

Molloy, Angela (1999)

PAYNE

The impact of common parasite control systems on the profitability of intensive beef units in New Zealand...

Agri-lab

Freepost 11-22-33
Agri-lab
c/o Post Shop Counter
WAIPUKURAU

Angela Molloy

VN(UK), CertVN(NZ), MNZS Parasitology

Phone / Fax 06 856 5893

Mobile 025 249 6151

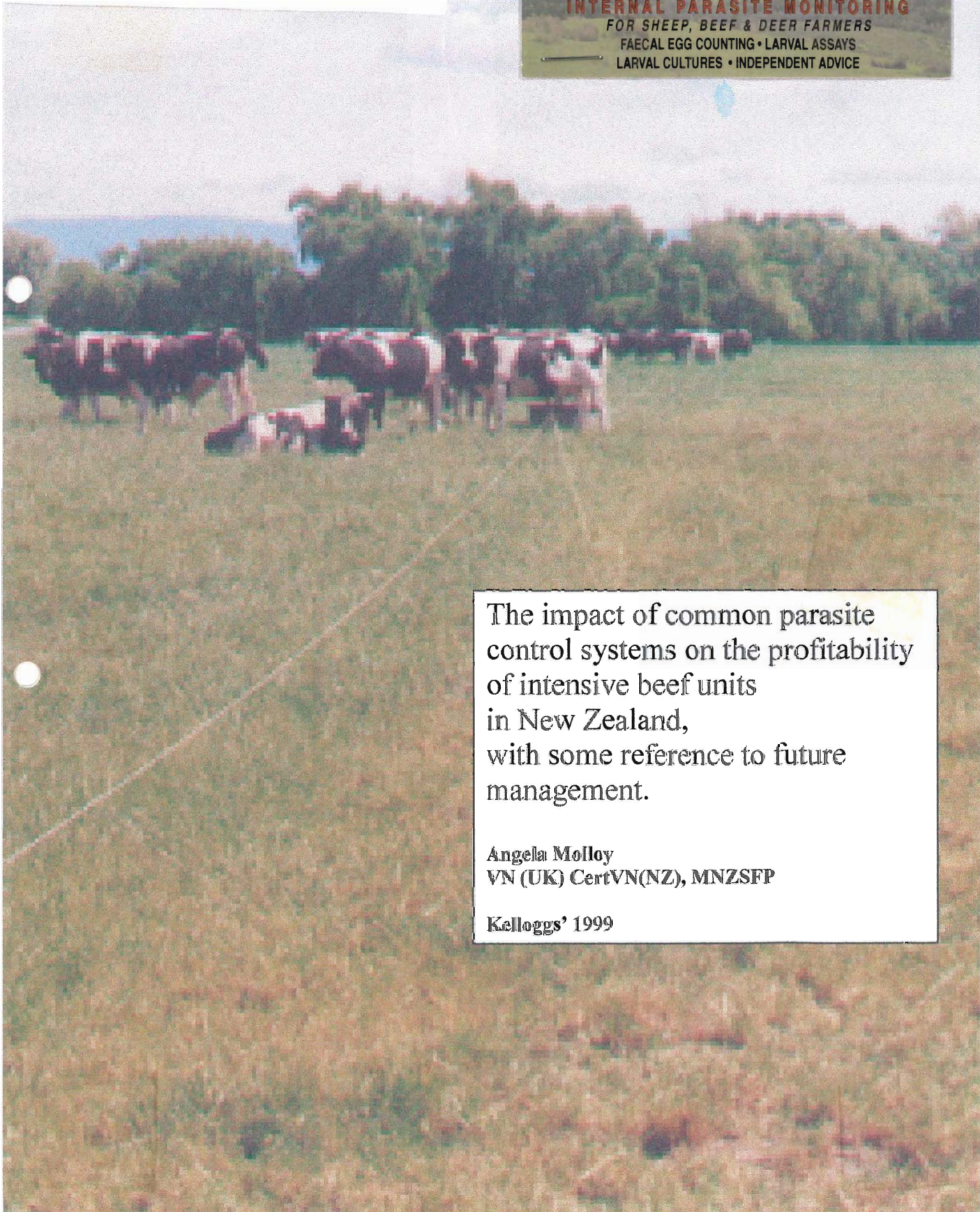
Email agri-lab@xtra.co.nz

INTERNAL PARASITE MONITORING

FOR SHEEP, BEEF & DEER FARMERS

FAECAL EGG COUNTING • LARVAL ASSAYS

LARVAL CULTURES • INDEPENDENT ADVICE



The impact of common parasite control systems on the profitability of intensive beef units in New Zealand, with some reference to future management.

Angela Molloy
VN (UK) CertVN(NZ), MNZSFP

Kelloggs' 1999

The impact of common
parasite control systems
on profitability of
intensive beef units
in New Zealand,
with some reference to
future management.

- Angela Molloy
- For Kellogg's Rural Leadership Programme 1999

EXECUTIVE SUMMARY

Intensification in beef units involves significantly increasing the number of cattle being farmed per hectare, in a controlled situation, so that feed requirements are calculated and provided at specific levels to maximize the conversion of dry matter into beef at the most critical and profitable times.

Internal parasitism reduces the appetite of animals, decreasing grass harvest, in addition, protein and energy are diverted into providing an immune response or to facilitate recovery. This diversion of protein and energy reduces the daily weight gain per head, and so is uneconomic in many cases.

Control of internal parasitism generally revolves around nutrition and anthelmintics (drenches). Continued use of macrocyclic lactones in particular (endectocides, e.g. Ivermectin, abamectin, moxidectin, eprinomectin, doramectin) in forms that have not provided adequate control of the full range of parasites has effectively screened the population on some farms, resulting in an increase in the number of inefficacy or resistance problems around, and a decrease in the productivity of affected farms.

There are options to identify and manage this problem, but a survey conducted by the author revealed that farmer awareness of the issues is not high.

The report recommends that farmers monitor the performance of all drenches on their farms, and cautions against relying on label claims and advertising. It suggests that effective quarantine drenching policies must be adopted, and outlines the risks of importing drench resistance onto another property.

It also outlines some monitoring and drenching strategies that are designed to minimize the risk of developing drench resistance, or manage the presence of it, and options for keeping drench expenditure to a minimum, as a way of increasing profitability.

Acknowledgements

Acknowledgement is gratefully made to the following people for their assistance and advice, both recently and over my formative years in the world of Parasitology.

In particular, I thank Dr Bill Pomroy of Massey University, and Dr Alex Familton of Ancrum Consultants for their feedback and discussions on various beef parasite issues over the years, where opinions were freely given without commercial bias.

I also sincerely thank the 43beef farmers who took the time to respond to a comprehensive survey on parasite issues on their farms, and also my Agri-lab clients whose farm monitoring plans and faecal egg count results have highlighted many of the trends identified throughout the report.

Thanks also to Greg Mirams who was a great sounding board, assisting with some statistics, and also provided some of the feedback and opinions which reflect the more southern beef farms of New Zealand.

In the preparation of some of the statistics I also thank Dr Alan Murphy of Fort Dodge Animal Health, for some of the comments on national expenditure on cattle drenches in New Zealand.

Finally, I sincerely thank my husband Jamie Molloy for reviewing the paper and providing many practical comments about the content and delivery of the presentation. He also put up with hours and hours of my absence from the household, and together with Anna Tilsen, nanny extraordinaire, ensured that our children were happy and well cared for so I could attend the Kellogg's residential phases free of worry.

*Angela Molloy
November 1999.*

TABLE OF CONTENTS

Executive summary	3
Introduction	5
Summary of current internal parasite control systems in NZ beef systems.	7
Part 1 - Beef Management Issues:	9
1. Intensification.	9
i. The bull beef unit – a sole species system.	9
ii. Intensive beef policies	10
iii. Reasons for farming beef cattle	13
iv. Intensification vs. extensive beef farming	14
2. Impact of high stocking rates	15
3. Where the worms come from – and why so many?	16
4. High drench usage – impact on profitability and sustainability.	17
5. Significance and impact of immature worm larvae on cattle growth rates.	22
6. Implications of feed covers being too low, at critical times of the year	24
Part 2 - Parasitology Issues:	26
1. Introduction.	26
2. Understanding of parasite epidemiology	27
3. Parasitism – Review of lifecycle, activity, modern control methods.	28
4. Worm larvae impact on growth rates.	31
5. Drench resistance detection and monitoring.	33
6. Adapting to changes in the parasite population as it responds to farm management and drench practices over the years	37
7. Seasonal effects and the impact of drought.	41
8. Preventing the importation of parasites with cattle purchases, through quarantine drenching.	42
9. Drench choices and application methods, and their impact on profitability.	43
10. The drench rotation theory.	48
Monitoring – general notes.	53
Concerns for the future	57
Recommendations to beef farmers.	58
References	60
Appendix	61

Introduction

Beef cattle production systems in New Zealand are predominantly pasture based, presenting special challenges when managing beef in intensive situations.

The 3 main limitations are:

- Pasture requirements (including quantity and quality)
- Bull behaviour
- Cost effective internal parasite control

Beef intensification in all its forms is commanding a much greater focus of the progressive farm business enterprise than was the case say 20 years ago.

Intensification, that is, the business of significantly increasing cattle numbers per hectare to create economy of scale, better pasture management and improved profitability, has enticed many farmers towards farming bulls, and Friesian bulls in particular, as opposed to the traditional castrated beef animal.

These bull populations have brought with them their own peculiar sets of management challenges – most obvious being their behavioral “problems”, and perhaps less obvious, the relative susceptibility to parasitism that the bull has compared to his female or castrated male counterpart.

Bulls are more susceptible to parasite problems than cows or steers.

The answer for many has lain in the trusty drench gun, or more latterly the pour-on gun, but situation is beginning to change – the parasites are responding to the selection pressure and already resistance is causing significant production loss on many farms.

Many intensive beef farmers are probably already experiencing this, but haven't actually identified this yet.

Also, the balance of the parasite species has been altered, changing the options for drenching for internal parasite control.

There is an opportunity on some farms to improve winter weight gains and significantly increase profitability.

High winter weight gains are achievable if cattle are well fed and the impact of internal parasites is kept to a minimum.

Monitoring is essential:

- Regular weighing (the ultimate measure of success)
- Feed budgeting
- Faecal Egg Counts - check that drench is working, and for how long.

Throughout the text the author assumes the reader is familiar with the following concepts:

Monitoring – The process of measuring and benchmarking various indicators that can demonstrate the performance of products, animals or systems. Early detection of problems or opportunities can significantly affect long term profitability and sustainability.

Faecal egg counts (FEC) – the number of worm eggs being shed per gram of faeces. FEC is not necessarily directly linked to worm burden, but indicates how the animal is handling the challenge.

Drench inefficacy – When a drench fails to reach therapeutic (effective) levels in the blood stream, because of poor administration technique, interaction with gut fill, or under-dosing.

Drench resistance – When a drench correctly used fails to remove the existing worm burden from a host.

Drench inefficacy, drench resistance, and poor drench choices mean that internal parasites are inadequately controlled, daily weight gains are lower than they should be, and the profitability of the beef unit is reduced.

If we measure the effect of everything we do, problems are quickly identified, and adjustments can be made to get production back on track.

Efficient beef production relies on maximum conversion of quality pasture into quality beef. The body diverts protein and energy into developing an immune response to internal parasites, and also into recovering from an infection – this protein and energy is more profitably utilized for weight gain.

An understanding of this principle is crucial for the intensive beef farmer.

Internal parasite control options are focussed on:

- Preventing the impact of worms on beef production, through good control during the beef animals life time
- Reducing the challenge to the animal by maintaining pasture at heights above the level at which parasites normally reside
- Reducing the impact of pasture larvae in the immune system by developing systems that reduce pasture contamination.
- Preventing the importation of parasites with cattle purchases, through quarantine drenching.
- Adapting to changes in the parasite population as it responds to farm management and drench practices over the years – in particular, the *Cooperia* species of intestinal worms.
- Reducing the cost of the inputs into the intensive beef unit – in particular, the cost of the anthelmintics – appropriate drench choices and administration methods can allow significant savings to be made.
- Monitoring the effect of drenching regimes – their efficacy, drench resistance issues.

Current farmer awareness is lacking in some areas, as highlighted by a recent survey of beef farmers conducted by the author.

Reference to these findings is made throughout the text, where required to emphasize or demonstrate a point, or to support a comment which is clearly the author's personal opinion.

Guide to symbols used in text:

☞ *Survey results are included here.*

🔗 *Key point*

Summary of current internal parasite control systems in NZ beef systems.

A survey of 43 beef farmers from around New Zealand was recently completed for the purpose of assessing the current cattle farming practices relevant to internal parasite control, and to measure current farmer understanding and awareness in general of significant internal parasite issues.

The survey targeted farmers who are already likely to have had access to quality parasite information, and so whose opinions represent the ideas of the upper percentile of informed NZ cattle farmers.

The results are attached in Appendix 1.

☞ Beef systems surveyed: (including multiple operations):

- 51% Bull beef (Friesian)
- 49% Dairy grazers
- 42% Finishing steers/beef bulls
- 28% trade in store
- 23% breeding cows
- 19% stud
- 9% Hobby

☞ All farm contours were represented – flat, moderate, steep country.

☞ Nationwide input - Opinions drawn from beef farmers from King Country, Gisbourne, Wairoa, Napier/Hastings District, Central and Southern Hawkes Bay, Manawatu, Wairarapa, Wellington, North Canterbury, Otago, Southland.

The author found that NZ beef farmers are moderately well informed about some aspects of the impact of drench resistance, but are often unaware of how to select drenches which maximize worm kill and reduce drenching costs.

There appears to be a great preference for using pour-on or injectable products, because they are so easy to use, but their reduced efficacy in some circumstances is not as well acknowledged.

Current quarantine drenching practices (i.e. drenching stock to prevent the transfer of resistant worms from one property to another) are not likely to be achieving their aims on many farms, because of poor drench choices, poor administration choices, and a failure to identify the resistance status of the property of origin.

If this status is unknown, then the author recommends that cattle be quarantine drenched as if resistance is presumed to be present.

A cursory examination of the advertising material which accompany cattle drench information found that more emphasis was put on the quality of the tool kit, torch, jacket, cordless drill or telephone accompanying the purchase than was put on identifying particularly effective products.

In some cases, more emphasis was put on the quality of the freebies than the effectiveness of the product

Get this great Spring bonus!



Here's another great Ancare offer. This stylish rugby jersey is yours with every qualifying purchase*

BE IN TO WIN
PICK UP YOUR FREE NETBALL OR RUGBY BALL & TRIP ENTRY FORMS AT YOUR VETERINARY PRACTICE

GET A FREE RUGBY BALL OR NETBALL



CHOOSE ANY OF THE FOLLOWING PRODUCTS AND RECEIVE A FREE FRASERS HAM

CHOOSE ANY OF THE FOLLOWING PRODUCTS AND RECEIVE A FREE FRASERS HAM



CHOOSE ANY OF THE FOLLOWING PRODUCTS AND RECEIVE A FREE FRASERS HAM

AVAILABLE EXCLUSIVELY TO AND RECOMMENDED BY VETERINARY PRACTICES.

