count after treatment with macrocyclic lactone (ivermectin)	Reduction in egg count after treatment with benzimidazole (fenbendazole)
1	52 (resistant)	85 (resistant)
2	-228 (resistant)	69 (resistant)
3	54 (resistant)	92 (resistant)
4	-3 (resistant)	93 (resistant)
5	34 (resistant)	98 (susceptible)
6	77 (resistant)	85 (resistant)
7	66 (resistant)	63 (resistant)
8	25 (resistant)	49 (resistant)
9	89 (resistant)	15 (resistant)
10	48 (resistant)	89 (resistant)
11	49 (resistant)	86 (resistant)
12	60 (resistant)	96 (susceptible)
13	78 (resistant)	99 (susceptible)
14	68 (resistant)	99 (susceptible)
15	60 (resistant)	89 (resistant)
16	51 (resistant)	89 (resistant)

Forty calves from the grazing group were weighed, faecal samples collected and the animals were treated with either a macrocyclic lactone product (ivermectin) subcutaneously at a rate of 1ml per 50kg bodyweight (n=20), or a benzimidazole product (fenbendazole) orally at a rate of 7.5ml per 100kg bodyweight. The calves returned to grass, and 14 days post treatment faecal samples were again collected. Anthelmintic efficacy was determined.

Results showed that resistance to macrocyclic lactone was found on all 16 farms tested, while resistance to benzimidazole was found on 12 of the 16 farms tested (**Table 1**). In some cases the egg count increased after administration of the anthelmintic.

The results from this study demonstrate that anthelmintic resistance to benzimidazole and macrocyclic lactone can be detected on Irish dairy calf-to-beef farms. Strategies to mitigate the risk of anthelmintic resistance need to be urgently put in place. Good GIN control practices, which reduce selection pressure on nematode populations, need to be urgently implemented. Such practices include avoiding treating too frequently, avoiding suboptimal dosing, and implementing a good biosecurity protocol for bought-in stock.

Acknowledgments

The authors would like to acknowledge the participating farmers and funding from the Teagasc Walsh Fellowship Programme.

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