

Technology attributes for farm decisions – management of endoparasites

I.S. TARBOTTON, M.S. PAINE AND A. HEATH¹

AgResearch Ruakura, Private Bag 3123, Hamilton, New Zealand.

ABSTRACT

Nine regional focus group meetings were held with farmers to understand their views about endoparasite management. A software package (Decision Explorer) was used to enable participants to express their views on endoparasite management, collectively reason, debate and reach agreement on a diagrammatic model. This model summarised how participants viewed the cause and effect relationships for endoparasite management. The three areas explored in the group meetings were general management, regional differences and information gaps. Focus group findings were used to guide the development of a decision tool. An emphasis was placed on a planning approach following the farmer focus group meetings. This planning would benefit from professional service providers and parasitologists but development was guided by the farmer knowledge elicited through the workshops. Making the decision tool available in both hardcopy and electronic forms should enhance accessibility. The authors suggest there is a need to seriously consider the establishment of a National Advisory Committee for endoparasites. One possible framework for such a committee already exists in the Dairy Industry (the National Mastitis Advisory Committee). This committee would contain representatives from the appropriate disciplines and be responsible for leadership on endoparasite management.

Keywords: technology; participation; endoparasites; planning; social research.

INTRODUCTION

This study investigated the opportunity to improve the management of endoparasites in New Zealand. Although almost \$30 million is spent annually on anthelmintics to control parasites in sheep losses due to parasitism are still estimated at approximately \$270 million a year (Leathwick and Vlassoff, 1996). Endoparasite management is a very complex area of pastoral livestock farming. Farmers have no obvious “neutral information provider” following privatisation of public extension services. This creates difficulties for farmers when they make decisions about endoparasite management. Some aspects of this problem include:-

- development of parasite resistance to proprietary anthelmintic drenches (Leathwick and Vlassoff, 1996),
- concern about anthelmintic residues in animal products (Sykes *et al.*, 1992) and environmental contamination (Wall and Strong, 1987),
- integrating animal hosts with differing nematode susceptibilities, such as alternating sheep and cattle as a management option (Barger and Southcott, 1978),
- differences among herbage species in levels of nematode larvae contamination (Moss and Vlassoff, 1993),
- the option of including herbage plants which contain condensed tannins into the grazing rotation (Robertson *et al.*, 1995),
- the large production and economic implications it has for the farm enterprise,
- the proposed option of organic (or low chemical input) pastoral farming systems (Mackay *et al.*, 1998).

This list illustrates the complexity and challenges of making effective endoparasite management decisions.

This paper discusses an approach to involving end-users (farmers) in the development of an appropriate decision tool. This decision tool was still under development at the time of writing. This paper will therefore focus on the principles and needs revealed by the farmers and how these were taken into account in the development process.

An understanding of technology is central to the development of decision tools for farmers. Technology is here defined as “the hardware (e.g., drenches and machinery), methods, (e.g., husbandries and marketing) and increments in knowledge (practical and scientific) used in agricultural systems” (Farrington and Bebbington, 1993). This definition is relevant to our needs because it incorporates knowledge or learning as part of the technology and recognises the different types of knowledge: the practical that arises from farmer experiences and science-based knowledge. Technology also has a social dimension as implied in the above definition and elaborated by Paine (1997). Paine explained that this involves the way actors (individuals) align and interact to develop and use technology. Okali *et al.* (1994) advocated farmer participation in agricultural technology development from an early stage. Parker (1999), reviewing “farm monitoring in New Zealand”, came to the conclusion that the lack of widespread uptake is because the product (farm monitoring) does not address the needs of most farmers. For these reasons the understanding of farmer needs for technology is a crucial social research arena.

METHOD

During July and August 1998, focus group meetings took place with sheep and cattle farmers in nine regions of New Zealand. Existing networks and farmer groups, (such as the Sheep Council) assisted in the setting up of these voluntary meetings. Attendance rates were very high after the purpose was explained to invitees (i.e., greater than 60% of those contacted, average group size of eight farmer participants). This suggested the topic was an important topic to sheep and cattle farmers. The regions were selected on the basis of:-

- i) differences in the type of livestock farming (i.e., sheep, or sheep and cattle),
- ii) climatic differences, (broadly categorised according to warm/ cold and wet/ dry parameters),

¹ AgResearch, Wallaceville, P O Box 40 063 Upper Hutt, New Zealand.

iii) geographic spread across the country.

