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A survey of helminth control practices on sheep farms in Great Britain and Ireland

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ABSTRACT

A telephone survey of 600 farmers throughout Great Britain and Ireland was conducted in order to characterise helminth control practices, and identify factors correlated with perceived anthelmintic failure.

Overall, 93% of surveyed farmers routinely treated their sheep against nematodes, 67% against liver fluke and 58% against tapeworms. Anthelmintic resistance in nematodes was perceived by farmers to be present on 10% of farms. Farmers who dosed ewes at mating were more likely to have observed anthelmintic failure, than those who were aware of national guidelines on parasite control. However, objective assessment of anthelmintic efficacy had only been undertaken on 19% of farms. Ewes were treated at mating and lambing on 63% and 62% of farms, respectively. On average, lambs were treated 3.6 times annually, depending on geographical region and on dates of lambing and finishing. Although 'quarantine' treatments were widely administered to bought-in stock, these were appropriately applied in only 3% of cases.

This study provides baseline data against which the impact of future anthelmintic information campaigns can be assessed; it will facilitate the development of rational, farm-level mathematical models in support of sustainable parasite control, and will aid in the design of farm management practices that prolong the effective lifespan of novel classes of anthelmintic.

Introduction

As anthelmintic resistance becomes a major constraint on sheep production in many countries (Kaplan, 2004; Bartley et al., 2006; Besier, 2007; Papadopoulos, 2008), the relationship between chemical prophylaxis and animal husbandry is recognised as increasingly important in that existing drugs need to be used in a more targeted, appropriate way in order to delay the development of resistance (Coles, 2002, 2003, 2005). Furthermore, as anthelmintic resistance rises, parasite control will increasingly rely on alternative approaches intimately linked to flock management and husbandry practices (Jackson and Miller, 2006). Crucially, novel anthelmintics such as monepantel (Zolvix, Novartis Animal Health) should be deployed cognisant of the mistakes of the past in order to prolong their efficacy (Besier, 2009; Hosking et al., 2010).

Knowledge of current helminth control practices on sheep farms in Great Britain and Ireland is highly relevant to our ability to control these parasites in the future. Mathematical models have been developed to facilitate parasite control (Smith and Grenfell, 1994; Kao et al., 2000; Cornell, 2005), and to predict the effect of such practices on the development of anthelmintic resistance (Gettinby, 1989; Dobson et al., 2004; Gaba et al., 2006; Leathwick et al., 2009; Leathwick and Hosking, 2009). These will be most effective when they reflect realistic farm settings (Learmount et al., 2006; Leathwick et al., 2009), and the construction of models in terms of relevant husbandry and treatment factors will be crucial to their subsequent usefulness.

There are very few published quantitative data on how sheep farmers in Great Britain and Ireland control helminths, and how this relates to other husbandry factors. The objective of the current study was to provide important background information on current helminth control practices on sheep farms in Britain and Ireland. The study set out to identify how high-risk management practices can be modified, and to characterise the environments in which novel anthelmintic strategies operate. The work provides baseline data on farming practices in the context of the recent launch of the SCOPS (Sustainable Control of Parasites in Sheep) information campaign advising farmers on sustainable helminth control in sheep in the UK (Abbott et al., 2009).

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Materials and methods

Farms were selected from commercial telephone directories[1] and farmers contacted by telephone in the order in which they were listed. After confirming that sheep were kept on the farm, farmers were interviewed about their husbandry and parasite control practices, on the basis of a standardised questionnaire that included both 'open' and 'closed' questions (Thrusfield, 2005) (see Supplementary material).

A total of 600 farmers were interviewed in the Republic of Ireland and in six different regions of the UK: Wales; Scotland; Northern Ireland; South-West England (Avon, Cornwall, Devon, Dorset, and Somerset); Northern England (Cheshire, Cumbria, Derbyshire, Durham, Humberside, Lancashire, Lincolnshire, Nottinghamshire, Northumberland, Staffordshire, and Yorkshire); Midlands/South of England (Bedfordshire, Buckinghamshire. Cambridgeshire, Essex, Gloucestershire, Hampshire, Herefordshire, Hertfordshire, Isle of Wight, Kent, Leicestershire, Norfolk, Northamptonshire, Oxfordshire, Shropshire, Suffolk, Surrey, Sussex, Warwickshire, West Midlands, Wiltshire, and Worcestershire).

Descriptive and analytical statistics were compiled using Minitab software (Minitab Inc.) and differences in scale variables between farm categories were compared using Mann–Whitney and Kruskal–Wallis tests. Where multiple comparisons were made, e.g. when using post-hoc Mann–Whitney tests subsequent to a significant Kruskal–Wallis test result, the Bonferroni correction was applied to the critical *P* value (Sokal and Rohlf, 1995).

The questions 'do you have drench-resistant worms on your farm?' (possible answers: yes/no/unsure) and 'do you alternate between groups of wormers?' (possible answers: yes/no) were asked in the nematode section of the questionnaire. Positive answers to the former question were taken as an index of anthelmintic resistance, on the basis that cases of overt treatment failure would increase in proportion to the underlying prevalence of anthelmintic resistance. Factors associated with suspected drug failures were then assessed using logistic regression. Logistic regression analysis was also used to compare observed disease problems associated with, and frequency of treatment against, liver fluke and tapeworm between regions.

Key farm characteristics and management factors (e.g. number of breeding ewes, minimum altitude, principal breed of ewes, presence of cattle, percentage of land used for grazing, and month of lambing) were used in principal component analysis. This technique is used to combine variation in multiple factors into composite higher order variables (Wullschleger and Jokela, 1999). In the current study, the aim was to reduce the various farm and management characteristics into general indices of farm type. Scores for each farm were calculated from the first two principal components, and associations between these scores and risk factors for anthelmintic resistance were assessed using the Spearman rank correlation.