Ancare
 The Sign of Good Animal Care

ANCARE BAGS ARE AVAILABLE AT PARTICIPATING VETERINARY PRACTICES AND WHOLESALE FEED SUPPLIERS

CYDECTIN POUR-ON

Purchase 5lt and receive an extra 10% Pour-On FREE while stocks last

5lt \$625.95

- Purchase 5lt, get 0.5lt
- Easy to use
- 24h milk withholding period
- Slowly released active
- Effective against lice
- No water loss weights during treatment
- Now get an extra 10% off per case



🔑 **Need to identify drenches that maximize worm kill at low cost.**

🔑 **Pour-on drenches widely used, even though not as effective.**

🔑 **Poor quarantine drenching practices likely to accelerate resistance on some farms.**

🔑 **The “freebies” influence many drench sales!**

Throughout the text references are made to this survey, when the author is contributing observations or opinions based on the findings.

Some of the authors observations and opinions are controversial, and contradict current accepted thinking or theories – debate or discussion is welcomed, and differing points of view pave the way for new ideas and offer other points for consideration.

🔑 **Better internal parasite control methods can increase growth rates and profitability on some farms through better understanding and focus on the impact of beef management issues and parasite control issues discussed here.**

Part 1 – Beef Management Issues:

1. Intensification.

The bull beef unit – a sole species system.

The bull beef unit, as intensive beef management systems are commonly known, is generally a farm or part of the farm dedicated to the growing and/or finishing of beef. As such, it is often a sole species system, and the advantages of integrated grazing which are available to extensive farmers are not an option for the bull beef unit on a regular basis.

Integrated grazing is the practice of grazing one species (e.g. sheep) alongside or after another species (e.g. cattle) so that the parasites passed by one are consumed and destroyed by the other, reducing the numbers of species-specific parasites on the pasture.

Internal parasites are generally host specific – that is, there are sheep worm that affect sheep, and cattle worms that affect cattle. If a host not specific to that species consumes infective worm larvae, then the larvae generally fail to establish, and may not reproduce. ¹ (Familton & McAnulty 1997)

Different animal species also have differing grazing patterns, so will more effectively “clean out” a paddock resulting in better pasture growth in the long term.

Table 1: Nematode species normally found in natural infections of cattle, sheep and goats in New Zealand.² (Note that the majority of worm species are host specific.)

Cattle	Sheep & Goats
-	<i>Haemonchus contortus</i>
<i>Ostertagia ostertagi</i>	-
<i>O. leptospicularis</i>	-
-	<i>Ostertagia circumcincta</i>
<i>Trichostrongylus axei</i>	<i>Trichostrongylus axei</i>
-	<i>T. colubriformis</i>
-	<i>T. capriola</i> (rarely found in sheep)
<i>Cooperia oncophora</i>	-
-	<i>Cooperia curticei</i>
<i>Nematodirus helvetianus</i>	-
-	<i>Nematodirus spathiger</i> (rarely found in goats)
-	<i>N. filicolis</i> (rarely found in goats)
<i>Trichuris ovis</i>	<i>Trichuris ovis</i>
<i>Oesophagostomum radiatum</i>	-
-	<i>Oesophagostomum venulosum</i>
-	<i>Chabertia ovina</i>
<i>Dictyocaulus viviparous</i>	-
-	<i>Dictyocaulus filaria</i>
-	<i>Muellerius capillaris</i> (rarely found in sheep)

Intensive beef policies:

Various stock policies are adopted according to the farm contour, grass growth, fencing options, target markets, and labour availability and financial limitations.

The intensification of beef systems focuses farmer's minds on harvesting grass and converting it into meat and converting that additional meat into additional profits.

The aim is to achieve maximum profit per head and per hectare, by utilizing all pasture grown. Each beef farming policy has general objectives or goals – they are outlined below, with some references to the likely impact on parasitism in that enterprise. (Only intensive policies are discussed.)

Trading Cattle:

The profit is the difference between sale price less the replacement price. The replacements are sought from other farms, agents or saleyards, so generally are of unknown drenching history.

The per hectare profit comes from the per head profit x the stocking rate.

The trading policy generally revolves around one or more of 3 cattle classes – heifers, steers, bulls.

The policies generally focus on finishing or quitting cattle before their second winter, or after their second winter, or a combination. Droughts and feed gluts considerably alter the buying behaviors of trading farmers.

🔑 Trading farmers are at an increased risk of introducing drench resistant worms onto their properties, and so an effective quarantine drench regime is required.

Calf rearing:

Some trading and finishing farmers rear their own bull calves to reduce replacement cost. The addition of a large mob of young stock on the property places increasing pressure on the requirement for drench, and the need for effective parasite control programmes. Drench resistance has a greater impact on young stock than on older classes of animals.

Susceptible young stock not only increase the requirements for drenching, but also increase the amount of pasture contamination that occurs through the shedding of large numbers of worm eggs onto the pasture. This can occur when the calves are under stress or the drenching programme has failed to control or identify an increase in worm burden or faecal egg count.

It is common practice to rotationally graze calves ahead of cows or bulls around the farm, primarily to provide good nutrition. The calves are moved to fresh pastures every 1–2 days, meaning feed availability is high as they are not required to eat the grass down to low levels.¹ This is known as the Ruakura System.

It is presumed that parasitism is rarely a problem and very little drenching is needed. However, if there is a lack of monitoring of weight gains and/or faecal egg counts, there is a great risk, in the authors opinion, that calves may suffer subclinical or even clinical parasitism because climatic and pasture conditions do not always guarantee that pasture larval challenges will be kept to a minimum, despite high feed availability. Also, if the calves develop high worm burdens, or high faecal egg counts, then the classes of stock following behind (e.g. bulls for finishing) are exposed to a higher challenge which may impact on their growth rates even if clinical parasitism does not result.

Calves develop a degree of immunity to parasitism as they get older, in response to regular low challenges of internal parasite infections. Thus, the intention is not to keep them totally parasite free, but to allow exposure at levels sufficient to allow immunity to develop without significantly affecting growth rates.

Late born calves, particularly those that are farmed in summer dry areas may not have acquired sufficient immunity before their exposure is reduced through low pasture larval levels that occur in drought times. When the rain comes, they may be at more risk of disease outbreaks from the sudden development of infective larvae, and growth will be seriously impaired.³ (Massey 1996.)

An effective preventive parasite control system removes much of the risk unless drench resistance is present, which further complicates matters. In all cases, it should be remembered that the later born calves have little acquired resistance and may be under-fed in winter, making them very susceptible to subclinical effects. Massey author (1996)

Regardless of the age of the calves, regular monitoring of pasture intakes, weight gains and faecal egg counts over their first winter is recommended.

¹ Ruakura System, as described in Veterinary Parasitology Notes, Year 4, Massey University, 1996.

Selling 15-22 month Cattle:

To achieve good carcass weights the 15 – 22 month cattle are generally a high priority for feed. This can, on some farms, result in younger cattle being “pinched” – that is, have their feed intakes restricted because it is being saved for the 15 – 22 month bulls.

When younger cattle are “pinched” their stress levels increase, tolerance and immunity to worms decreases, faecal egg counts and pasture contamination increases, and they are more susceptible to the debilitating effects of parasites.

Thus the policy itself impacts on another class of cattle.

Parasite control is generally not a problem in this age group, although on some farms there is room for improvement in the growth rates over winter for the 12 – 15 month bulls, where *Cooperia* is often an undetected but significant problem – easily managed once identified. These bulls need to go into the winter at a good weight as a yearling to achieve 400- 500kg as a 20 month bull, so good parasite control over the autumn is increasingly important.

Most of these bulls are farmed for the works, but there is a demand for and significant margins to be made out of bottom ones (lighter) sold store – i.e. through the saleyards for another farmer to finish.

The intensive beef unit generally targets specific markets, and manages this around predicted feed surpluses or deficits, both of which are often planned for or created.

Technosystems:

Technosystems is a trade mark name which refers to a system invented by Harry Weir designed to allow large numbers of cattle (usually bulls) to be efficiently and very easily managed in a small area, to effectively make use of winter feed deficits, spring feed surpluses, and weight gain opportunities associated with compensatory growth.

The system involves creating lane ways (usually about 25 metres wide) in electric fencing, with carefully placed water systems complementing “cells” or mini-paddocks of precisely known sizes. This allows very accurate feed management and rationing to occur.

The bulls feed requirements can be altered according to the time of the year, the class of the stock, and the target weights required for a specified date.

Compensatory growth is the phenomenon whereby cattle held on restricted rations with a nil weight gain over winter, then fed ad lib over spring, will catch up and in some cases exceed their peers who were better fed throughout the entire period.

This system allows more bulls to be wintered so that stock numbers are on hand to capitalize on massive spring grass growth at a time when the market for store cattle is traditionally high.

The technosystem is basically a refinement of the previously described beef policies.

A recent analysis of the economics of intensifying beef finishing systems through the use of a technosystem ^{TM 4} (Tither, 1999) concluded that in 83% of cases a Technosystem would increase net worth over a traditional beef system. Tither commented that a large part of this is due to the capacity to carry and finish increased livestock numbers. He stated that the effects on short to medium term cashflow will make Technosystems less attractive for those financially stretched,

but for other farmers able to carry the cost of the set up costs, this form of beef intensification is a cost effective option. A local beef farmer ⁵ (Horgan, 1999) endorsed these comments.

Another beef farmer ⁶ (Mabin, 1999) reminded farmers that farm gate prices continue to be reduced it is necessary to improve production per hectare and per labour unit just to maintain a farmers current profitability.

These findings, presented at an East Coast Beef Council Field Day in 1999, are likely to increase the interest in intensification.

However, like other field days covering this subject, internal parasite control issues were not discussed, and the implications of intensification not considered.

It is disturbing how frequently effective parasite control is overlooked in the design of these systems, yet it has the potential to significantly reduce profitability, through increased expenditure and decreased growth rates.

Such an important animal health issue should in my opinion be at the forefront of the intensive beef farmer's mind, and definitely considered by the consultants and financiers of the operations.

Despite the parasite control issues mentioned already, the following list of reasons, supplied by the Meat & Wool Economic Service, probably summarizes why for most the challenge of beef intensification is one farmers have found very attractive to date:

Reasons for farming beef cattle:²

- Maximize profit per hectare or per animal
- Pasture control
- Pasture development - control of weeds promoting growth of new and improved pasture species
- Low labour requirements compared with some other livestock species
- Maintain cash flow
- Risk management
- Tax advantages
- Animal health reasons
- Farmers may prefer cattle to sheep

As a result of increased awareness of the benefits of intensification many farmers are changing their approach to beef farming. There appear to be few guidelines available or considerations made to enable the successful management of internal parasites when making the transition from extensive to intensive beef farming.

² Source: Meat & Wool Economic Service web site

The following is a comparison of challenges facing extensive and intensive beef farming systems.

	Extensive Beef Systems:	Intensive Beef Systems:
Stocking rate – beef	Low (< 8 SU/ha)	High (> 12 SU/ha)
Species mix (sheep/beef/deer)	Integrated grazing policies	Usually sole species for prolonged periods of time
Grazing rotation	Varied	Varies
Pasture length	Moderate to high	Aim to keep high
Pasture quality	Varies	High
Young stock	Mixed with older and alternate species	Often run as sole species
Finishing stock	Low proportion of stock nos.	Predominate
Parasite susceptible stock	Low proportion of stock nos.	Predominate
Parasite hardy stock	Predominate	Low proportion of stock nos.
Drenching frequency	Low	High
Reliance on drench	Lower	High
Incidence of drench resistance	Low	High
Drench expenditure per head per year	Majority: \$5 - \$12 per head	Majority: \$5 - \$20 per head
Profitability of enterprise	Moderate	High
Sustainability	High	Questionable
Impact of global warming	Little	High

The above table demonstrates that although intensification offers significant opportunities for increased profitability off an equivalent area of land, there are many parasite control issues to be considered if units are to be managed profitably.

☒ Survey results: Type of system of surveyed farms:

49% Intensive

23% Extensive

28% Semi-intensive or both

🔗 **The survey opinions and findings are biased towards intensive beef properties.**

2. Impact of high stocking rates:

Any system involving one species farmed at high stocking rates (greater than 12 SU/ha) attracts animal health problems (and specifically parasitism problems) that would not normally be seen in the extensive system.

The parasitism problems are accelerated when the system is weighted towards young stock – bulls younger than 15 months of age, or sheep younger than 18 months of age, for example.

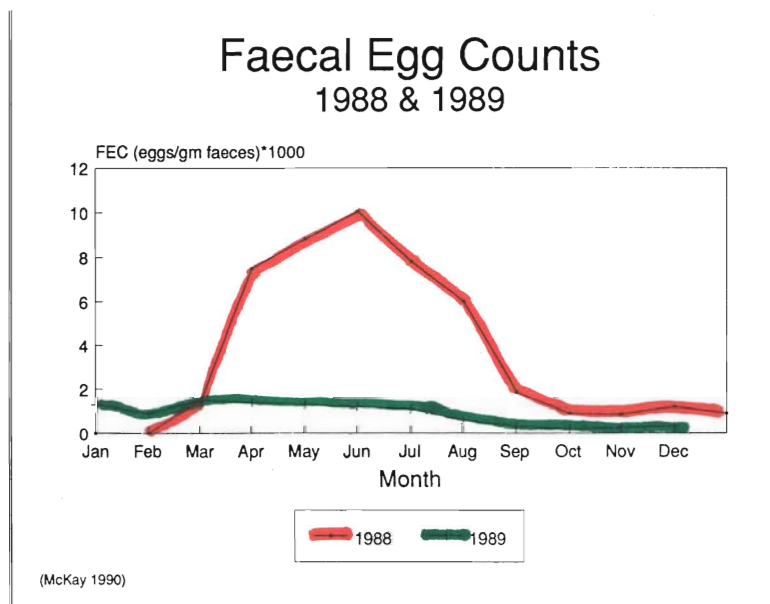
An old saying, “a sheep’s worst enemy is another sheep” can equally be applied to mobs of young bulls in the bull beef unit.

The high stocking rates of young bulls on a bull beef unit, year after year, leads to a build-up of cattle-specific worm larvae on the pastures, meaning that grazing bulls are constantly exposed to worm larval challenges. (⁷Cook, 1999)

⁸Niezen et al (1991) demonstrated the impact of cattle grazing habits on the worm burdens of organically raised lambs.

In 1988, at the Ballantrae Research Station³, without cattle in the grazing rotation, the ability to produce pasture for lambs which was low in parasite numbers was poor. High lamb faecal egg counts were recorded over autumn and winter. In 1989, cattle were added to the system, with a marked improvement in the ability to prepare pasture for the lambs, resulting in lower FEC’s. See Fig 1.

Figure 1: Faecal egg counts of lambs grazed without cattle in the rotation (1988) and with cattle in the rotation (1989).



³ Ballantrae Research Station and Organic Sheep and Beef Unit, Woodville, Near Palmerston North, North Island.

If the reverse applies (and it is reasonable to assume it does) then it can be demonstrated that sheep grazing in a cattle system will significantly reduce the challenge of infective cattle worm larvae on the pasture.

A single species system such as a weaner to yearling bull beef unit is likely to experience greater difficulties in controlling parasitism than one that includes sheep or deer in the grazing rotation. It may not be the farm policy to introduce sheep or deer into the system, so a better vigil of the management of parasites using drench and grazing techniques is required.

3. Where the worms come from – and why so many?

Mature worms of both sexes reside in the gut – the specific location varies between species – most have a preferred site.