Management features (e.g., production systems, access to information, ethnic background etc.) were also represented across the regions (see Table 1).

TABLE 1: Location and Description of Focus Groups

Meeting Region (Location)	Climatic Zone	Descriptive Farm Feature	Management feature
Northland (Wellsford)	Warm, wet zone	High cattle: sheep ratio	Breeders
King Country (Pio Pio)	Warm wet zone	Intensive hill land	Early finishers
East Cape (Tikitiki)	Warm dry zone	Trust land	Maori
Gisborne (Wairoa)	Warm dry zone	Intensive	High vet influence
Hawkes Bay (Waipukurau)	Warm dry zone	Rolling land	Access to experts
Whanganui/ Mild Wairarapa/Manawatu (Whanganui)	wet zone	Hill country	Store systems
Canterbury (Mayfield)	Mild dry zone	Flat land, many options	Many enterprise options
Otago (Alexandra)	Cool dry zone	High Country	Extensive systems Merinos
Southland (Gore)	Cool wet zone	Intensive sheep production	No cattle/ stud sheep

The focus group meetings were designed to rapidly investigate farmer understanding of endoparasite management (i.e., about 2.5 hours operating time per group). A software package called Decision Explorer (Brightman, 1997) was projected onto a large screen and the group started with a clean sheet. The responses to questions asked of the group were added as items that were later linked to form a flow diagram of activities that formed a logical sequence. The initial question asked was “what are the activities you associate with the management of endoparasites on your farm?”. A group view was constructed by ensuring no item was added to the flow diagram until the group universally agreed on the significance and relation of the item to others in the diagram. This approach was used for each of the three aspects: general management, regional issues and information gaps. General management identified the management activities typical of the farmers in the focus group. Regional issues recorded management factors that were unique to a region and may require consideration when making recommendations for providing endoparasite information to a region. Information gaps were those topics where farmers were seeking solutions to problems but where they perceived considerable ambiguity in advice from service providers. Figures 1, 2 and 3 are examples of these findings.

Several forms of data collection were used during the focus group meetings. Transcriptions of audio recordings gave insights into farmer reasoning and the basis of debates thereby aiding with interpretation of the output from

Decision Explorer. Focus group participants completed a written questionnaire to describe the different demographics and farming systems represented in the groups. A summary of outcomes from the focus group meetings were sent to all participating farmers. This included a two-page summary of key points that compared results across regions.

RESULTS

The most frequently used and valued information source for making decisions about endoparasites is vet comments on analyses (see Table 2). Farmers make regular reference to this information source through the year. Other important sources of information include farming magazines and notes from discussion groups. This finding on information sources is consistent with results on information networks (i.e., important personal contacts) in relation to decision making (see Table 3). Veterinarians were the personal contact farmers used most frequently. These sources of information and networks of personal contacts provided a range of products and services but primarily were seen as a source of advice for endoparasite management (see Table 4).

TABLE 2: Information sources

Sources of information	% of replies who use	Average score for usefulness 1 = essential 5 = general	Average no. times used per year
Vet comments on analyses	82	2	5
Farming magazines	79	3	13
Notes from discussion groups	69	3	3
Booklets	63	3	3
Product technical info.	60	3	2
Videos	56	3	2
Newspaper	53	3	83
Conferences	37	3	1
Radio / TV	35	4	82
Internet	10	4	10

TABLE 3: Information networks

Key contacts	% of contact people providing information	Average number times contacted (per year)
Vets	56	6
Farmers	11	7
Discussion Groups (farm, monitor, etc)	11	6
Researchers (scientists, technicians)	5	3
Sales reps / drug companies	5	3
Consultants / farm advisors	5	6
Other	3	5

TABLE 4: Products and services provided by information source and network

Services & Products	% of people
Advice / information	73
Analysis (FEC etc)	13
Products	12
Monitor farm trial	1
Rams with worm resistance	1

A range of goals relevant to the development of decision tool were identified during the focus groups. These varied across regions and in level of detail. A summary of these goal statements is provided in Table 5. A characteristic feature across regions was the need for endoparasite management to achieve improved stock performance - in particular higher lamb liveweight gains and early sale of lambs.

