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Survey of parasite control practices in sheep and cattle

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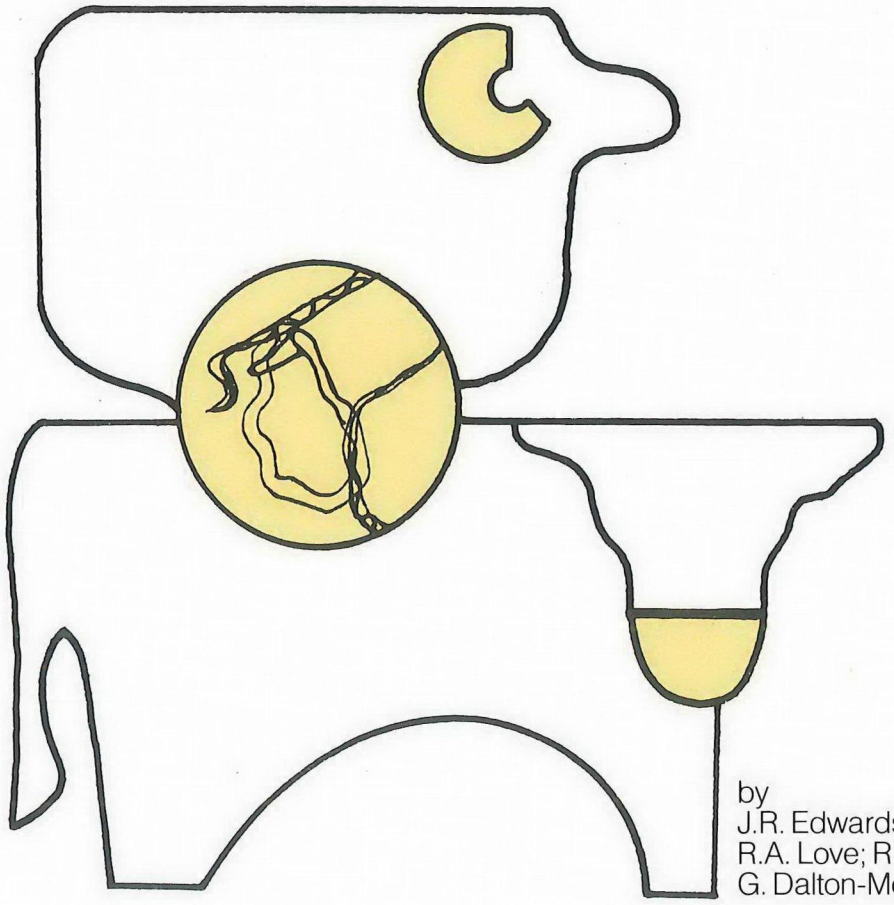

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Summary

Farms in the Albany, Esperance, Jerramungup and Katanning districts were surveyed to determine parasite control strategies currently used, to evaluate the adoption of recommended control practices and to detect areas of ineffective parasite control.

In July 1981, 800 farmers were contacted by mail. The questions asked related to control of worms in cattle and sheep and blowfly strike in sheep. Some 73% of the farmers contacted replied to the survey.

For cattle, the number of drenches given in the low rainfall zone was higher than the number given in the high rainfall zone. The mean number of drenches given to yearling cattle was only slightly greater than for other types of cattle and the use of autumn drenching for control of worms in this age group was poorly adopted.

Although the mean number of drenches given per year was similar to current recommendations for control of worms in sheep, the timing of these drenches was not. The use of two drenches in 'summer' as the basis for a worm control programme had been widely promoted, but had been adopted by only 50% of farmers for ewes, 61% for weaners and 30% for wethers. Those farmers who had not given two drenches in 'summer' gave responses suggesting they did not believe in or did not understand the philosophy behind this strategy.

For the control of blowfly strike in sheep, most farmers used the Mules operation and docked tails at the recommended length. However, the "V" Mules was poorly adopted (27.5%) particularly in the Albany and Katanning districts. It was found that contractors were used to mules sheep on only 53.4% of properties. An extension campaign carried out in 1980, and aimed at mulesing contractors, may have missed the significant number of farmers who mulesed their own sheep. Jetting was mainly used by farmers in the higher rainfall zones.