The most pathogenic nematodes (roundworms) inhabit the abomasum (4th stomach of the ruminant) or the small intestine. (There are other worms that reside in the large intestine, lungs or tissues, but they are not the subjects of this paper.)

After mating, females lay eggs, which pass with the faeces onto the pasture. There the larvae develop in the egg, hatch, and undergo several moults. Environmental conditions need to be favourable – a temperature in the vicinity of 12 – 25 degrees Celsius, with adequate moisture and nourishment – unfortunately these conditions are generally found in a cow pat all year round.

While at the L1 and L2 stage the larvae are susceptible to climatic adversity especially freezing, heat and desiccation (drying out.)

The larvae feed on nutrients and microorganisms found in dung pats during the first 2 stages. They grow a 3rd skin, but instead of shedding the previous one, it is retained as a “suit of armor”, known as the sheath.

The sheath protects the larvae from the elements, and L3 larvae may survive on pasture or in the soil for up to 18 months.

If consumed by another species, the infective larvae will not establish (with the exception of *Trichostrongylus axei*, a relatively minor parasite of sheep and cattle.)

The time to develop from an egg to L3 can be as little as a week in favourable conditions.

The age and size of the worm burden, species of worm present, immune and nutritional status of the host influence worm egg numbers passed in the faeces.

- Age of worm burden – recently established but immature worms do not lay eggs yet.
- Size of worm burden – more worms usually results in higher faecal egg count.
- Species present – some worm species (e.g. *Cooperia*) are particularly more fecund (prolific egg layers) than others, so a higher FEC is recorded from lower worm burdens. However, worm infections are generally mixed - pure infections are rare.
- Immune status of host – older, previously challenged animals have superior defense mechanisms to resist the establishment of new infections. There are also immune responses, perhaps hormonally linked, which can result in suppression of the egg-laying capacity of

female worms, even though there is a reasonable worm burden. It is generally accepted that an animal in this state is coping well with the resident parasite population, and drenching would rarely be indicated in the commercial situation.

- Nutritional status – impacts on both the immune status of the host, and the environment of the target organ (altering pH, by-pass protein availability, presence of inhibitory substances) which can alter worm establishment or fertility.

Even with a low faecal egg count of, for example, 25 – 50 eggs per gram of faeces, a yearling bull could be passing up to 2,510,000 worm eggs per day.

Only a low percentage of eggs passed actually survive to the L3 stage, but even if the success rate is as low as 5% of eggs passed, the pasture contamination is added to at the rate of 125,500 infective larvae per bull per day.

Thus, “clean pasture” is extremely difficult to achieve.

Generations of infective larvae can accumulate, posing a significant threat to susceptible grazing animals.

4. High drench usage.

Internal parasite control programmes in the modern bull unit is heavily reliant on anthelmintics (drenches.)

There are two major schools of thought regarding the planning of an annual parasite control programme.

1. Adopt a fully preventative summer/autumn-drenching programme which “will result in relatively low challenges for rising one-year-old bulls in the winter.”(Cook 1999). OR
2. Adopt a monitoring system that involves drenching the bulls as and when they need it, based on feed covers (i.e. dry matter intake), weight gains, appearance, and faecal egg counts. Regular monitoring of faecal egg counts can identify a change in parasite status in the animal before clinical signs are evident. Drench is given when the FEC’s start to rise above a particular level. The interval between drenches will be influenced by the weather patterns, the animals immunity, age, breed, feed quality and quantity, and larval challenge off the pasture (how high the worm levels on the pasture are to start with.)

Promotion of a fully suppressive summer/autumn drench programme does not take into account the economics of such a programme in terms of drench expenditure, impact on drench resistance, and the sustainability of systems that depend on very high chemical usage.

Planned drench programmes often involve drenching by the calendar rather than drenching according to the season, the cattle faecal egg counts, and the paddock history (a rough assessment of pasture contamination.) Unfortunately, monitoring of drench efficacy often does not occur, and there is a fair measure of blind faith involved. Just because a suppressive drenching programme should reduce pasture contamination does not mean that it will.

Clear evidence that farmers cannot believe that every anthelmintic will perform according to its label claims was demonstrated in trials by the Hawkes Bay Ewe Monitor Group. (⁹ Molloy 1999)

The group found that in some cases there were big differences between the results of managed trials prior to registration compared to the results of products used on monitor group farms under real conditions.

In the authors opinion, some drug companies and retailers are not taking responsibility for educating their product users. In some cases, the use of monitoring on-farm does not give the same results as product trials and advertising would lead the sheep farmer to expect. Beef farmers are in a similar situation.

🔗 Check up on how products are working on your farm, before you keep using them again and again. If something works – use it. If it doesn't work – look for another option.

Promotion of a monitoring system requires a greater commitment to weighing, recording, faecal egg count monitoring, pasture management, and a better understanding of the dynamics of the internal parasite population across the seasons.

High winter weight gains improve financial performance, particularly when bulls are being finished.

Specific benefits of targeting high winter weight gains:

- Winter killing schedule generally higher than autumn or summer one (there may be extra premiums paid not always reflected in the published schedule price)
- Replacements are often cheaper to purchase = higher margin between sale price less cost of replacement.
- Efficient use of valuable winter feed
- Cattle (bulls in particular) can be finished before the bloat season arrives (threat may vary from farm to farm or between regions)
- Decreased drench costs if the most appropriate drench is selected – promoting good health over winter, improved immunity.

There is an opportunity on some farms to improve winter weight gains and significantly increase profitability.

High winter weight gains are achievable if you can feed your cattle and keep internal parasites under tight control.

An alternative strategy is the practice of holding higher numbers of cattle at nil weight gain over the winter, so that the stock are on hand to take advantage of a feed surplus in the spring. In this case, parasitism needs to be kept low so that other animal health problems aren't exaggerated, minimum feed is consumed for maximum return, and pasture contamination with worms is kept to low levels so that spring growth rates are not compromised.

Whether targeting high weight gains, or high stock numbers wintered on nil weight gains, increased drench frequency is likely, and monitoring is essential:

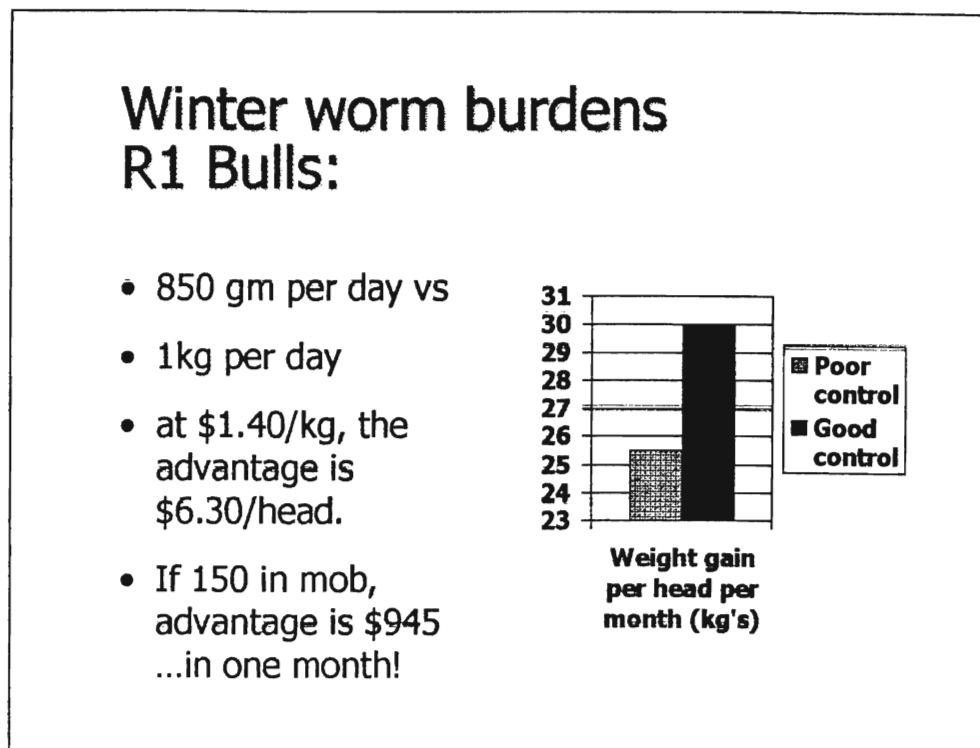
- Regular weighing (the ultimate measure of success)
- Feed budgeting
- Faecal Egg Counts - check that drench is working, and for how long.

If we measure the effect of everything we do, problems are quickly identified, and adjustments can be made to get production back on track.

High winter weight gains are only achievable when parasitism is well controlled – burdens must be low going into winter, and stay low through winter, particularly if pasture levels get low. Remarkably high winter weight gains on short pasture can be achieved, if parasitism is not an issue.

The graph below demonstrates the difference between 850 g per day and 1 kg a day on profitability.

This graph clearly shows that good parasite control gives good results, but great parasite control is even better, in R1 bulls on intensive beef production units.



Mackey, 1997,¹⁰ emphasized the need for focussing on maximum growth rates for maximum production.

“Regardless of the basic feed system, the growth rate, productivity and profitability of cattle can be influenced via three main mechanisms - increasing daily dry matter intake, enhancing rumen function and targeting specific nutrient intakes.

Generally, for any given diet, the more an animal eats, the faster it grows. The faster the growth rate, the cheaper becomes each kilogram of liveweight gain, as smaller percentages of an increasing total intake go to the ‘fixed costs’ of maintenance (or survival).

Increasing daily grass dry matter intakes requires attention to animal management as well as pasture management.”

Internal parasites (worms) are costly in terms of drench expenditure, lost growth rates, poor pasture utilization, loading of parasite problems onto following generations, lost market opportunities (especially failing to meet target weights for slaughter dates under contract), and are closely associated with many other animal health problems.

Many experienced farmers testify to the fact that if the grass is kept up and the worms are kept down, most other animal health problems become infrequent.

To achieve the higher growth rates excellent parasite control and good feeding is essential.

The following table is an example of the “costs” of two systems applied to a **typical intensive bull unit** following 150 Friesian bull calves bought in at 100 kg and farmed for a year.

	Suppressive drench programme	Monitoring programme
Drench frequency	From November: Once a month for 6 months, July, September (Ref: Local veterinarian. CHB)	Quarantine on arrival, on weight/pasture/FEC thereafter – say 3 – 5 oral drenches, 1 injectable endectocide
Drench type	5 oral combination drenches, 1 injectable endectocide, 1 pour-on endectocide	2 oral combination drenches, 1 – 3 oral levamisole drenches, 1 injectable endectocide
Drench cost	$(5 \times \$0.78) + (\$4.14) + (\$5.50) = \mathbf{\$13.54 \text{ per head}}$	$(2 \times .55c) + (3 \times .28c) + (\$3.48) = \mathbf{\$5.42 \text{ per head}}$ (calculation assumes 3 of the oral levamisoles were used – may not necessarily be this high)
Faecal Egg Count Monitoring:		Two mobs 4 times over 6 months, plus 2 other checks, plus two post-drench checks = $12 \times \$37 = \444
Other monitoring	Weighing, Pasture covers, livers for trace elements	Weighing, Pasture covers, livers for trace elements
Cost per 150 bulls: (weaner through to yearling)	Drench costs: \$2031 TOTAL: \$2,031	Drench costs: \$813 Monitoring costs: \$444 TOTAL: \$1,257
Benefits:	<ul style="list-style-type: none"> • No FEC monitoring required. • Can buy the season's drench requirements on forward order. • Aims to reduce larval contamination on pasture through drenching before the next generation of worms are mature. 	<ul style="list-style-type: none"> • Avoid overuse of endectocides. • Post-drench checks identify effective drenches on the property, can adjust quickly if resistance is a concern, before weight gains are significantly affected. • Drenching is restricted to need – avoid overuse of chemicals (& \$\$!) especially if the season and pastures are not as favourable for worm infections. (E.g. summer dry, or good immunity – no significant worm burden = no treatment.) • Can reduce larval contamination on pasture through identifying if the next drench is required sooner rather than later.
Drawbacks:	<ul style="list-style-type: none"> • Drench inefficacy or resistance is not detected until it impacts visibly or slows weight gains significantly. • Heavily reliant on drenches performing according to their label claims. • Drench expenditure becomes a fixed cost – does not allow for seasonal, farm and mob variation. • Frequent drenching screens the population for resistant worms – drench resistance develops faster. 	<ul style="list-style-type: none"> • Good monitoring and stockmanship skills required.

☐ **Survey finding: Drench expenditure.**

Extensive farmers are spending between \$5 - \$16 per head per year
(Majority: \$5 – 8 per head per year.)

Intensive farmers are spending \$5 – 20 per head per year (majority did not know.)

32% of intensive beef farmers and 18% of extensive beef farmers **did not know** what their annual drench expenditure was.

🔗 **You need to know what your current expenditure and production per head or per hectare is, to determine if there is an opportunity to reduce inputs or increase production through better management.**

🔗 **To know where you are going, it is useful to know where you are now.**

5. Significance and impact of immature worm larvae on growth rates.

Immature larvae reside on the pastures, in the soil and in the dung pats.

At the L3 or infective stage, these larvae move up the pasture sward and are available to be ingested as the animal grazes.

If the animal has a high level of immunity, most of these infective larvae will fail to establish in the gut. An immune response by the host (the bull for example) diverts protein and energy into protecting the gut lining.

Even where no adult worms have established, this high larval challenge alone can depress growth rates. (Cook 1999.)

The extent of production losses resulting from exposure to parasite larvae (Sykes, 1997) ¹¹ depends on:

- The severity and worm species involved in the challenge
- The effectiveness of the host immune response (i.e. how well does it fight off the challenge)
- The duration of the exposure, and whether or not this allows time for an effective immune response to develop
- The effect that the challenge has on the metabolism of the host, and
- The cost of providing any immune response (i.e. what protein, energy, important trace elements were diverted from growth into fighting the worm challenge.)

If growing animals are exposed to low levels of infective larvae, immune responses may develop at a rate sufficient to cope with the challenge, providing even better immunity later on in life.

However, in the sole species beef unit, especially where feed covers are low and temperatures favourable for parasite development, young animals can be exposed to large numbers of infective larvae over a short period of time, resulting in overwhelming infections that cause clinical parasitism.

Older beef animals (15 to 18 months and older) are better able to cope with high levels of infective larvae than younger animals. With this in mind, it is better to graze older, less susceptible stock over pasture known to have had a high level of contamination in the past.

Some workers suggest that beef animals (bull beef in particular) develop a good level of immunity to parasites at around a year of age.

It is the author's experience that yearling bulls are still generally very susceptible to parasitism in the intensive bull beef unit, and generally immunity of any consequence starts to be observed when the bulls approach 15 – 18 months of age. Until then, a high level of monitoring, usually with significant drench inputs, is still required.

🔑 Bull immunity to worms often “kicks in” at around 15 – 18 months of age. Requirement for drench suddenly decreases (and profitability suddenly increases!)

6. Implications of feed covers too low, at critical times of the year

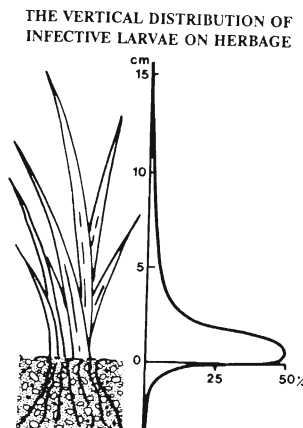
Infective worm larvae are found in greater concentrations around dung areas. The larvae tend to be concentrated in the base of the pasture sward (see diagram) between ground level and 5cm up, with lesser concentrations found above 5 cm in pasture height.