TABLE 5: Goals of Regional Focus Groups

Region	Goals
Northland	Seeking best liveweight gains
King Country	High lambing % and high growth rate with no drenching
TikiTiki	Healthy sheep and lambs at least cost / labour
Wairoa	Maximum productivity of animal with minimal drenching
Hawkes Bay	Maximising GR of lambs / ewe performance
Whanganui	Early disposal of lambs. Reducing costs / significant expense
Canterbury	Profitable sustainable farming with quick finishing of lambs
Central Otago	Minimising the effect of worms on the dollar value of stock
Southland	Farmers to understand the effect of the products we are using and our management on the development of resistance

Comparative analysis of information gaps identified that the impact of boluses on drench family resistance was a common question to all groups (see Table 6). Many groups were also concerned about the ambiguity in advice provided on the appropriateness of dosing ewes with anthelmintic, and how effective the rotation of drench families is on delaying the development of resistant strains. Information gaps were also related to the breeding of flocks with high tolerance to worm burdens, and more detailed advice on alternatives to drenching.

More specific information was gathered from the flow diagrams on a region by region basis. The following example will outline how this more specific information will contribute to the development of a decision tool for farmers (see discussion below). The flow diagrams in Figures 1 and 2 represent a goal as an oval shape, strategies as square corner boxes and activities as round cornered boxes. Activities are linked in time or causal sequence and represented by the use of arrows.

The Flow diagram in Figure 1 identifies best liveweight gains as the overall goal for the group. Three strategies to achieve this goal included monitoring faecal egg counts, minimising drenching and developing a programme with the vet. A large number of activities are required to realise these strategies in practice. Activities are often interdependent or related in some way. The arrows indicate the linkage and sequencing of activities.

TABLE 6: Information Gaps of Regional Focus Groups

Region	Information gaps
All	<ul style="list-style-type: none"> impact of boluses (or injections) on drench family resistance
Most	<ul style="list-style-type: none"> dosing of ewes with anthelmintic (from oral drench or bolus) what alternatives to drenching are being researched (e.g., biological control) is it effective to rotate drench families is it worthwhile to breed stock for worm tolerance
Northland	<ul style="list-style-type: none"> threshold levels to drench lambs treatment of meat lambs versus replacements do combination drenches speed up resistance should we drench for tapeworms?
King Country	<ul style="list-style-type: none"> how to more effectively target weak points in the parasite lifecycle
Tikitiki	<ul style="list-style-type: none"> lack of region specific information how to make better use of local knowledge in groups
Wairoa	<ul style="list-style-type: none"> what are the limits to farming in this area? Is a worm population resistant forever? who to believe – what is reliable knowledge? are goats an impediment to endoparasite management?
Wanganui	<ul style="list-style-type: none"> what effect do parasites have on pregnancy rates how widespread is white drench resistance what management systems yield cleaner pastures
Hawkes Bay	<ul style="list-style-type: none"> how to use white drenches on resistant farms conflicting information on farming/technical recommendations
Canterbury	<ul style="list-style-type: none"> does winter cold reduce pasture worm levels? commercial trial results controlled to enhance sales of animal remedies lack of specialists on topics of internal parasites/trace elements
Central Otago	<ul style="list-style-type: none"> best method for monitoring internal parasites, blood tests versus FEC measuring pasture to know worm no., spraying the pasture to kill worms present droughts affect on worm no. and cold temperatures affect worms deer/sheep interaction of internal parasites
Southland	<ul style="list-style-type: none"> which computer model do you use to decide what to use and when better use of DNA mapping, blood testing for breeding decisions effect of chemicals on immune system of host and non target organisms

The flow diagram in Figure 2 (regional issues) describes the overall goal: as many heavy lambs as early as possible. Strategies include pushing ewe body weight over the summer, visual appraisal of stock and weighing of stock. Some other examples of regional issues include longer worm seasons resulting from mild winters, a higher cattle to sheep ratio and *Haemonchus* increasing with the first period of wet weather following an extended dry weather period.