The main finding arising from this survey was that significant differences existed between district recommendations and current practices for each aspect of parasite control. This revealed areas in which future research and extension could be undertaken to improve the control of parasites.

There is a need to promote worm control programmes for cattle in each rainfall zone with particular emphasis on yearlings and the use of an autumn drenching programme. The autumn drenching strategy needs to be tested in field trials in the survey area.

Likewise, there is a need to test that the use of two 'summer' drenches, as the basis of a worm control programme, is necessary in all areas for all classes of sheep. A change is needed in the extension programme of the two 'summer' drench concept. There is a need to understand why there is resistance by farmers to this strategy so that an effective extension campaign can be implemented.

The programme for extension of the "V" Mules operation needs re-direction to ensure that farmers, including those who mules their own sheep, are aware of the technique.

Note: In this survey, the term 'summer' refers to the months of November to March inclusive. The official seasons are:

Summer—December, January, February.

Autumn—March, April, May.

Winter—June, July, August.

Spring—September, October, November.

Contents

Abstract

Questionnaires were sent by mail to 800 randomly selected owners of registered stock brands from the southern area of Western Australia in July 1981. Seventy-three per cent of farmers returned questionnaires. The rate of response was greatest in the Katanning district followed by the Albany and Esperance districts. Flock and herd sizes of farms in the survey population were representative of farms in the area.

Half the farmers only had sheep; 14% only had beef cattle and 36% had both sheep and beef cattle. The average area of farms was 1,297 ha and the average length of time the owner had been farming the property was 18.9 years. The average number of labour units available per farm was classified as self (0.87); family (0.67), and hired labour (0.38). The total amounted to 1.92 units of labour. Contractors were rarely used by farmers for activities such as jetting (3% of farmers), drenching sheep (3.5%), or drenching cattle (3.2%), but were used more often for shearing (87.4%); crutching (63.7%), and the Mules operation (53.4%).

Most farmers did not set stock any class of sheep or cattle. Wethers were set stocked to a greater extent than ewes and weaners. Most farmers used cereal stubbles to graze weaners (74%), ewes (70%) and wethers (52%). Only 20% of respondents had no cereal stubbles.

The main beef cattle activity was selling baby beef at weaning with the sale of yearlings as the most important secondary activity. Mating commenced on most properties between May and July with a peak in June. Bulls were left with the cows all the year on 17% of farms.

Half the respondents treated all cattle as part of a routine worming programme and this was most common in smaller herds. About half the farmers treated calves at weaning and this occurred most frequently in the Katanning district followed by Esperance and Albany.

Contrary to expectation, drenching intensity was highest in the low rainfall Shires. Intensity was highest in the Katanning district followed by Albany and Esperance. The average number of drenches given to steers and heifers to be sold (1.0) was greater than the number given to replacement heifers (0.9), adult cows (0.7), steers (0.7) and calves (0.6). Most farmers gave no drenches to yearling cattle during autumn and most of the remainder gave only one drench.

The main drenches used were Systamex ® (22%); Panacur® (21%); Nilverm ® (17%); Valbazen ® (14%); Ripercol® (9%); Rintal ® (6%) and Thibenzole ® (6%). the new benzimidazole group were used most (63%), followed by the levamisole (26%) and old benzimidazole groups (9%).

The adoption of the new benzimidazole groups by cattle producers was lower than expected.

An estimated 236,600 worm control treatments were given to cattle in this area during 1980/81 costing $181,000, including labour.

Further research to develop effective worm control programmes for cattle and extension of information on the importance of internal parasites in yearling cattle is needed.

Wool production was the main sheep activity on 95% of farms. Fat lambs are the most frequent secondary activity in the Albany district (67%) while wethers for export were most frequent in Esperance (62%) and Katanning (48%). Merinos were the major breed. Ninety-two per cent of all ewes in the survey area were Merinos as were 80% of all rams.