If the residual feed covers can be left at not less than 1500 kg of DM per ha, or the equivalent of a grass length of not less than 5 cm after grazing, then exposure to infective larvae, and impact on production, will be significantly reduced.

This approach contradicts some grazing strategies, which see wintered bulls pushed to consume pasture down to residual covers of 800 - 900 kg DM per Ha (i.e. no grass left, from the bulls point of view).

Thus, it should be kept in mind that bulls pushed to lower grazing levels will be considerably more exposed to internal parasites than their counterparts who are allowed to browse over similar pasture without taking it down below the critical 5 cm in height.¹²

The distribution of infective nematode larvae on pasture (from Vlassoff, 1982).



Pastures are often "spelled" (left free of stock for a period) in order to let pasture covers recover.

There is a misconception that "spelling" pastures allows worm larvae levels to be significantly reduced by being killed off from frosts or dry spells. Familton and McAnulty (1997) explained that infective (L3) worm larvae could survive considerable periods (several months in some conditions) in undisturbed dung-pats but not for long away from them under hot, dry conditions.

Infective larvae (L3) survival varies with the circumstances and time of year, with cool wet conditions providing the optimum environment, allowing survival for perhaps up to 18 months in some cases.

Under most New Zealand conditions one would need to spell pastures for such long periods of time that pasture production and quality would be affected because the grass grows so quickly. 13 (Massey, 1996)

In pasture based systems, resting the paddocks has the effect of allowing grass growth to dilute the numbers of larvae present per kilogram of pasture consumed.

Pasture shut up for silage or hay can theoretically be a useful source of relatively clean pasture. There is a natural decline in the worm larvae numbers on pasture over time, with some of the population succumbing to lack of moisture, exposure to ultraviolet radiation (sun), or "old age" i.e. they use up all of the metabolites stored in their body, and, being fully sheathed, are unable to feed to replenish their energy supply.

However, enough are well adapted to withstand long periods of adverse conditions, and will survive the spelling period.

If the cutting height is below 5 cm, a significant proportion (not documented) of the worm larvae are taken with the grass and are unlikely to survive the haymaking or ensiling process.

The remaining larvae are likely to be killed by the UV rays and desiccation, if weather conditions dictate. However, if the hay or silage was made during a relatively dry period of weather, (as is normal) then it is likely that a significant proportion of the infective larvae are residing in the soil, having tracked the moisture down.

When the next reasonable rain comes, masses of these larvae will emerge from the soil, wriggle up the blades of grass in films of moisture, and so be available for ingestion by grazing animals. Depending on how long the pasture was saved, this may or may not be an issue.

Crops can be used as a practical alternative, and research is continuing into identifying those that have their own anti-parasitic effects in addition to their feed value.

Research focussing on the value of crops containing condensed tannins is expected to offer significant benefits to pastoral farmers wishing to reduce chemical use.

Part 2 – Parasitology Issues:

1. Introduction.

Problems emerging across all modes of beef farming, but in particular affecting those that farm young stock intensively (young stock = cattle up to 15 months of age) are:

1. Increasing drench resistance – especially BZ and endectocide
2. Increased reliance on ML's – including a widely held assumption that these are the most effective products, and the more expensive ones are better
3. Change in predominant parasite species on some farms – *Cooperia* now appears to be the most economically significant internal parasite in many units.
This change is induced through:
 - (a) incorrect drench choices
 - (b) overdrenching
 - (c) increased stocking rates
 - (d) Droughts – poor parasite management during and after dry spells.
4. Increased use of high endophyte pastures (unwittingly, in many cases) especially those containing high levels of ergovaline. These can produce signs similar to internal parasites (ill thrift and diarrhea) and so encouraged unnecessary and ineffective drench use.

There are several other parasite issues which may impact on profitability of some intensive beef units:

- Understanding of **parasite epidemiology** – basis of better management decisions
- Adapting to **changes in the parasite population** as it responds to farm management and drench practices over the years – in particular, the *Cooperia* species of intestinal worms.
- **Seasonal effects**
- **Monitoring** – progress can be faster if you are prepared to learn from past mistakes!
- **Drench resistance** – identifying – prevention – management.
- **Quarantine drenching:** Practical methods to prevent the importation of parasites with cattle purchases.
- **Drench application methods:** impact on efficacy, cost, sustainability.
- **Drench choices:** Reducing the **cost of the inputs** into the intensive beef unit – appropriate drench choices and administration methods can allow significant savings to be made.

🔑 **Resistance: Worms survive the normal dose of drench**

🔑 **Inefficacy: The drench did not achieve high enough therapeutic blood levels and so did not kill the parasite. (E.g.. Some pour-on results on some farms.)**

2. Understanding of parasite epidemiology⁴


Any parasite control programme is aimed at preventing clinical disease, and minimizing the subclinical effects of parasitism.

Clinical disease is the actual disease state resulting from the presence of the parasites – the animals are observed to be doing poorly, look unwell, are losing weight, or have diarrhea and reduced appetites associated with the effects of high worm burdens.

Subclinical effects: The effects of the worm burdens are less obvious, resulting possibly in reduced weight gains rather than weight loss, reduced efficiency at converting grass into meat, increased susceptibility to other diseases or stresses. Subclinical parasitism could go undetected if unmonitored, resulting in significant production losses when a whole mob situation is considered.


E.g. 150 yearling bulls each growing at 100 gm per day less than they should, would not be immediately obvious, but after 30 days, there would be $100\text{gm} \times 150 \text{ bulls} \times 30 \text{ days} = 450\text{kg}$ missing from the system.

At a liveweight value of \$1.60 per kilo, this represents a loss of \$720 per month.

 **Small daily losses add up to large financial losses over time.**

Attempts by farmers to design effective parasite control programmes are often complicated by a lack of understanding of a number of issues:

- The parasite lifecycle is often not clearly understood, particularly the free-living stages (those larvae that reside on the pasture.)
- The effects of subclinical parasitism are under-estimated.
- Action and mode of activity of specific drenches, including variations within drench families, needs to be appreciated. (It is not necessary for farmers to understand each of these issues, but they should seek reliable and informed advice when making drench purchases.)
- Management systems vary a great deal, and it is difficult to take a “recipe” off one farm and apply it to another, and expect to get the same result.
- The effectiveness of the drench may be of less importance than the ease of its application, and need for good timing, in some systems.
- There are many sources of parasite control advice available, and many are contradictory. This further muddies the water.

 **Top performing beef farmers are notable in their focus on growth rates – growing beef is producing a profit.**

Healthy, non-parasitised animals will convert the same pasture far more efficiently (and profitably) than parasitised animals.

However, to focus on drenches as the sole method of achieving this increases expenditure, in some cases without improving profits, so improved nutrition also must play a part.

⁴ Epidemiology – studying the distribution of diseases e.g. parasites in a given population.

On most intensive beef units there is scope to improve parasite control and reduce drench expenditure, through better drench choices. Identifying and controlling drench resistant species offers further opportunities for increased profitability on some farms.

It is important that any effective parasite control programme is tailored to suit the particular property, and includes a, monitoring plan, to identify what is working, and make changes quickly if they are required.

3. Parasitism – Review of lifecycle, activity, modern control methods.

Bisset (1994) stated that “Any disease that limits the productivity of cattle can therefore result in economic losses which, on a national scale, could be considerable.”

Although there are at least 27 nematode species that can affect cattle in New Zealand, there are three in particular that are thought to be of the most important due to their impact on production and their prevalence throughout the country.

These species, which may be referred to under names according to different texts, are:

Ostertagia ostertagi
Trichostrongylus axei, and
Cooperia oncophora.

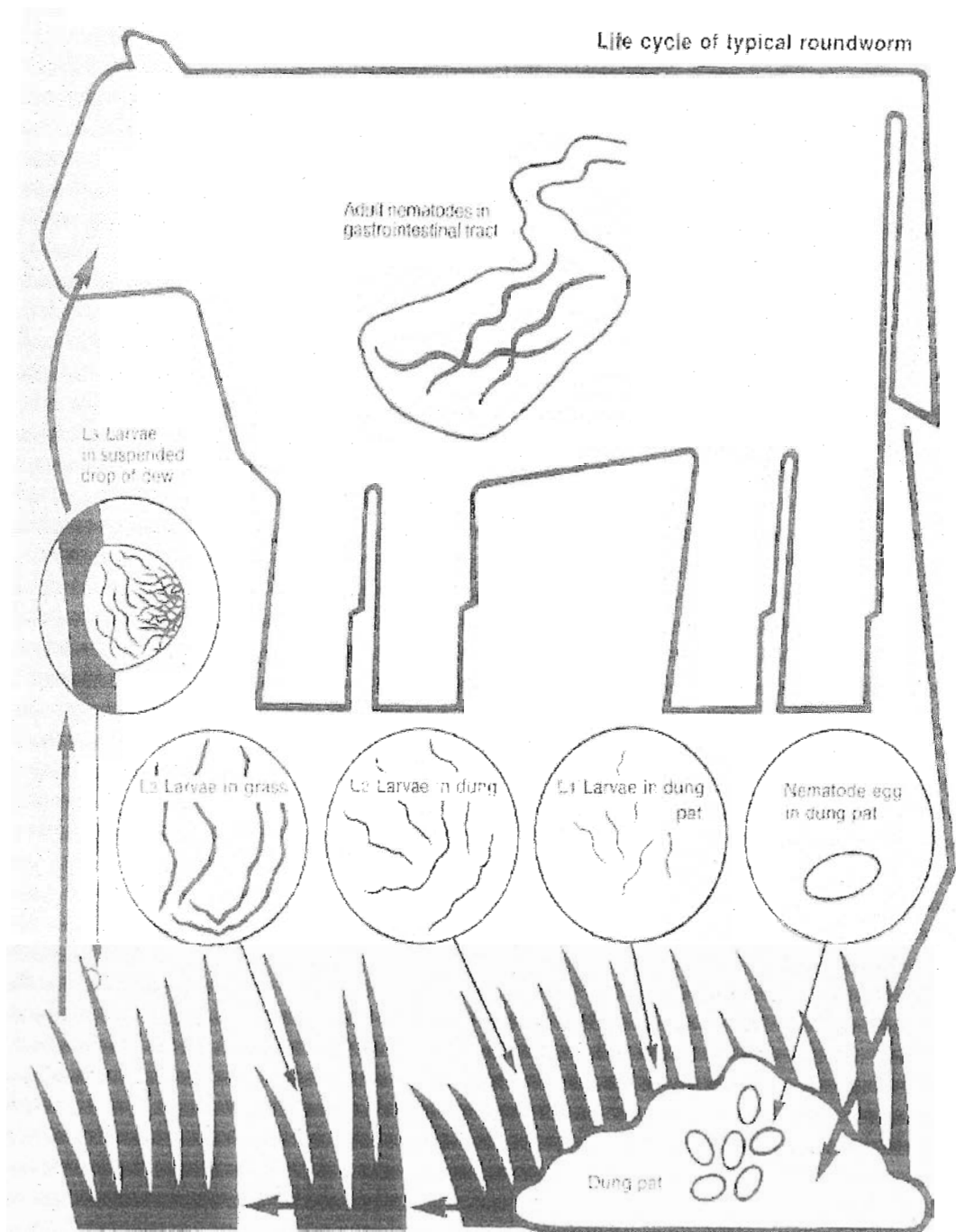
All are gastro-intestinal parasites. *Ostertagia ostertagi* invades the abomasum, or 4th stomach, as the target organ, an important site for breakdown and digestion of nutrients, and *Trichostrongylus axei*, and *Cooperia oncophora* do their damage in the small intestine, which is the site of nutrient absorption.

Adult worms of various species affect cattle all over New Zealand. The nematodes all have similar lifecycles. Adult female worms established in the gut of the animal mate and lay eggs, which are passed in the faeces. These eggs hatch into larvae, which then undergo several moults before reaching a 3rd stage (the infective stage or L3). As 3rd stage larvae the skin from the 2nd stage encases them and this acts as a sheath or protective layer. This allows them to endure adverse conditions such as cooling and, to a lesser extent, desiccation.

Very motile, the 3rd stage larvae are able to move in moisture, meaning they can travel from the faecal pat across pasture, or more down into the soil as the humidity decreases, or travel in dew or rain up blades of grass where they are eaten by the grazing animal.

Once consumed by a suitable host, the larvae then undergoes a 4th stage of development in their preferred site in the gut (assuming it has survived all host responses). The 4th stages emerge as young adults, which mature, and the cycle continues.

Lifecycle of typical roundworm (Ref. ¹⁴)



In addition to the typical lifecycle described above, *Ostertagia ostertagi* is recognized in two clinical forms – Type 1 Ostertagiosis, and Type 2 Ostertagiosis.

Type 1 is the uncomplicated form described above in the typical life cycle of the cattle nematode.

Type 2 Ostertagiosis can occur after a period when the 4th stage larvae can accumulate in the abomasum, in an arrested form (that is, development stops and they just stay “parked” in the crypts of the abomasal wall).

These inhibited larvae, accumulated over the autumn and winter period, can, under times of significant stress, all begin maturing again together, resulting in the emergence of massive numbers of immature adult worms simultaneously. It can cause the abomasal wall to be “punctured” resulting in protein leakage, change in abomasal pH, disruption to normal digestive processes, consequent acute diarrhea rapidly followed by death.

What can trigger this sudden simultaneous emergence is still not clear, although many parasitologists suggest that it can be associated with the stress of calving, transportation, or sudden dietary changes (sudden increases or sudden decreases in dry matter offered, or in pasture quality or type.)

However, other scientists¹⁵ have stated that Type 2 Ostertagiosis is one of the most over-diagnosed conditions of cattle around – “if it died suddenly, and you don’t know what it died of, then it was probably *Ostertagia*.”

This ignores other differential diagnosis for sudden death in cattle including malignant oedema, black leg, black disease, tetanus, hypocalcaemia (milk fever), hypomagnesia (staggers), poisoning and death by misadventure, to suggest a few.

(Four of the above list can be prevented simply by vaccination, and the balance through pasture and paddock management.)

Particularly convenient for farmers and for drench companies was the discovery that Type 2 can be relatively easily controlled through the use of long-acting endectocides at key times over the winter months.

☑ Survey findings: Incidence of *Ostertagia* Type 2.

56% of beef farms had never experienced deaths from *Ostertagia*.

Of the farms that had:

23% lost 1 in 10 years

10% lost 2 in 10 years

5 % lost 3 in 10 years

5% lost 5 in 10 years.

54% of the cases occurred in early spring.

🔗 **Are losses from Type 2 *Ostertagia* overstated in advertising or promotional material?**

🔗 **Need to confirm if deaths are caused by Type 2 *Ostertagia*, or some other animal health problem.**

🔗 **The author recommends a regular clostridial vaccination programme for all cattle.**

☑️ **Diagnosis of Ostertagia deaths:**

62% of the deaths reported were not diagnosed by a vet.

In the cases that were diagnosed by a vet, a post-mortem was done in 8% of them.

🔗 **A standard for diagnosing Ostertagia would be useful in ascertaining the true extent of the problem.**

It is likely since endectocide used became widespread that Type 2 Ostertagia is less common these days.

Cooperia is the dose limiting species for many anthelmintics.