FIGURE 1: Decision Explorer diagram for Endoparasite General Management (Warm wet zone)

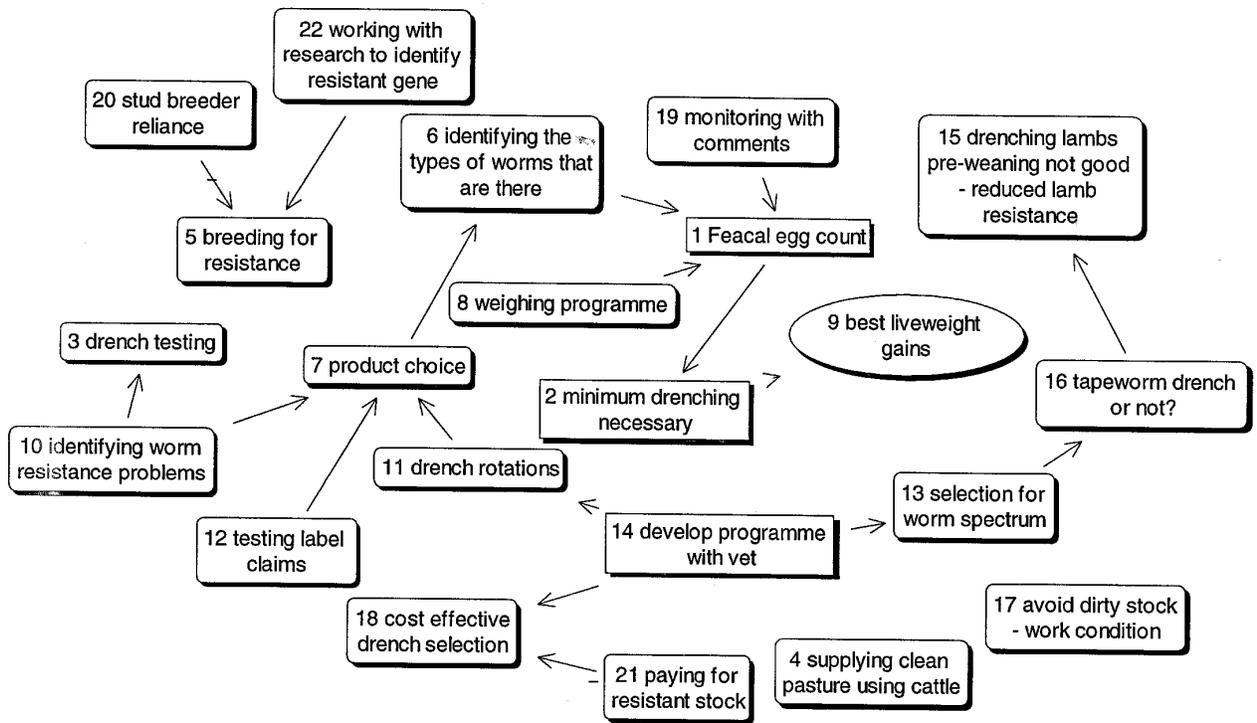
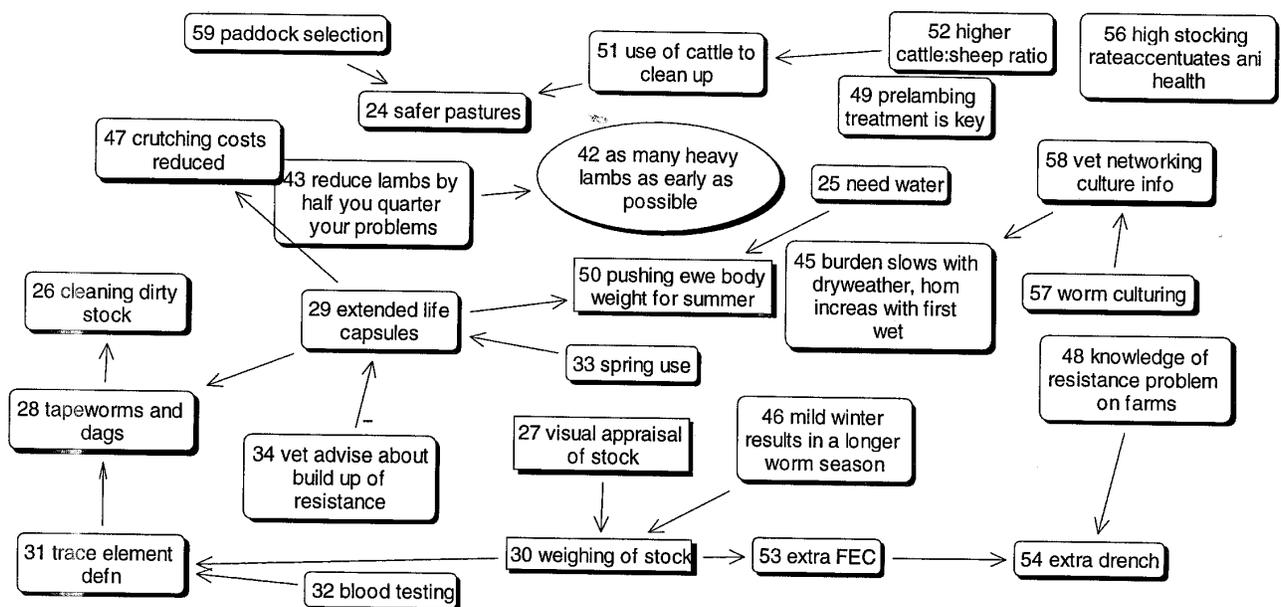