The purpose of this analysis was to determine whether general features of farm type increased the risk of the development of anthelmintic resistance. Risk factors were defined as those variables that had a significant association with the farmer reporting a treatment failure as identified by logistic regression, as well as variables considered *a priori* such as 'number of annual treatments of ewes/lambs', 'whether sheep were imported onto the farm', and 'whether the classes of anthelmintics used alternate from year to year'. These risk factors were similarly condensed using principal component analysis into a 'risk type' variable for each farm. Associations between risk type and individual farm type and management factors, geographical region, and condensed 'farm type' scores, were assessed using the Kruskal–Wallis test (for categorical variables) and the Spearman rank correlation (for scale variables).

Results

Farm management

A total of 600 farmers were interviewed throughout Great Britain and Ireland (Fig. 1). Farm elevation differed significantly between regions (Kruskal–Wallis $H = 64.4$; 6 d.f.; $P < 0.001$), being highest in Scotland (median 233 m; $n = 85$) and Wales (median 166 m, $n = 100$), and within England farm elevation increased from the Midlands/South (95 m, $n = 100$) to the South-West (120 m, $n = 100$) and North (135 m, 100). Farms in Ireland had the lowest elevation (45 m, $n = 90$), except in the northern region (100 m, $n = 25$). Most farms were 'mixed' ($n = 418$), with some being grassland only ($n = 151$), and 9% had common grazing between farms. The average size and stocking rate of farms is illustrated in Table 1.

Cattle were kept on 365/600 farms (55%), of which 90% were beef and 10% were dairy breeds, respectively. Mixed sheep/dairy farms were relatively few in number ($n = 35$; 6%). Where farms stocked cattle, 91% rotated grazing between cattle and sheep. The

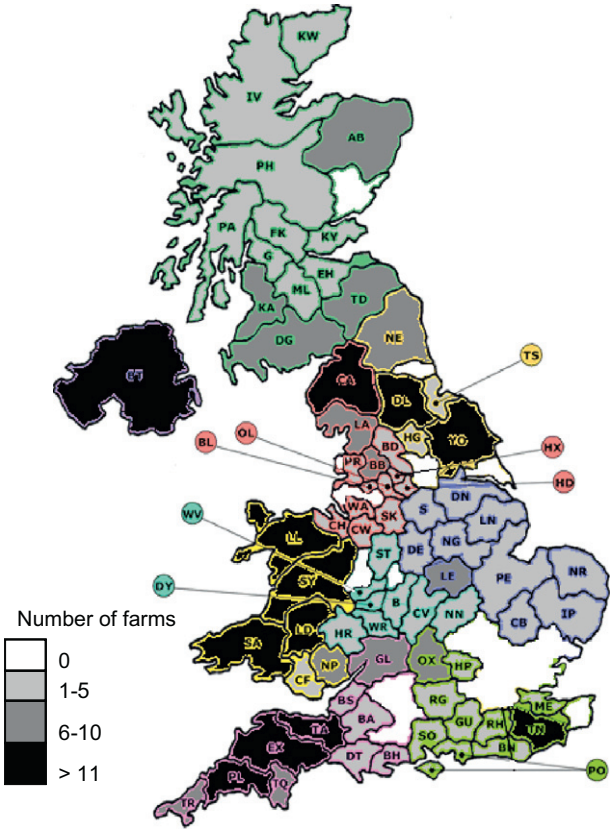

Fig. 1. Distribution of surveyed farms by UK postcode. Number of farms sampled per postcode varied from 1 to 42 (mean 5.8, mode 3). Number of farms, mean and mode within categories were: 1–5 (58, 2.6, 2); 6–10 (13, 6.9, 7); >11 (12, 18.8, 15). Postcodes were not specified for 22 farms. The location of farms sampled in the Republic of Ireland was specified in 50/90 cases. These were widely distributed across 18/26 counties, with an average of 5.1 farms/county (median 2, range 1–7).

main sheep breeds on each farm were: Suffolk ($n = 64$); Texel ($n = 40$); a mixture of these or various other lowland breeds or crosses ($n = 252$); Mule or Leicester ($n = 206$); and upland/hill breeds ($n = 96$).

Although lambing took place most commonly in March (27%) or April (21%), significant numbers of flocks lambed in January (19%) or February (20%). The month of lambing differed significantly between regions (Kruskal–Wallis $H = 54.10$; 6 d.f.; $P < 0.001$), and was generally earlier than average in The Republic of Ireland (January), Northern Ireland and South-West England (February), and occurred later in Scotland (April). Later lambing was also related to higher farm altitude (Kruskal–Wallis $H = 37.76$; 3 d.f.; $P < 0.001$; $n = 547$). The mean minimum altitudes for lambing in January, February, March, and April were 211 m, 265 m, 307 m, and 313 m, respectively. Ewes were housed for all or part of the year on 67% of farms, but in 56% of cases this was for <6 weeks, typically at lambing.

Parasite control

Sources of decision support

Almost all farmers (93%) routinely treated their sheep against nematodes, 67% against liver fluke and 58% against tapeworms. Of these, most (92%) planned their own worming strategies, while 7% involved a veterinary practitioner and 1% an agricultural merchant or other party. 84% of farmers gave their main sources of information when deciding on their worming strategy. 46% obtained this information from their veterinary practice and 34% of respondents cited veterinary practices as their primary source of such information.

[1] See: www.yell.com and www.goldenpages.ie.