Dose limiting: The species that needs the highest dose rate to provide a complete kill. Some parasites (e.g. *Ostertagia*, *Dictyocaulus* (lungworm) are susceptible to very low levels of anthelmintics. Others (e.g. *Cooperia*) require much higher levels to achieve the same kill.)

Although *Ostertagia* was for years considered the most significant parasite in beef herds, in my opinion it is *Cooperia oncophora* that is now emerging as the silent production stealer. Although deaths and dramatic disease entities are rare, the insidious production loss of 10 – 25% across an entire mob of young stock can have a significant impact on profitability.

Sub lethal dose: A dose which is insufficient to kill the entire worm population (for example, if therapeutic blood levels did not get high enough to kill, or did not stay high enough for long enough to eliminate the population.) Sub lethal doses are attributed to some as being the cause of “break-downs” in parasite control when long acting pour-on drenches or boluses are used.

4. Worm larvae impact on growth rates.

The larval stages as well as the adults of all the cattle nematodes initiate considerable immune and host responses which cost the animal in terms of diverted protein, energy, and minerals, as a result of a complex interaction of immune and salvage responses.

These include changes to gut pH, changes to blood profiles, and nutrient and mineral utilization. In addition, there is an increased gut cell turnover, inflammatory reaction in the gut lining, sloughing of epithelial cells, and mucus secretion into the alimentary tract.

There is evidence (Symons & Jones, 1983, cited in Sykes, 1997) that infection in one site in the gut may stimulate a reaction resulting in protein turnover in the whole alimentary tract. A big increase in protein turnover is costly in terms of energy required for additional protein syntheses.

The result is a decrease in efficiency of feed conversion (decreased growth rates, decreased fertility, increased animal health problems, in extreme circumstances.)

Of the three main parasite species discussed in this paper, the seasonal differences must be taken into consideration when planning a sustainable parasite control programme.

All species are present throughout the year, but in certain areas of the country *Cooperia oncophora* appears to be more of a problem in the autumn and winter. *Trichostrongylus axei* is frequently a problem over the spring, summer and autumn, while *Ostertagia ostertagi* accumulates as inhibited larvae through late autumn and winter, can be a threat as Type 2 Ostertagiosis in spring, and can be an ongoing problem as type 1 in the following summer and autumn, particular in younger animals.

In addition, changes to the species balance, or effectiveness of drench programs aimed at controlling them, can be induced through ineffective drench policies or poor drench choices.

It is interesting to note that most of the applied work in internal parasite studies of cattle in New Zealand was done between the mid 1960's to 1980's. There has been relatively little published work in the subsequent years, apart from that which has been commercially driven by the drug companies either directly or through sponsorship of various research projects and undergraduate studies.

Traditional advice (source: Vet Notes Parasitology year 4 1996) offered to beef farmers includes:

- Minimizing early exposure to worm larvae by only grazing calves on pasture prepared by overgrazing with an alternative or non-susceptible species first. *Author's comment: Ideal, but not always practical, so other strategies need to be developed to manage parasitism in the intensive situation.*
- Not allowing calves to graze over paddocks previously grazed by other calves. *Author's comment: Difficult to achieve in the sole species unit (e.g. the professional large-scale calf rearing operation.)*
- Preventative drenching – drenching at 4 – 8 week intervals (depending on the drug and formulation used) from weaning for the next 3 – 4 months in the extensive system, and until one year of age in the intensive bull beef system. *Author's comment: Unfortunately, a failure to adequately monitor the effectiveness of the treatments has, in the authors opinion, significantly contributed to the “screening” of the parasite population and so increased the proportion of resistant worms which will cause problems both now and later in the system.*
- A conservative risk management policy, where drenching was regarded as insurance against impaired production through parasitism, evolved when monitoring of beef faecal egg counts as a means of monitoring parasitism was undeveloped. *Author's comment: This policy persists, but without determining that drenches are effective, or even required, there may be negative impact on drench resistance and on annual drench expenses. There are serious doubts about the sustainability of a system that involves frequent drenching.*

- The recommendation to give a drench to new stock on arrival was intended to reduce the incidence of Type 2 Ostertagiosis, which can be induced after a major stress such as transportation and the associated resulting period of starvation or dehydration. *Author's comment: Quarantine drenches were always recommended, but farmer uptake on this advice was poor over the past 10 years. Modern recommendations advocate quarantine drenching to control the transfer of resistant parasites – the success of this will be dependent on the effectiveness of the drench and administration method.*

5. Drench resistance detection and monitoring:

There is often debate about whether drench failures are due to drench inefficacy or to drench resistance.

Drench inefficacy occurs when the drench failed to reach therapeutic levels, for example, because of poor administration (e.g. pour-ons) or the full dose was insufficient to kill a particular species e.g. *Cooperia*.

Drench resistance occurs when a parasite species survives what would normally be a killing dose. While both definitions are often argued, in the author's opinion the on-farm impact and management strategies are the same, so there is little useful reason to try and separate out the two cases.

In the author's experience, drench inefficacy (e.g. high endectocide pour-on use) has quickly led to the development of drench resistance anyway.

Geary, (1999)¹⁶ stated that “anthelmintic resistance is an undeniably catastrophic problem in some segments of the animal health market, especially in small ruminants.”

He went on to state that drench resistance in sheep is a world wide problem, but few cases of drench resistance in cattle have been formally recorded to date.

Bisset (1994) reported that at that time only 6 cases of anthelmintic resistance in cattle had been identified.

There are very few statistics available on cattle drench resistance, there being no national database, but the progress of resistance appears to have been impressive and no doubt is grossly understated here.

Pomroy, (1998)¹⁷ stated that there are more cases of drench resistance in cattle in New Zealand than the rest of the world put together.


Agri-lab⁵ has detected drench resistant worms in cattle in greater numbers in the last 18 months:

- Benzimidazole (white drench) resistant worms were discovered in cattle on 10 out of 18 farms tested during the period researched.
- Endectocide resistant worms were discovered on 11 out of 18 farms tested
- Most of the properties had a history of high pour-on or injectable endectocide use over the previous 5 years
- On 6 of the 18 farms, there were both BZ and endectocide resistant worms present.
- All farms tested were responding to production problems – i.e. there are probably many more cases around – we haven't started looking properly yet!
- *Cooperia* species were predominant in all larval cultures performed.
- There have been no cases of levamisole resistance detected to date.
- There have been no cases of combination resistance to date.

Summary of Agri-lab data:

 **BZ resistant cattle worms found on 55% of farms tested**

 **Endectocide resistant cattle worms found on 61% of farms tested**

 **33% of farms had resistance problems to BZ's and endectocides**

 **Levamisole and combination drenches still very effective on these properties.**

It is likely that the incidence of drench resistance in cattle in New Zealand (and in sheep) is far more common than previously imagined.

The only available published statistics draw on cases tested through the government MAF animal health laboratories, and does not take in to account (or even attempt to collect) data from private laboratories or from farmers doing their own testing and monitoring.

It would be useful to compile an independent national database of drench resistance statistics, but commercial reality and competition for business appears to be a significant restraining factor!

Pomroy stated that the main parasite involved is *Cooperia*, with the main drench being the benzimidazoles (white drenches.) It is the authors experience that there are many cases of avermectin (endectocide) resistance in beef units also, mostly involving moxidectin or ivermectin. The author has also recorded one case of doramectin and two cases of eprinomectin resistant *Cooperia*.

 Survey results:

95% of beef farmers were concerned about the potential impact of drench resistance on their farms.

23% of beef farmers had actually tested to see if resistance was present already.

⁵ Agri-lab FEC Services – Internal parasite monitoring and resistance testing service for sheep, cattle and deer farmers, New Zealand.

🔑 The level of testing for resistance is so low, that it is likely that there are many more cases of drench resistance around than those that have been recorded so far.

🔑 Early detection improves likelihood of management without production loss.

📄 Survey results: Of the farms that have tested for drench resistance, 22% had detected problems with endectocides (ivermectin, moxidectin etc.) and 33 % had problems with benzimidazoles (white drenches.)

Also, most of the cases of resistance reported came from North Island properties.

In the author's practical experience, the incidence of endectocide and BZ resistant *Cooperia* is grossly under-reported. Resistance or inefficacy problems are detected in approximately 85% of cases where growth rate problems have been detected, and in about 40% of routine checks (with no history of problems.)

The author has not found (to date) any drench inefficacy problems in cattle treated with oral levamisole or concentrated combination drenches.

🔑 More drench checks in cattle are recommended. Identify resistant strains of worms early.

Drench resistant parasites are thought to develop in the following way:

1. A few worms survive the drench, but are not fertile. Their siblings however, still on the pasture, contribute to the gene pool when they are ingested and reproduce when the cattle are not drenched.
2. Some worms then survive the next drench, are infertile for a while, but recover and contribute to the gene pool again.
3. The next generation of worms survive the drench, continue to lay eggs but the eggs are sterile for a period after drenching.
4. The next generation of worms survives the drench, egg production is slowed down, but eggs are viable, the resultant infective larvae are better able to withstand drench challenges, and drench resistant escalates.
5. The next generation of worms survives the drench and thrives, continuing to reproduce completely unchecked. Drench resistance is now noticeable in that the animals still look wormy, and record high faecal egg counts after drenching. Production is lost.

(It seems that steps 3 and 4 do not last very long, and step 5 is reached quickly.)

Drench checks.

Drench checks on farms, and various bioassays (laboratory tests) attempt to identify drench resistant parasites early – neither test however can detect resistant worms until they are in relative abundance. (Geary, 1999).

However, there is currently no method available that is an improvement on the faecal egg count reduction test, so this method continues to be accepted as the most useful on-farm tool available for detecting drench resistance. In practice, early detection enables the farmer to modify drenching programmes, in many cases with little impact on profitability.

Drench resistance in cattle is widespread throughout New Zealand.

In many cases, inefficacy (poor delivery of active ingredient) and drench resistance are involved - the product didn't work well and resistant worms are present.

Key points considered at the 1998 Parasitology conference held at Lincoln University included:

- Widespread use of endectocides (Ivomec, moxidectin, abamectin etc) is selecting for a predominance of *Cooperia* species in cattle throughout the country.
- Iver/aver/moxidectin resistant *Cooperia* are affecting cattle all over the country. Quarantine drenches of ivomec or similar don't help reduce the spread of this resistant parasite.
- Pour-on anthelmintics are not achieving acceptable control under field conditions. The presence of dirt or dust on the coats binds the active drug and reduces the dose that can pass through the hide. However, even in very clean cattle, pour-ons are frequently less effective than the label claims.
- Oral and injectable drenches are a more reliable form of control of internal cattle parasites; pour-ons are great for the treatment of external parasites.
- Doramectin injection (Dectomax) is providing better control on some farms than ivermectin pour-on and moxidectin pour-on, although some delegates felt a comparison of injectable efficacy vs. pour-ons was a little biased.
- When iver/aver/moxidectin resistant *Cooperia* were present, none of these products could be relied upon to give full control.
- While moxidectin is giving less than satisfactory results on many beef farms, its success in sheep and horses has been outstanding.
- Farmers must be careful not to make comparisons between sheep and cattle when the parasites are different, and the efficacy of drugs is quite different too – a product that works well in one species may not be great in another. Check up and see.
- The treatment of subclinical parasitism in dairy cows significantly increased milk yield. It appears that *Cooperia* were responsible for taking the “cream” off production, even at levels which previously were thought to be insignificant. It is probable that low levels of *Cooperia* are having a similar negative effect on weight gains in beef, and subclinical parasitism is an important issue for profitable beef farming. Combine this with problems with control of *Cooperia* (through ineffective drugs or methods of application, or drench resistance) and the outlook for beef farmers is of concern.

Two methods are available to monitor drench performance:

1. **FEC** - test faecal samples 11 - 14 days after drenching.
2. **Worm counts** - examine the gut to see how many and what types of worms are left behind after drenching. (Problem: Only possible on post-mortem.)

🔗 **Faecal egg count monitoring is a useful tool for monitoring drench performance, without having to slaughter the animal.**

Regular drench checks should be made 11 – 14 days after drenching, by collecting individual faecal samples and submitting them to a lab for faecal egg count testing.

6. Adapting to changes in the parasite population as it responds to farm management and drench practices over the years

Cooperia was not considered such a significant parasite 5 - 10 years ago, but is becoming predominant because of widespread use of ivermectin and related products, and of pour-ons in particular.

Cooperia is a difficult parasite for drugs to kill. There are many recorded resistance problems, which include ivermectin, abamectin and moxidectin, and the BZ (white) drenches too.

The use of products that don't entirely clear the infection has resulted in a shift in the proportion of *Cooperia* around on many farms, particularly on those that don't have sheep available to clean up pastures.

🔗 **Identify products that work well on your farm.**

The parasite population on the pasture, and in the animals, may well have been altered over the years to become *Cooperia* dominant because of:

- increased use of pour-on formulations (convenient, but provide lower peak concentrations of drug compared to injectable or oral formulations)
- Increased use of endectocides (seen as the magic bullet)
- Falling for advertising – most expensive is best – applying dairy information to beef units
- Inappropriate quarantine drenching practices
- Poor drench choices (not identifying predominant parasite, or specific drench actions)
- Insufficient monitoring – not identifying stock that need drenching sooner than planned (increase larvae dumped on pasture) or overdrenching of stock when it is not justified (selects for drench resistance)
- Insufficient drench checking – not identifying what works and what doesn't - not identifying a problem until production loss is visible as a failure to bloom after drenching.

***Cooperia* screening:**

A possible explanation for the increase in *Cooperia* problems seen in beef units around NZ in the late 1990's may be due to the "screening effect" on the population on the pasture.

The authors suggests that this has occurred in the following way:

1. In the beginning, the pasture and cattle were home to various parasite postulations, in not necessarily equal, but perhaps balanced proportions.
2. Thus, the cattle are excreting eggs from mixed worm infections onto the pasture, and ingesting mixed worm larvae.
3. When drenched, only those worms surviving the drench, (resistant *Cooperia*) contribute to the pasture contamination over the next 3 - 6 weeks or so (until the adults of new infections ingested after drenching have established and are now fecund.)
4. Thus, there is an unbalanced proportion of *Cooperia* worm egg being shed onto the pasture for a short period.
5. Another drench, another pour-on endectocide for example, is used, and again eliminates the other parasite species except for the endectocide-resistant *Cooperia*, including any new *Cooperia* infections.
6. Thus a significant number of *Cooperia* adults, surviving the pour-on drenches, are contributing to pasture contamination at far greater proportions that they would if totally effective drenches were to be used, and the whole worm burden eliminated.
7. Because *Cooperia* eggs are the predominant species being shed on to pasture, and so *Cooperia* larvae are being ingested in "abnormal" proportions, and each subsequent pour-on endectocide is not eliminating the *Cooperia* population, the situation escalates. Suddenly *Cooperia* is the most dominant parasite species on the farm – it is also the most difficult to control – is also reduces weight gains, reduces milk production, and reduces pasture utilization.
8. An increase in the *Cooperia* population has allowed for a massive increase in the proportion of resistant genes there are around, and also increased the odds of a resistant worm mating with a resistant or heterozygous worm to increase the odds of further resistant genes being added to the gene pool.
9. The farmer has real problems when drenching the cattle – the cattle fail to thrive the way he/she expected, even though the "best drench on the market" was used. He/she may then look at other avenues to explain poor performance – mineral and trace element status, feed quality and quantity, endophytes, and a whole host of animal health queries. Unless faecal egg counts are done 11 – 14 days after drenching, to check to see if the drench actually worked, then the drench inefficacy/drench resistance problem will go undetected, production losses will continue, and valuable dollars will be spent looking for answer in other areas.