FIGURE 2: Decision Explorer picture for Endoparasite Regional Issues (Warm wet zone)



DISCUSSION

Science findings are not often in a form which are amenable to direct uptake by farmers. An appreciation of the farmers world view (Parker, 1999) is necessary to understand the needs of farmers. In this endoparasite project a process was used to account for farmers views, knowledge and needs in the design process. The practicalities of doing this can be daunting but with robust planning and the use of appropriate tools like Decision Explorer, useful insights are attainable. In this case, participants also benefited from comprehensive discussions on the topic. The challenge was how to incorporate these findings into a decision tool for farmers. Some of these challenges are explained in this section.

The farmers desired to plan the management of endoparasites but they explain that their primary mode of operation is more one of trouble-shooting. In Figure 1 the development of a programme with the vet refers to this desire for forward planning or having a programme for endoparasite management. This planning approach is consistent with the moves in the agricultural industry toward product traceability and quality assurance (QA). Therefore, the decision tool needs to be developed so it enables and encourages planning to be undertaken. A decision tool that enabled effective planning would therefore diminish the stress and risks to poor animal performance arising from trouble-shooting.

A planning approach has implications for the way information is used in the decision making process. Planning is a process (i.e., a way of performing the management action) rather than treating information as a prescription or a final solution. A planning process approach to information considers situational and seasonal variables when managing endoparasites. Farmers want to have access to third party support when they develop their plans. The decision tool will need to be designed to facilitate participatory approaches to decision making and enable farmers and service providers to incorporate unique farming situational variables into the decision making process. Examples of these variables include pasture species, stock policies and resistance problems. There was a fear that anthelmintic resistance would reduce the options available to farmers. This had led to the need for a longer planning time frame. Farmers emphasised the need for long term benefits rather than focusing on a short-term gain (e.g., this season). This time dimension to decision making will have to be assessed in relation to the financial performance of sheep and cattle enterprises.

Distinct differences were revealed between the regions. These differences will require a planning approach that is robust across regions and farming systems. The authors came to the realisation that there are three levels of information support to farmers managing endoparasites:

National - those technical facts or principles which apply across the whole country

Regional- the information that applies to a region with particular climatic and farm system features. Some of this information will apply to multiple regions.

