

**Investigating the effect of gastrointestinal  
nematodiasis in Merino sheep on the Northern  
Tablelands of New South Wales and  
implications for Integrated Parasite  
Management**

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## SUMMARY

On the Northern Tablelands of NSW, gastrointestinal nematodiasis imposes significant constraints to sheep production. The overall aim of this thesis was to quantify this production loss and evaluate the extent to which it can be ameliorated by integrated parasite management approaches. The general hypothesis tested in this work was that gastrointestinal nematode infection (i.e. worms) present on commercial sheep properties in the Northern Tablelands of NSW induces significant production loss and that worm control utilising Integrated Parasite Management in Sheep (IPM) would reduce this loss and the overall economic impact of worms.

Chapter 1 reviews the relevant literature and identifies the need for a greater understanding of the constraints imposed by worms, and the extent these constraints can be alleviated by management changes as critical questions for the Australian Sheep Industry.

Chapter 2 quantifies the effects of worms in grazing Merino ewes on the Northern Tablelands of New South Wales. A  $2 \times 2 \times 2 \times 2$  factorial experiment with two levels of farm management, each with two worm treatments (suppressed or naturally infected) and two age groups of ewes, conducted over 2 years. Results confirm the significant production loss caused by worms in this region and show that IPM reduces these effects and

frequency of anthelmintic treatment compared with typical worm management methods currently used by the industry.

Chapter 3 used data from the experiment described in Chapter 2 to determine the effect of phenotypic resistance and resilience to worms. Relationships presented demonstrate that phenotypic measures of these traits can be used to aid worm control in environments dominated by *Haemonchus contortus* to limit contemporaneous costs to production.

Chapter 4 used data from Chapter 2 to outline the key risks associated with mortality for mature sheep on the Northern Tablelands of NSW. The most significant factors associated with mortality were fat score, indicative of nutritional status, and worm egg count, indicative of *H. contortus* burden.

The effect of worms in previous chapters was quantified by measuring the difference between sheep with worms serially suppressed with a controlled release albendazole capsule and an injection of long-acting moxidectin or remaining naturally infected. Chapter 5 tested the hypothesis that challenge from third stage infective larvae would not cause production loss in worm-suppressed sheep. The experiment was an incomplete 2x3 latin square design with sheep either infected or uninfected and receiving either no treatment, anthelmintic treatment when worm egg count exceeded 1500 eggs per gram or worm-suppressed with a controlled release capsule. Results

indicated that larval challenge in worm-suppressed sheep is mildly immunogenic but is not associated with production loss.

In Chapter 6 the biological data from Chapter 2 was used to quantify the economic cost of worms on the Northern Tablelands of NSW, and update estimates for the national sheep flock. The cost of worms was greatly reduced with IPM which justifies the additional monitoring costs associated with monitoring of worm egg counts and anthelmintic resistance status. The estimated cost of worms in a high summer rainfall region exceeded previous estimates suggesting that the industry has underestimated the cost of worms in areas dominated by *H. contortus*. The total annual cost of GIN parasitism has declined since 2006 in line with a contraction of the national sheep population.

This research has quantified the biological and economic impact of worms on commercial farms on the Northern Tablelands of NSW in the largest and most comprehensive study of its kind to date. It has shown it to be higher than previous estimates which is primarily due to increased commodity prices. The work has also clearly demonstrated the benefits of Integrated Parasite Management in Sheep in reducing both worm-induced mortality and the overall economic impact of gastrointestinal nematode infection. It is hoped that the information presented in this thesis will ultimately support an increased adoption by industry of sustainable worm control programs.

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## List of abbreviations

<b>Acronym</b>	<b>Definition</b>
CRC	Controlled Release Capsule
CRCT	Controlled Release Capsule Treatment
DSE	Dry Sheep Equivalent
DWG	Daily Weight Gain
EOS	Eosinophils
FCE	Feed Conversion Efficiency
FS	Fat Score
GFW	Greasy Fleece Weight
GFWDEP	Greasy Fleece Weight Depression
GFWINF	Greasy Fleece Weight when Infected
GFWSUP	Greasy Fleece Weight when worm Suppressed
GIN	Gastrointestinal Nematode
HCT	Haematocrit
HCTDEP	Haematocrit Depression
HCTINF	Haematocrit when Infected
HCTSUP	Haematocrit when worm Suppressed
HGB	Haemoglobin
INF	Infected
IPM	Integrated Parasite Management
LSM	Least Square Means
LWG	Liveweight Gain
LWGDEP	Liveweight Gain Depression

LWGINF	Liveweight Gain Infected
LWGSUP	Liveweight Gain Suppression
LWT	Liveweight
LYM	Lymphocyte
MJ	Megajoule
ML	Macrocyclic Lactone
MP	Metabolisable Protein
NEU	Neutrophil
NOCAP	No Controlled Release Capsule (farm management)
NPV	Net Present Value
NSW	New South Wales
SUP	Suppression
TBZ	Thiabendazole
TST	Targeted Selective Treatment
TT	Treatment Threshold
TYP	Typical
UINF	Uninfected
UNE	University of New England
VFI	Voluntary Feed Intake
WBC	White Blood Cell
WEC	Worm Egg Count

## List of Publications

- Kelly, G. A., Kahn, L. P. & Walkden-Brown, S. W. (2010) Integrated Parasite Management in sheep reduces the effect of gastro-intestinal nematodes on the Northern Tablelands of NSW. *Animal Production Science*, 50, 1043-1052.
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