Agri-lab has worked with a number of intensive bull beef farmers who have experienced actual production loss through *Cooperia* problems, particularly in the winter, and they have recorded significant production gains through more appropriate drench choices.

While it is not the intention to specifically recommend particular products, in the authors experience, oral levamisole and combination are very effective anthelmintics where *Cooperia* in cattle are a problem.

Pour-on endectocides are not as useful or effective, especially where clinical disease exists.

While sheep farmers have readily grasped the concept of drench resistance, and adopted ways to minimize its impact (albeit unsuccessfully in many cases!) cattle farmers and their advisors in many respects have been slow to recognize the emergence of drench resistance in cattle, and even slower to respond to its impact on productivity.

Much of this I feel is commercially driven – drench resistance in the sheep industry has been highlighted by the drench manufacturers because there are some easy (but more expensive = profitable) solutions available.

That luxury is not available to the cattle drench manufacturers and retailers, who I believe in some cases would prefer farmers not to know that the most expensive products have significant resistance issues associated with them, and some of the cheapest products on the market (= low profit margin) are in fact the most effective against these resistance parasites.

Some of the most effective cattle drenches are also the cheapest!

If no monitoring programme is in place, then drench resistance problems are generally first detected when cattle fail to thrive after drenching.

The following case (authors work, 1998) is a classic example.

The farmer had experienced poor parasite control in his young cattle over winter – pour-on endectocides had been used extensively over the past 5 years.

An extremely mild and wet winter, after a long, hot dry summer, and a hot autumn with some light showers, had created an environment ideal for the development of cattle parasites on pasture.

Locally (Hawkes Bay), many very high faecal egg counts had been detected in various mobs of cattle of all ages.

Extremely high FEC's, particularly in the young bulls on the test farm, and rapid reinfection soon after drenching, caused him to examine the efficacy of moxidectin on this farm.

Problems with recurring internal parasite infections in the R1 bulls, with very high faecal egg counts (2500 epg) prompted the farmer to do a post-drench check 14 days after moxidectin pour-on was used. An 88.5% reduction in FEC was achieved. The farmer was keen to continue to use pour-on drenches, for the convenience. A further trial was conducted to test the efficacy of moxidectin injection, pour-on, ivermectin injection and pour-on on this farm.

Pre-and post-drench faecal egg counts were taken from each mob. No drench treatment was totally effective. Larval cultures on samples collected 14 days after drenching revealed the surviving parasite population is 100% *Cooperia* species.

Resistance to drugs from the macrocyclic lactone family (ivermectin/milbemycin - Ivermectin/moxidectin products) appears to be a problem on this farm. There was little variation in efficacy between pour-on and injectable formulations on this farm.

🔗 The prevalence of *Cooperia* species resistant to ivermectin/milbemycins on other farms in Hawkes Bay should be investigated further, in light of anecdotal evidence from other farmers who have complained about poor parasite control over winter, but who are unaware of the results of this trial.

The dose rate for the ivermectin/milbemycin products available should be re-examined in light of the results of various trials. However, increasing dose rates will increase the costs, making some of the drench choices less attractive.

The efficacy of all anthelmintics used in cattle should be monitored more regularly than is currently occurring.

A degree of complacency by farmers is part of the problem – because they are buying what they consider to be elite products which are high priced, they assume that the monitoring work is being done for them on commercial farms by drench companies “somewhere else.”

🔗 Farmers assume that if there were efficacy problems, or if drench resistance became more prevalent in cattle, they would be advised of this fact.

Techniques to avoid drench resistance:

- Drench all stock on arrival, if it was not drenched at the point of sale. Discerning buyers may be able to dictate what they want to the market place. Quarantine drenching is more important than ever, with the increasing rate of drench resistance detected around New Zealand. Quarantine drenching is just as important for sheep, cattle, and deer.
- Monitor the effectiveness of drenches - drench test regularly to see that they are still working. Do faecal egg counts 11 - 14 days after drenching cattle (or 7 – 10 days after drenching sheep.)
- Check bodyweights dose rates and drench guns - underdosing is still a likely cause of drench resistance.
- Select effective products according to the farm requirements.
- Larval culture (where worm eggs are grown out to a stage at which they can be positively identified) will become more important in the future, as we learn to select parasite control strategies which are influenced by the predominant species on individual farms, particularly for those farms where satisfactory parasite control has been difficult in the past (e.g. due to overstocking or non-traditional farming policies.)

7. Seasonal effects and the impact of drought:

In a drought situation, survival of the infective larvae on pasture is low. Most of the parasites are residing in the animals.

Use of ineffective products (or the presence of resistant worms) means that only the eggs of worms that have already survived one drench are being dropped on the pasture.

In simple terms, this means that larger proportions of infective larvae are picked up off the pasture (especially after rain) that carry genes for "survive at least one drench". Resistance problems are accelerated.

Parasite larvae need moisture to move about.

The third stage larvae, the infective stage, wriggle out of soil and dung pats and up the grass blades on drops of dew or rain.

Until this happens though, they can shelter in the soil or dung pats for considerable periods of time.

This explains why internal parasites are often a big problem after the rain comes, at the end of a drought, at the same time that many cattle are also not as able to handle the challenge, because of poor feeding levels in the months prior.

In addition, a lack of challenge over the dry period may mean that immunity has waned (i.e. has not been sufficiently stimulated to be able to cope with a sudden and massive challenge such as can occur after a drought breaks.)

🔑 It is essential that very effective drenches be used during drought periods, to prevent the survival of drench resistant parasites through to the wet season.

When it is dry, most worm eggs fail to hatch, or are killed off soon after hatching.

Survival rate of parasite larvae, (which live on the grass) is excellent when conditions are warm and moist. A much larger percentage of worm eggs passed survive through to the infective stage, so worm burdens on pasture can rise rapidly.

Regular faecal egg counts help determine when it is worthwhile drenching without losing any weight gains to worms. Start from 3 weeks after the last drench.

Worms do not always cause scouring, and likewise not all scouring is caused by worms. Moulds, fungi and their toxins, and other organic and inorganic matter, plant species, bacterial and viral diseases, bad water (from ponds or dams) and lushness of feed can all affect the digestive system and faecal consistency.

8. Preventing the importation of parasites with cattle purchases, through quarantine drenching.

Regardless of the ongoing plan for managing cattle on your farm, the author recommends a quarantine drench on arrival of all stock – sheep and cattle – with the quarantine drenches of choice being a concentrated oral combination drench for cattle, and moxidectin drench for sheep.

The author does not recommend endectocide products as quarantine drenches for cattle – there is widespread resistance to these (mainly involving *Cooperia*) and oral combination drenches are the safest bet until more is learned about managing drench resistance.

Ivermectin type drenches still do have a big part to play in cattle drench programmes once the stock have moved onto the farm.

☞ Survey results: Origins of beef animals farmed:

28% home bred

30% bought in

42% had home bred stock AND bought others in.

☞ Quarantine drenches given to cattle:

Always – 47%

Sometimes – 12 %

Not usually (extensive units) – 21%

Not usually (intensive units) – 9%

🔑 The risk of importing drench resistance is significant on farms that trade cattle or buy in replacements.

☞ Quarantine drench types used -:

50% Endectocides (includes ivermectin, abamectin, moxidectin, doramectin, eprinomectin)

15% Oral combination drenches

4% oxfendazole (white/BZ drench)

Many used endectocide pour-ons for quarantine drenches – not the quarantine drench of choice in the author's opinion.

🔑 With probably widespread resistance to BZ and endectocide drenches, a review of quarantine drench policies is needed on some farms.

Quarantine drench of choice for cattle:

1st Choice: Oral combination drench

2nd choice: Oral levamisole drench

3rd choice: Injectable abamectin

4th choice: Pour-on abamectin

In the author's experience, drench resistance problems have been less commonly associated with abamectin, a particular type of endectocide, compared with ivermectin, moxidectin and eprinomectin.

(Anecdotal and personal evidence only – unsupported.)

9. Drench choices and application methods, and their impact on profitability.

There are significant differences in actions and efficacy of various drenches, drench families and methods of administration.

Within each drench family, there are various brands that have different active ingredients. Some of these have better success in one species than another does, even though it is from the same family.

Different active ingredients within the same drench family have unique advantages and disadvantages.

Apart from the physical differences of orally dosing vs. injecting or pour-on drenching, there are also significant differences in how quickly they reach their therapeutic blood levels (killing power), how high the drug concentrations reach in the animal, and how much active ingredient is given to reach these levels.

Injectables often reach maximum blood levels within 24 hours, and so are rapidly effective.

Pour-ons can take 5 to 10 days to reach maximum (i.e. therapeutic blood levels). The rate that they recede at is slower too, hence the claims for persistent activity.)

Injectable anthelmintic peak concentrations are much higher than pour-ons and so are more effective. In some cases the period of persistence is shorter though.

Pour-on anthelmintics are not working well on some farms. Dirt on the coats binds the active drug and reduces the dose that can pass through the hide. However, even in very clean cattle, pour-ons are frequently less effective than the label claims.

The pour-on drenches, which very convenient, are extremely expensive because per set weight, 2.5 times the active ingredient is administered when given via pour-on instead of by injection. The pour-ons also present more potential problems than the other oral drenching or injectable

drenches, and should be reserved for those special situations where the other two methods are out of the question (e.g. no yards, or unruly bulls.)

🔑 Just because a product is marvelous in sheep does not mean it will give you great results in cattle.

🔑 Also, if a product disappoints in sheep, don't disregard its usefulness in cattle or deer!

Intensive beef producing units are reliant on anthelmintics (drenches) to allow profitable beef farming.

Over the past 15 years, drench choices have become significantly more sophisticated, effective, and expensive!

While modern drenches are credited with lifting per head production and per hectare production the impact on national expenditure and national production has not been as positive.

Cattle drench expenditure in New Zealand was around \$27.9 million per year in 1994 (Bisset 1994)¹⁸.

By the year end September 1999, wholesale expenditure had increased to around \$38.7 million per year.

This represents an increase of \$10.9 million, or 39%, in only 5 years, during a period where beef cattle numbers have remained relatively stable, and beef production only moderately increased, in comparison.

In Australia, around 58% of the cattle drench market (in number of doses administered) is held by the endectocides (ivermectin, avermectin, moxidectin etc.)

New Zealand endectocide use is likely to be similar if not higher.

Clearly the spending on cattle drenches is significant. Add to this poor parasite control on increasing numbers of farms, including drench inefficacy and drench resistance, and the outlook for some intensive beef units is of concern.

Some of the issues warrant closer examination to determine some of the causes, and identify some possible solutions, to reduce on-farm expenditure and maintain or improve production.

While it is a challenge on some farms to improve per hectare production, measured in terms of liveweight gain per hectare, but there are significant opportunities on some farms to reduce inputs, which has a similar net result to improving production in some cases by as much as 10%.

☑ Survey results: Drench administration methods used:

40% injection

24% pour-ons

36% oral formulations

☑ Survey results: Facilities on farms

74% of farms used oral drenches in cattle.

88% of farms have an effective head bail.

👉 With skill & care, more farms could use oral drenches in cattle as one was of reducing annual drench expenditure.

Reducing the cost of the inputs into the intensive beef unit – in particular, the cost of the anthelmintics – through appropriate and cost-effective drench choices and administration methods can allow significant savings to be made.

☒ **Survey results: Farmers own experience, and advice from vets, influenced the majority of farmers decision about which cattle drench to buy.**

☒ **Main sources of cattle drench information:**

60% of farmer's information came from vets.

Other sources:

30% Agri-lab

28% Rural newspapers

14% FECPAK info

14% Farmers experience

9% Junk mail

Balance: discussion groups, stock & station agents, seminars, drench company rep visits.

🔑 **Veterinarians are the main source of cattle drenching information, and are also the major influence on which cattle drench to purchase. The information they deliver must be accurate, up-to-date, and, in the author's opinion, free of commercial bias. Many farmers are relying on vets to recommend the best product for the job.**

? How free from commercial bias are veterinarians that are also major drench retailers or endorsing vet-only anthelmintics?

Inappropriate drenching choices occur because of:

1. Poor awareness of drench resistance
2. Poor drench checking rate even where there is some awareness – why?
3. Victims of successful marketing campaigns
4. Victims of desire to decrease work load even if it compromises effective parasite control – e.g. pour-ons vs. orals
5. Lack of knowledge of parasite dynamics on own farm.

Some farmers are in a position to reduce expenditure simply by reconsidering their current drenching practices in calves and weaners.

For example, drenching cattle under 8 – 9 months with an endectocide pour-on will not kill any more adult worms than an effective oral drench will, at considerably less expense. However, the pour-on and injectable drenches have a longer period of persistency (except where *Cooperia* is a problem.) If young cattle are moving onto highly contaminated pasture, then persistent activity drenches appear to offer some advantages. (A similar effect can be achieved through monthly oral drenches also, at significantly lower cost.)

If the cattle are moving onto “clean” pasture, then any persistent activity is of little advantage.

Generally, the endectocide drenches persist in the bloodstream for longer than other drenches, although these levels may not necessarily remain high enough to kill all parasites present. The level of persistency varies between each active ingredient and between worm species - *Cooperia* is generally the first parasite to reappear.

If the mob has exposure to high levels of pasture worm larvae, and *Cooperia* are not dominating the worm population, then the more persistent drenches have distinct advantages.

Persistency varies between drench ingredient and worm species from 18 hours up to 28 days.

☞ If *Cooperia* are a problem, there may be little or no persistent effect gained from some long-acting drenches.

The injectable endectocides are also very effective at killing sucking lice, with some effect against biting lice; the pour-ons are very effective against both.

These may be important factors to the farmer when planning a drench purchase.

Around 20 years ago, American workers claimed consistent increases in milk yield following drenching of dairy cows around calving.

Various trials in New Zealand over the past 4 – 5 years have focussed on the benefits of treating lactating dairy cows, with variable results.

Where pasture contamination was low (because of good parasite control in young stock) negligible responses to drenching were observed. However, where pasture contamination was high, or the heifers were stressed or first calves (i.e. young) then more tangible benefits could be measured.

Good parasite control in the young stock, calves in particular, not only benefits them but also the older stock on the farm and reduces the need for cow drenching.

Since the milk withholding periods on some pour-ons have been lifted, there seems to have been more emphasis placed on demonstrating the benefits of these products in lactating dairy cows.

The benefits produced must outweigh the cost of the product – monitoring is recommended to determine that a problem exists, and therefore a response is likely, before whole herd treatment is contemplated.

Beef farms should consider a similar approach.

This observation has been overlooked in many drench company advertising campaigns, particularly since various pour-on products have become licensed for use within the lactation i.e. have a nil milk with-holding. (It is important to note that many nil-milk-withholding drenches have a lengthy meat-withholding period – of significance if the milk is being fed to bobby calves.)

Examples: (current at time of publication)

Genesis Pour-on (Ancare), Vetdectin & Cydectin Pour-on (Fort Dodge) – 35 days meat withholding, nil milk withholding period.

