The integration of grazing management and anthelmintic treatment to provide clean lambing paddocks in the northern tablelands region of NSW, Australia.

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Abstract

The three experiments described in this thesis have been submitted as research articles to Veterinary Parasitology. Each research article has been included in the thesis as an experimental chapter, essentially as submitted for publication but with the abstract removed. These abstracts are provided below.

Chapter 4:

This experiment was designed to determine the infective consequences of winter pasture contamination by sheep infected with 6 species of trichostrongylid gastro-intestinal nematode (GIN) at Armidale in the northern tablelands region of NSW. Ten helminthologically inert pasture plots were contaminated using 'donor' sheep harbouring artificial infections of *Haemonchus contortus*, *Trichostrongylus colubriformis*, *Trichostrongylus vitrinus*, *Trichostrongylus axei*, *Nematodirus spathiger* and *Teladorsagia circumcincta*. A single plot was contaminated in March to serve as a positive control and three plots in each of the winter months of June, July and August of 2007. Weekly assessments of twenty-four hour faecal output and worm egg count of all donor sheep, combined with differentiation of larval cultures enabled calculation of total egg deposition per plot for each GIN species for each month of contamination. All plots were provided with supplemental spray irrigation sufficient to remove desiccation as a cause of non-development. The infective consequence of each monthly contamination was assessed by grazing each plot with two tracer sheep for the last fourteen days of each month following contamination until a final grazing in November. Translation for each GIN species was expressed as the percentage of eggs deposited translating to worms counted in tracer sheep.

The GIN parasites fell into two distinct groups differing greatly in translational success. Translation of egg to establishment in the tracer host was ineffective for *H. contortus*, *T. axei* and *T. colubriformis* but effective for *T. vitrinus*, *T. circumcincta* or *N. spathiger.* Overall mean total translation for each of these species throughout the experiment was respectively 0.00%, 0.00%, 0.00%, 0.34%, 0.45% and 0.48%.

We conclude that winter contamination of pastures in this region with eggs of the latter 3 species is capable of impacting on the health of sheep subsequently grazing these pastures. These findings are particularly relevant to the preparation of clean spring lambing paddocks in this region using grazing management.

Chapter 5:

This survey was designed to determine the spatial and temporal distribution and the relative contributions of *Trichostrongylus colubriformis*, *Trichostrongylus vitrinus*, *Trichostrongylus axei* and *Trichostrongylus rugatus* to sheep infected with *Trichostrongylus* spp. on the northern tablelands of NSW.

Thirty completed larval cultures were collected from a commercial parasitology laboratory servicing the northern tablelands of NSW between June and December 2007. Cultures were selected at random from within 16 regional localities whenever the combined results of faecal worm egg counting and coproculture indicated >200 *Trichostrongylus* spp. eggs per gram and >40% *Trichostrongylus* spp. respectively. Selection of cultures was constrained to prevent multiple samples from a single grazing property. Larval cultures were stored at 4°C and subsequently used to artificially infect GIN-free sheep which were sacrificed for collection of gut contents at three weeks post-infection. Abomasal contents were examined for the presence of *T. axei.* From the anterior small intestine 100 adult male *Trichostrongylus* spp. per animal were identified to species (*T. colubriformis*, *T. vitrinus* or *T. rugatus*) according to spicule morphology.

T. colubriformis was the most prevalent *Trichostrongylus* species (present in 100% of the samples) as anticipated in a summer rainfall region. *T. vitrinus* was present in 20% of the samples while *T. rugatus* was present in only 10% of the samples, yet when present comprised a much higher proportion of the total *Trichostrongylus* population than has previously been reported. In an unexpected result, *T. axei* was not identified in any of the samples collected. The epidemiological basis for these results and the implications for gastro-intestinal nematode control are discussed.

Chapter 6:

A replicated field experiment using nine 2 ha paddocks was designed to compare the efficacy of 3 management strategies to prepare spring lambing paddocks of low gastro-intestinal nematode (GIN) infectivity. The management treatments were designed to provide the same overall stocking rate over the lambing paddock preparation period (Phase 1, 16 January - 9 June, 2006). The first treatment involved two 21-day periods of intensive grazing with drenched wethers in Jan-Feb, and in late March (Smartgraze summer rainfall, SGSR). The second treatment was industry standard practice of continuous grazing of adult sheep over the entire preparation period (continuous sheep, CS) and the third treatment was industry best practice of continuous grazing of adult cattle (continuous cattle, CC). Phase 2 of the experiment (14 August-12 December, 2006) tested the efficacy of the paddock preparation treatments. Single bearing ewes (n=10 per paddock) were introduced on 14 August following an effective short acting anthelmintic treatment. Lambing commenced 2 weeks later on the 25th of August with lamb marking at 7 weeks and weaning at 15 weeks when the experiment was terminated. Tracer sheep (n=2) were run in each of the paddocks for two weeks at the start of Phase 1, and at the start and conclusion of Phase 2 to assess pasture GIN contamination.

Total worm counts in tracers were reduced by 97.7% (SGSR), 96.9% (CC) and 88.5% (CS) between the start of the experiment and the introduction of lambing ewes. Between the start of the experiment and weaning, total reductions were 87.9% (SGSR), 85.6% (CC) and 26% (CS). Worm egg counts of ewes and lambs grazing SGSR or CC paddocks were significantly lower than those grazing CS paddocks. As a consequence ewes grazing CS paddocks required anthelmintic treatment at both marking and weaning and their lambs at weaning, whereas no anthelmintic treatments were required for ewes or lambs on SGSR paddocks. Ewes and lambs grazing paddocks prepared with SGSR and CC were significantly heavier at weaning than those grazing paddocks prepared with CS, despite requiring fewer anthelmintic treatments. This experiment demonstrates that an understanding of regional GIN epidemiology can be employed to prepare pastures of very low infectivity in sheep only systems (SGSR) providing parasitological and production benefits equivalent to those obtained by grazing non host species, in this case mature cattle (CC). Implications of these strategies for the development of anthelmintic resistance are discussed.

Certification

I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

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Justin Neville Bailey

Table of contents

List of tables

List of figures

List of plates

List of publications

Bailey, J.N., Kahn, L.P. and Walkden-Brown, S.W. (2008). Availability of gastro-intestinal nematode larvae to sheep following winter contamination of pasture with six nematode species on the northern tablelands of New South Wales. *Veterinary Parasitology*, (Accepted).

Bailey, J.N., Walkden-Brown, S.W. and Kahn, L.P. (2008). Comparison of strategies to provide lambing paddocks of low gastro-intestinal nematode infectivity in a summer rainfall region of Australia. *Veterinary Parasitology*, (Submitted).

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Bailey, J., Walkden-Brown, S., Kahn, L. and Besier, B. (2007). The integration of anthelmintic treatment and grazing management for the provision of clean lambing paddocks in a summer rainfall region of Australia. In '*The 21st International Conference of the World Association for the Advancement of Veterinary Parasitology*', Gent, Belgium.

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