Individual farm- the information tailored to a particular farm with its own system, history, scale and management.

The provision of a decision tool to support planning

needs to be complemented with research that is generating answers to some of the information gaps regularly identified during the meetings. Answers to some of these questions may influence how planning is undertaken and alternative strategies evaluated. Examples would include:-

-will the use of slow release anthelmintic products (boluses) increase the rate of drench resistance?

-is breeding for tolerance to endoparasites possible and how would one go about doing this?

The next stage in this study involves parasitologists who are using the farmer based endoparasite management perspectives, together with information gathered from veterinarians to develop a decision tool that will use a decision tree structure to assist endoparasite management for a 12-month planning period. Farmer generated flow diagrams from Decision Explorer are providing the basis for guiding the organisation of scientific information. The resultant decision tool will be assessed by farmers and modified following their feedback before being offered to a wider farming population through Meat New Zealand.

Access to technical databases via a decision tree structure will allow rapid access to the information gaps repeatedly stated by the groups, where this information is known.

In planning the focus groups and during other parts of the study vets input was also gained. Vets expressed that they would like a decision tool that assisted with planning endoparasite management on a seasonal cycle. Some vets are seeking a decision tool that will assist them to give advice that farmers see as independent from any sales activities related to animal remedy products. A forward planning approach which has a medium to long term focus would help to make the purpose of any purchase decisions clear because the attributes of the product would need to be made explicit in terms of contribution to the overall plan. Vets also discussed the benefits of farmers monitoring (e.g., lamb live weights) to help to objectively measure changes in performance and make changes to the original plan. A planning approach to decision making could provide the basis for integrating monitoring with control strategies.

LEARNING FROM OTHER SECTORS

The need for an agreed position on mastitis management among the professional service providers was one of the initiatives claimed to have assisted was the establishment of the National Mastitis Advisory Committee (NMAC) in 1991 (Paine, 1997). The role of this committee was to co-ordinate the various disciplines in managing mastitis. A Livestock Improvement Corporation secretariat was appointed as a co-ordinating interface while membership included farmers, veterinarians, consulting officers, regulatory authorities and testing laboratories. Service providers represent their respective professions in the NMAC and feedback to the committee how their organisations and disciplines are coping with mastitis problems. The committee then establishes the guidelines that the various professions follow next season. Endoparasite management in the meat sector would lend itself to this approach. It is an economically significant problem to meat producers and there are opportunities to improve the alignment among the numerous professional

service providers. A study should be commissioned to evaluate whether a national advisory committee is a viable option for endoparasite management. The task would be to determine whether it would be feasible for a neutral body to oversee and co-ordinate management guidelines on a seasonal basis. Information written or approved by this committee should contribute to a more coordinated approach across organisations and disciplines. They could also serve as a monitoring body for the industry. Leathwick and Vlassoff (1996) have stated that “the challenge being to implement change before the resistance problem becomes unmanageable”. We question how this challenge will be addressed without national coordination and leadership? A National Endoparasite Advisory Committee (NEAC) that is supported by the key organisations and disciplines could provide such leadership.

SUMMARY

Involving farmers in the development of a decision tool improves the likelihood of delivering to farmers’ needs. Prior to the focus group meetings a key direction of the programme was to produce a manual so farmers could understand the biology of parasitic nematodes. This was a scientific approach suggesting exhaustive understanding of the information is necessary for effective management outcomes. Following the exploratory focus group meetings the whole emphasis was changed to one of supporting the forward planning of endoparasite management.

A decision tool will be produced which is designed to encourage a planned approach to endoparasite management. A key feature will be a decision tree that embodies a sequence of questions arranged in a way to promote effective diagnostic analyses and information searching routines as part of a process to develop management plans. Two farmer groups, along with a sample of vets will evaluate the tool prior to its release to a wider population of service providers and farmers.

ACKNOWLEDGEMENTS

The authors would like to thank the farmers involved in the focus group meetings and fellow researchers Greg Lambert, Gavin Sheath and Annie Perkins for their valued input into this work.

Funding for the project was kindly provided by Meat New Zealand.

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