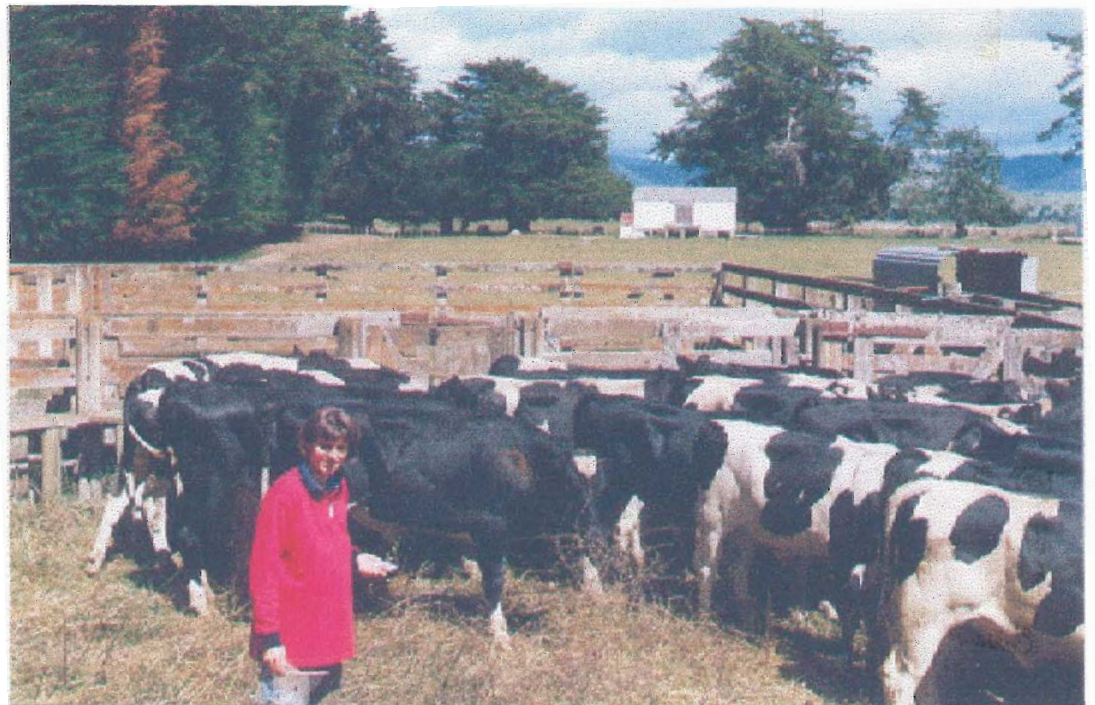
Eprinex Pour-on (Merial) – 14 days meat withholding, nil milk withholding period.

While pour-on drenches with a nil-milk with-holding period are very attractive, the economics of using a short acting oral drench (e.g. levamisole – 24 hour milk with-holding period) should also be considered, particularly in situations where milk is being held back from the vat to feed to calves anyway.



Drench resistance and insufficient monitoring....

A:\angela and bulls in yards.jpg (local)



Sensible drench choices continued

10. The drench rotation theory.

The transfer of information from industry to farmers is slow at the best of times, but discussion and debate of the drench rotation theory has been actively discouraged by many drench manufacturers, veterinarians and animal health consultants.

The author does not advocate drench rotations for the following reasons.

Strict drench rotations are not slowing the development of drench resistance, contrary to what was thought in the past. (Barger, 1997)¹⁹

New evidence shows that drench rotations are not effective.

The best strategy is to **select a product based on what you want it to achieve**, and then find a drench that fits the bill.

This contradicts the rotation theory which attempts get a drench from just one family to achieve a whole years parasite control, across many classes of stock, from pre-weaned calves right through to mature bulls.

Regular checks for efficacy is necessary, but as long as a product works well on your farm then it should stay on the list of products of choice.

Note that drench resistance problems detected in sheep appear to be unrelated to drench resistance problems in cattle.

Each drench type must be tested for against each species of production animal.

When selecting drenches for worm control, choice of product will be determined by:

- Need to control specific worm problems.
- What products work on my farm? (Families with significant drench resistance problems are best avoided)
- How long does it need to keep working for?
- Withholding period.
- Minerals or Trace elements to be added?
- What price am I prepared to pay?
- What labour shortcuts do you want? How often is it convenient to drench? How accessible are the stock?

Once you have the answers to each of these questions, farmers can make an informed decision about the best option for the stock concerned. Drench retailer should be able to guide you, but farmers ought to be clear about their own farm requirements first.

So why are drench rotations still being recommended in brochures and by drench company representatives?

1. For the past 10 years, consultants and veterinarians have been recommending that farmers adopt strict drench rotations in order to prevent the development of drench resistance.

With over 70% of New Zealand farmers now following drench rotations, there is a degree of reluctance amongst the industry to admit that predictions were wrong.

Adhering to drench rotation is **not** increasing drench resistance either, (as long as the drench is effective on that farm), but it **is** limiting some farmer's options for parasite control and animal health expenditure.

(Some models have shown that using combination drenches are an effective way to delay the onset of drench resistance.)

Farmers should select products according to purpose rather than drench family.

This will free up the animal health budgets for those on expensive drenches, and improve parasite control options for those who were on straight white or clear drench rotations.

2. A great deal of material, pamphlets, labels etc. are already published, which include drench rotations in the recommendations - it would cost millions of dollars to throw it all out and print new information - it will be replaced as time goes by.
3. It is very convenient for many of the drench companies to continue promoting strict drench rotation – many they all get a decent slice of the cake that way. Many have a captive market.

📊 Survey findings: Drench rotation practices:

76% of farmers surveyed do not practice drench rotations in their cattle system.

5% “sort of” do.

🔗 Drench rotations are ineffective and outdated – why do so many still follow a drench rotation in their sheep flocks, when they never have for the cattle?

Drench choices – costs vs. benefits:

The following table is a cost comparison of cattle drench choices, based on prices (incl. Gst) listed by the Kiwi Trading Stores flyer, distributed November 1999, unless otherwise indicated.

Note: Inclusion in this table is not an endorsement of any product.

Product:	Drench family	Mode:	Price per mob of 100 bulls @300 kg each	Advantages:	Disadvantages:
Bomatak C Low Dose	BZ/white	Oral	\$56.97 (15 ml dose)	Cheap	Less effective against BZ resistant <i>Cooperia</i> No persistence.
Systemex Low Dose	BZ/white	Oral	\$90.48 (15 ml dose)	Cheap	Less effective against BZ resistant <i>Cooperia</i> No persistence.
Levicare Hi Min (Price ex local vet)	Lev/clear	Oral	\$28.69 (60 ml dose) Per 100 bulls!	Very cheap and very effective against <i>Cooperia</i> , and all other adult worms	Large volume to administer orally. Not great against inhibited <i>Ostertagia</i> . No persistence
Arrest – C (Price ex local vet)	Combination	Oral	\$111 (30 ml dose)	Very effective against all parasites, good quarantine drench	No persistence.
Scanda (Price ex local vet)	Combination	Oral	\$100.50 (30 ml dose)	Very effective against all parasites, good quarantine drench	No persistence.
Cydetin injection	Endectocide	Injection	\$343.31 (6 ml injection)	Easy to administer. Longer acting.	Cattle don't like injectables. Get nervy. Not as effective against resistant <i>Cooperia</i> .
Genesis injection (Price ex local vet)	Endectocide	Injection	\$385.54 (6 ml injection)	Easy to administer. Longer acting	Cattle don't like injectables. Get nervy.
Dectomax injection (Price ex local vet)	Endectocide	Injection	\$438.00 (6 ml injection)	Easy to administer. Claims to be much longer acting in some circumstances	Cattle don't like injectables. Get nervy. Not as effective against resistant <i>Cooperia</i> .
Genesis Pour-on (Price ex local vet)	Endectocide	Pour-on	\$386.00 (15 ml pour-on)	Easy and safe to administer. Some persistence.	
Ivomec Pour-on	Endectocide	Pour-on	\$355.36 (30 ml pour-on)	Easy and safe to administer. Some persistence.	Not as effective against resistant <i>Cooperia</i> .
Cydetin Pour-on	Endectocide	Pour-on	\$377.08 (30 ml pour-on)	Easy and safe to administer. Some persistence.	Not as effective against resistant <i>Cooperia</i> .
Eprinex Pour-on	Endectocide	Pour-on	\$420.42 (30 ml pour-on)	Easy and safe to administer. Some persistence.	Not as effective against resistant <i>Cooperia</i> .

🔑 In the authors opinion, there is a place for oral drenches on many cattle farms, and the investment in a good head bail (\$400 - \$600) and a cattle drenching hook (\$135) will be quickly recovered.

🔑 The choice of drench purchase should be a decision influenced by the following information:

- Determine that the cattle actually need drenching – FEC/weight
- Age of the cattle
- level of worm challenge to the mob
- What does the drench need to achieve
- How long does the drench need to last for
- What do the labour and facilities allow (head bail etc)
- What is the weather like (some pour-ons are not rainfast)
- What is the meat or milk withholding period?

The move away from strict drench rotations is a point advocated by the author.

It is important to select a product according to what it needs to do, not what drench family you feel you should be using.

E.g. If *Cooperia* is a problem, (causes poor weight gains especially over winter and spring) then levamisole or oral combination drenches are the most appropriate products to use, generally giving a more complete kill (i.e. clean-out) than the ivermectin type products. In this situation, use of ivermectin and its relations without careful monitoring can result in rapid build up of *Cooperia* and a disappointing season despite significant expenditure on drenches.

However, where *Ostertagia* is a threat (e.g. Young cattle (bulls or heifers) being transported close to spring or subject to drastic changes in feed) then endectocide products are an ideal choice. These terminate *Ostertagia* burdens (including inhibited stages) with some persistent activity, and giving the production lift required at the time.

The withholding times regarding milk and meat supply need to be carefully considered when drench programmes are being designed.

🔑 Must budget for monitoring costs (faecal egg counts) to check drench performance regardless of the drench choice.

Drench resistance costs money.

If a product is only removing 85 - 90% of the worm burdens, then only 85 - 90% of the growth rates will be achieved afterwards.

All animals use protein and energy to provide an immune response against parasites - this response helps to get rid of or reduce the effect of parasites.

In high producing beef systems, all available protein and energy should be used for maximizing weight gains, not diverted into fighting parasite burdens.

In beef cows and replacement heifers, the use of protein and energy to mount an immune response is acceptable, because this will help her to resist the effect of parasites later on.

In bulls, the development of immunity through prolonged exposure to low worm burdens is paid for with slower weight gains, and an appropriate anthelmintic (drench treatment) is often a sensible economic alternative.

Although steers usually fare slightly better than bulls, in this situation the use of drench is a cheap way to convert feed into weight gains instead of into fighting off worms by developing an immune response.

Monitoring – general:

Where possible, adopt management techniques that reduce the need for excessive drenching. Stocking rates, sheep/cattle/deer ratios, contour, and feed types/availability will impact on this.

Regular monitoring and drenching according to need (based on faecal egg count) is now more appropriate than ever.

Accurate interpretations and fast results are important when farmers are using faecal egg count monitoring as a management tool on their farms.

FEC's enable parasite control problems to be identified and rectified as they develop, before there is major loss of production.

☑ Survey results: Cattle drench programmes have changed over the years.

29% are doing more monitoring.

19% have increased the frequency of drenching.

24% are using more oral drenches.

14% are using more endectocides.

5% are using more pour-on drenches, boluses.

5% have introduced new cattle policies that affect drench use.

FEC's are used to locate the reason for ill-thrift problems throughout the year, but especially over winter.

Depending on the planned system for managing dairy or beef animals after weaning, FEC's can optimize drench administration (do it at the right time), or monitor the situation – drenching is not always necessary, but you want to identify if it is and do something if required.

There are a lot of points to consider when deciding what products to drench cattle with – the drench family and method of administration (oral, injection, pour-on or bolus) will vary according to the season, class, and time of year.

A faecal egg count can identify a potential production loss looming - action can prevent a substantial loss in daily weight gain.

Faecal Egg Counting in cattle does have some limitations, but these must be considered in context.

Faecal egg counting is successfully used in cattle up to 15 - 18 months of age.

Not as accurate in older cattle:

FEC is not as accurate in older cattle e.g.. Cows over 2 - 3 years of age.

A healthy cows' own immune system will suppress worm egg production even if she has a low to moderate burden.

A sick wormy cow, or one with a high worm burden, can be detected via FEC.

Dairy Cows: Treatment at low faecal egg count gives a measurable response (increased milk in the vat.)

Beef Cows: A response to treatment of low to moderate burdens is difficult to measure. How much is something worth if you can't measure it?

Accuracy of technique affects the result:

The worm eggs are reasonably well distributed through the dung by the time it is passed, and testing a sample of the pat gives a relatively good indication of the FEC of the animal.

A positive faecal egg count indicates that adult female worms are present and fertile - it gives no indication of the burdens of immature larvae that can limit beef production. However, many believe that drenching at the point of reasonable FEC provides a cost-effective balance between slowing weight gain and premature product use.

Because a small sample size is required, testing cattle is a practical and simple procedure.

- Must use high-powered microscope (100x magnification)
- Depending on faecal consistency, parasite eggs are often difficult to see in cattle samples (unlike sheep, which are relatively easy to detect)
- If worms eggs are present but not counted (i.e. Missed), then a false low result will occur.
- If a false low result is used in interpretations, cattle parasite burdens are not accurately monitored, leading to disappointing results.

Accuracy of trigger levels

Opinion about what trigger levels to use varies widely from Parasitologist to Parasitologist. The following views expressed by the author may contradict others used in the industry.

Gather information from many sources, and see what works for you.

In my experience, the following seems to work well for the author's clients:

Only individual faecal egg counts are used (usually 10 per mob).

In cattle up to 15 months of age, a herd average of between 100 - 200 epg, or a significant proportion of the samples tested approaching 100 epg indicates that drenching is required to keep weight gains at maximum.

This contrasts with other opinions that cattle should be drenched at around 500 epg, sometimes even higher. In years past, many farmers monitored FEC's and found their cattle were not performing, even when FEC's were much lower than 500 epg. To make matters worse, when

they drenched the stock there was an immediate production response, indicating that the drench had been administered too late.

This made farmers very wary about cattle faecal egg counting as a reliable tool, and the concept was abandoned "because it didn't work."

I believe the problem was not clearly identified, and using incorrect trigger levels was the culprit. The levels of around 500 epg were developed when cattle weight gains of 700 - 800 grams per day was considered satisfactory.

🔗 These days, we expect far higher performance from our beef animals, and so must adjust our parasite control programmes accordingly.

🔗 **The use of faecal egg counting to modify a suppressive drenching programme is an ideal way to maximize weight gains and reduce chemical (i.e. \$\$\$!) use.**

Limitations of faecal egg counts in cattle:

FEC cannot detect Type 2 (Inhibited) *Ostertagia*:

Faecal egg counting can only detect the presence of adult worms that are laying eggs.

Some *Ostertagia* larvae accumulated over autumn and winter can go into a dormant stage, burrowing into the lining of the abomasum (4th stomach) and staying there for varying lengths of time (months - years?)

If the animals become stressed, the inhibited *Ostertagia* can interpret this as a good time to hatch out, sometimes simultaneously. This causes massive damage to the stomach lining as each larvae leaves a hole as it emerges - protein leaks out of the hole, and the surface does not function properly, resulting in diarrhea, poor digestion, rapid loss of body condition and often death. This does not happen to every animal, it is not seen every year, and scientists do not fully understand what triggers the problem. Many cattle accumulate and shed these inhibited larvae over a period of time with no dramatic events - *Ostertagia* however is responsible for reduced growth rates and is a production-limiting parasite.

Faecal egg counting will not detect the inhibited stages of *Ostertagia*, but it will detect the adults when they start to lay eggs.

In Hawkes Bay in particular, when winters are mild, *Cooperia* is often far more important than *Ostertagia*, and this is detected via FEC.

Cooperia infections result in reduced weight gains – the losses are not as dramatic visibly, but the impact on accumulated weight gains (= profitability) is.

Depending on class and time of year, FEC monitoring from 3 - 4 weeks after the last drench is appropriate.

Never presume that a product with long-acting claims is providing that for you - check it out. Many farmers lost significant production in winter 1998 because drenches with long-acting claims did not adequately control the massive *Cooperia* problem that was prevalent on many farms.

🔗 **Not detecting a problem means that further production is lost - without even knowing about it!**

Drench resistance is a problem on many farms, and when significant, results in a failure of weaners and yearlings to bolt after drenching – often ending up as store instead of killed prime (beef), or disappointing target mating weights (dairy heifers). (Cobalt/B12, copper or selenium deficiency and various diseases may also be implicated – check the local situation with your veterinarian.)

Sample collection procedure

Faecal samples are collected directly off the paddock.

About a tablespoon per sample is required.

Each sample should be sealed in an airtight container (pottle or sealable plastic bag) and sent to the lab promptly.

Store samples in the fridge if there is to be a delay before posting.

Samples should be processed within 4 days of collection.

Control of parasitism in young animals is important.

When the weather remains mild over autumn and winter, survival of the worms on the pasture is very good and the cattle are reinfected quickly after drenching. Depending of pasture availability, faecal egg counts from 3 weeks after drenching is recommended – this identifies when eggs are being deposited onto pastures again. A positive FEC indicates that adult female worms are present and fertile – there is no indication of the burden of immature larvae, which can limit beef production.

The control of cattle parasites for the first 15 months of the animal's life is an important part of profitable beef farming.

Young animals are the most vulnerable to worm infections, and were the main source of pasture contamination.

Many farmers have found that drenching at the point of reasonable FEC (around 100 eggs per gram) provides a cost-effective balance between slowing weight gain and premature product use. *Cooperia* worms penetrate the lining of the small intestine and cattle make poor use of feed, taking longer to meet market weights. Oral levamisole or combination drenches are usually effective, but can be difficult to administer.

When *Cooperia* is prevalent, oral or injectable drenches are preferable – there is growing evidence that the pour-on formulations are not as effective against *Cooperia* infections, despite the label claims.

Cases of drench resistance in cattle, mainly involving *Cooperia*, are increasing and regular monitoring of drench performance is recommended – especially on those farms where endectocides (ivermectin/moxidectin etc) have been in use for several years.

Often the first time a beef farmer becomes aware that drench resistance is a problem is when there was no great response to drenching, or there was a visible lift in health but the young stock quickly slipped back again within 2 – 3 weeks of drenching.

🔗 Monitoring the effect of drenches we use is essential to check they are working, to identify resistance, to identify the pour-on problem, and to identify cheaper drenches.

🔗 Unnecessary drenching can speed up drench resistance on your farm.

Faecal egg counts are a useful and economical monitoring strategy for assessing internal parasite burdens in cattle under 18 months of age, and they compliment good stockmanship, animal husbandry skills, combined with visual assessment and weighing.

CONCERNS FOR THE FUTURE:

☒ Survey findings: Most important parasite issues perceived by farmers:

- 51% Efficiency of the drenches
- 40% Sustainability of the systems
- 33 % drench resistance
- 16% cost of the drenches
- 19 % Need to identify ways to reduce chemical usage
- 12% Identify tactical drenching times
- 12 % Clean green image / reduced chemical or organic farming
- 4% Cost benefit of long acting drenches
- 4% Improve palatability of oral drenches
- 8% develop management systems to reduce larvae on pasture
- 4% Identify effective quarantine drench policies
- 4% More work on which worms are causing production loss

Other major concerns:

- How to farm beef profitably from beaches of Fiji
- How to drive more profit from system
- Optimum mineral levels for maximum weight gain & fertility
- Autumn ill-thrift in beef
- DM consumed to weight gain – breed variations
- Friesian bull growth rate genetics
- Profitable finishing of jersey- cross beef
- Feed requirements in relation to temperature
- Improve agents understanding and use of Breedplan

Opportunity lost:

If the issues surrounding beef intensification are not highlighted, then many beef farmers will lose valuable production opportunities simply through a lack of application of the correct ideas, appropriate drench choices and monitoring.

An increase in drench resistance in beef cattle will affect those farmers attempting to finish young stock (home bred or bought in).

It will also impact on those farmers buying weaners and trying to supply the store market.

The impact on finishing farms is possibly less dramatic at the moment, in classes of cattle over 15 months of age, but the potential is there for some low grade production losses to reduce profitability.

Recommendations to beef farmers:



Identify and implement good parasite control programmes for your farm:

- Provide high feed covers (min. 5cm post grazing) or strictly monitored drenching programmes.
- Gets timing of drenches right – faecal egg count young stock regularly
- Drench test regularly (11 – 14 days after drenching) - *"If you don't look for resistance you will not find it until it finds you!"*
- Check drenches are working – dosing technique effective?
- Quarantine drench all stock purchases – preferably with an oral combination drench.
- Monitor FEC's after drenching – especially during a drought
- Monitor after the drought breaks
- Verify whether or not drenching recommendations are free of commercial bias.
- Keep up to date with the latest in parasite control information

Benefits of improvement in farmers understanding of major internal parasite control issues:

- improved awareness of the benefits of monitoring
- realize that cheaper drenches are often more effective
- recognize impact of current drench choices on profitability
- acknowledgement of desire to reduce chemical usage

ACTION:

- Check the resistance status of cattle on your property – identify drenches that work well.
- Ascertain the resistance status of stock brought in – maybe a premium for “certified resistance free” in the future?
- Continue to monitor drench performance – weigh up the benefits of oral drenches over the ease of pour-ons and Injectables.
- Learn more about the parasite problems on your farm – and understand general and seasonal trends.
- Find out what commercial bias is behind drench sales – common thought – more expensive is best.

When planning to intensify:

- Young stock – budget for a decent head bail
- Budget for oral drenches
- Budget for monitoring
- Ascertain the status of bought in stock – premiums form those that are certified resistance free?
- Identify breeds that require lower inputs

 There are four keys to effective parasite control in young cattle.

1. Good feeding.
2. Timing of drenching.
3. Use the right products – ones that work, and check for drench resistance.
4. Use cost effective drenches – cheaper, effective products can have a huge impact in profitability over the season. But don't skimp on the endectocides when they are needed.

-
- ¹ Familton, A.S. & McAnulty, R. W. (1997). Life cycles and development of nematode parasites of ruminants. G.K Barrel (Ed) *Sustainable control of internal parasites in ruminants: Proceedings of the Animal Industries Workshop, Lincoln University, June 1997.*
- ² Bisset, S.A., Vlassof, A., Pulford, H. 1991. Rotational grazing/grazing interchange systems. *Practical aspects of internal parasite control – the Proceedings of the 21st Seminar, Sheep and Beef Cattle Society, New Zealand Veterinary Association 1991.*
- ³ Massey, Veterinary Parasitology notes for Year 4 Veterinary Students 1996.
- ⁴ Tither, P. 1999. *Economics of intensifying beef finishing systems.* Beef Intensification handouts, Technosystem field day of East Coast Beef Council 1999
- ⁵ Horgan, S. 1999. Technosystem field day 1999
- ⁶ Mabin, 1999. Oral presentation at an East Coast Beef Council Field Day held on his property, Waipukurau, 1999.
- ⁷ Cook, T. 1999. Rearing bull beef – successful enterprises have animal health programmes. *NZVET Countrypractice Issue 4 1999 p8.*
- ⁸ Niezan, J.H., Stiefel, W., Ransom, J. and MacKay, A.D. 1991. “Controlling internal parasitism on an organic sheep and beef unit.” *Practical aspects of internal parasite control – the Proceedings of the 21st Seminar, Sheep and Beef Cattle Society, New Zealand Veterinary Association 1991.*
- ⁹ Molloy, A.M. 1999. “The effect of various anthelmintic treatments on the faecal egg count of twin and single nearing ewes over lambing.” *Farmer Initiated Technology Transfer Document # 53522 File Number REO100 Meat New Zealand.*
- ¹⁰ Mackey, S. 1997. *Grass Fed Beef*. <http://www.nzmeat.co.nz/angus/a9711.htm> (accessed 3/11/99)
- ¹¹ Sykes, A.R., 1997. Effects of nematode parasitism on ruminant animal performance. “*Sustainable Control Of Internal Parasites In Ruminants*” pp82-83.
- ¹² Vlassoff, A. 1982. Biology and population dynamics of the free-living stages of gastro-intestinal nematodes of sheep. “*Internal parasites of sheep*”, a handbook produced by the Animal Industries Workshop, Lincoln College. P 16
- ¹³ Massey Veterinary Parasitology notes for Year 4 Veterinary Students 1996.
- ¹⁴ MSD Agvet, 1995. *Parasites of cattle* (2nd ed.) New Jersey: Merck & Co.
- ¹⁵ Anon 1996, 1997, 1998. Various discussions on the subject of Type 2 Ostertagiosis and its diagnosis.
- ¹⁶ Geary, T.G. et al. Frontiers in anthelmintic pharmacology. *Veterinary Parasitology 84 (1999) 275 - 295*
- ¹⁷ Pomroy, W. 1998. Parasitism in beef cattle. *An attachment to the proceedings: “Beef Production Seminar”, East Coast Beef Council, Waipukurau 30th October 1998.*
- ¹⁸ Bisset, S. A. (1994). Helminth parasites of economic importance in cattle in New Zealand. *New Zealand Journal Of Zoology, 1994, Vol.21: 9 – 22*
- ¹⁹ Barger, 1997: *Use of models in worm control.* “Sustainable Control Of Internal Parasites In Ruminants” p 206.

Beef survey results:

Number distributed: 130

Number returned: 43

Response rate: 33%

Survey purpose: *(Part of Kelloggs '99 project - A. Molloy)*

To obtain an assessment of the current cattle farming practices relevant to internal parasite control, and also to measure current farmer understanding and awareness in general of significant parasite issues.

Survey bias:

Survey targeted farmers who are already likely to have had access to quality cattle parasite information and so whose opinions represent the ideas of the upper percentile of informed NZ cattle farmers.

Beef systems surveyed:

Stud cattle	19%	
Bull beef - Friesian	51%	
Finish steers/beef bulls	42%	(uneven percentage because of multiple enterprises)
Breeding cows	23%	
Dairy grazers	49%	
Trade in store	28%	
Hobby	9%	

Farm Types & Location:

Contour:

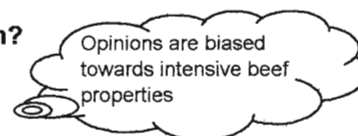
Flat	7%
Flat & Rolling Hills	52%
Mod - Steep Hills	26%
All Contours	14%

Region:

King Country	2%
Gisbourne	2%
Wairoa	7%
Napier/Hastings District	12%
Central Hawkes Bay	42%
Southern Hawkes Bay	12%
Manawatu	5%
Wairarapa	5%
Wellington	2%
North Canterbury	5%
Otago	2%
Southland	5%

Are the cattle farmed intensively, or is it an extensive system?

Intensive	49%
Extensive	23%
Semi-intensive/both	28%



Source of stock:

Home bred	28%
Bought in	30%
Both	42%

Quarantine drench given:

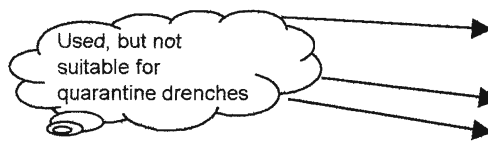
Always	47%
Sometimes	12%
Not usually (Extensive)	21%
Not usually (Intensive)	9%
No response or N/A	12%

Quarantine drench type:**Mode of administration:**

Injection	40%
Oral	36%
Pour-on	24%

Type:

Iver/abamectin	28%
N/A	17%
Not stated	13%
Combination	15%
Moxidectin	11%
Doramectin	7%
Oxfendazole	4%
Eprinomectin	4%

**Do you use oral drenches in cattle?**

Yes	74%
No	26%

Oral drench types used:

Benzimidazole	52%
Combination	35%
Levamisole	17%
Endectocide	0%

Facilities:

	Yes	No	Maybe
Does the farm have a cattle head bail?	88%	12%	
Is it able to restrain bulls over 15mths of age?	77%	8%	15%
Chin bar, or safe head holder?	47%	53%	

Have your drench programmes changed much over the years?

Yes	58%
No	21%
No response	13%
N/A (new owner)	8%

Of the yes's: More orals used	24%
Increased frequency	19%
Increased monitoring	29%
More endectocides used	14%
More pour-ons used	5%
Use Bolus	5%
New cattle policies	5%

Have you ever had cattle die of Ostertagia?

Yes	32%
No	56%
Don't know	10%
No response	2%

Frequency:

Never lost any	60%
1 in 10 years	23%
2 in 10 years	10%
3 in 10 years	5%
4 in 10 years	
5 in 10 years	5%

	Yes	No
Diagnosed by a vet?	38%	62%
Post-mortem done?	8%	92%

Other diseases with similar symptoms:
 - Metabolic diseases (milk fever/staggers)
 - Blackleg, malignant oedema, blood poisoning,
 - Plant/other poisonings
 - Foreign body penetration (wire)
 - Fighting injuries Etc.....!

What time of year did it occur?

Autumn	23%
Winter	15%
Early spring	54%
Late spring	8%

Do you follow a drench rotation programme in your cattle herd?

Yes	12%
No	76%
Sort of	5%
Poor/no response	7%

← Comment: Drench rotations are ineffective and outdated - why do so many still follow a drench rotation in their sheep flocks, when they never have for the cattle?

What do you perceive is the most important internal parasite issue for beef farming?

"Efficiency of the drenches"	51%
"Sustainability of the systems"	40%
"Drench resistance."	33%
"Cost of the drenches"	16%
"Identify ways to reduce chemical usage"	19%
"Clean, green image and how to manage worm"	12%
All of the above	7%
No response	2%

Note: Multiple answers offered - % reflects weighting of factors in decision-making process

What other beef production issues or research would you like to see more focus on?

No response	37%
-------------	-----

Of those that did respond:

Tactical drenching times	12%
Reduced chemical or organic farming	8%
How to farm profitability from Fiji beaches	8%
How to drive more profit from system	12%
Mineral levels for max weight gain & fertility	8%
Autumn ill-thrift in beef	8%
DM consumed to weight gain - breed variations	4%
Friesian bull growth rate genetics	4%
Profitable finishing of jersey X beef	4%
Feed requirements in relation to temperature	4%
Improving agents understanding and use of Breedplan	4%
Cost benefit of long acting drenches	4%
Improve palatability of oral drenches	4%
Management systems to identify/reduce larvae on pasture	8%
Identify effective quarantine drenches/policies	4%
More work on which worms are causing production loss	4%

Note: Multiple answers offered - % reflects weighting of factors in decision-making process