Mating commenced on most farms between October and February with a peak in November and December. Mating commenced earliest in the Esperance district followed by Katanning and Albany. Mating commenced earliest for large wool producing flocks in the lower rainfall areas. Shearing followed a similar trend. Shearing was done each month of the year, but there was a peak in August, September and October.

The same paddocks were used for lambing each year to a greater extent on the smaller farms in the higher rainfall area where little cropping was done.

The mean number of drenches given to ewes (3.41 $\pm$ 0.11), lambs (3.70 $\pm$ 0.15), weaners (3.77 $\pm$ 0.21) and wethers (2.39 $\pm$ 0.11) was highest in the higher rainfall area of

Albany followed by Esperance and Katanning. There was a wide range of frequency of drenching within districts. The percentage of farmers who had not given at least two drenches in 'summer' was: 50% for ewes, 48% for lambs, 39% for weaners and 70% for wethers. Of those who did not give at least two drenches in 'summer', three-quarters did not believe in the value of, or did not understand the philosophy behind, this strategy.

The drenches most used were Nilverm ® (18%); Thibenzole ® (18%); Ripercol ® (16%); Systamex ® (13%); Panacur ® (9%); Valbazen ® (8%); Rintal ® (6%) and Synanthic ® (5%).

Of the drenches used, 61.5% were of the benzimidazole group and 37% were of the levamisole group. Narrow spectrum drenches were rarely used (2%). About half the farmers alternated drenches on a regular or irregular basis.

During 1980/81 an estimated 34.7 million worm control treatments were given to sheep in the survey area at a cost of $3.6m.

There is a need for further research to define effective worm control strategies in sheep and to confirm the value of two 'summer' drenches for all parts of the area. The importance of worm control in weaner sheep and drenching in 'summer' still requires extension inputs.

Some 71% of farmers considered that blowfly strike would be a major problem if they took no preventive action, and this perception varied between districts and climatic areas. Body strike was considered to be of equal or of more importance than breech strike on 55% of properties with the percentage of farmers of this opinion being lower in the low rainfall inland Shires.

The Mules operation was widely adopted. Of the farmers with Merino sheep, 87% mulesed all or some of their lambs. Of those who did not use the Mules operation most had acceptable reasons for not doing so. The majority of lambs (84%) were mulesed at lamb marking.

The currently recommended 'V' Mules operation was poorly adopted with only 27% of farmers using this method to control blowfly strike. A conventional radical Mules operation was used by half the respondents. The use of contractors for mulesing was lower (53%) than expected. Contractors were used more in the Esperance district (72%) and less in Albany (51%) and Katanning (49%). An extension campaign carried out in 1980, aimed at mulesing contractors, may have missed the significant number of farmers who mules their own sheep.

Over three-quarters of respondents dock lamb's tails at a length level with the tip of the vulva or the equivalent in wethers.

The majority of farmers did not jet ewes (69%); lambs (74%); weaners (74%) or wethers (81%). The frequency of jetting was highest in the Albany district followed by Esperance and Katanning which reflects the greater importance of body strike in the coastal districts. Although jetting was done in all months of the year except July, there was a peak of jetting between September and November. Jetting was least used in flocks mated before June.

Jetting races were used on 29% of properties. These were usually farms with large numbers of sheep. Hand wands were used for jetting on 63% of properties. Some 27% of farmers used Lucijet ® insecticide for jetting; 26% Vetrazin ® ; 13% Dipjet ®, 11% Diazadip ® ; 9% Suprex ® 100; 6% Dizon ® while 8% did not specify insecticides use. The use of these chemicals varied significantly between Shires, but there was no trend between climatic areas, which suggests differences in sales promotion between Shires.

Sheep were crutched at least once a year on most farms. Ewes were crutched most frequently at 1.11 times/year, followed by wethers (0.96); weaners (0.92) and rams (0.87).

The estimated cost of blowfly control for the area in 1980/81 was $3.5m which is about 35 cents per sheep.

Introduction

In the South-West Province of Western Australia significant economic losses are caused by blowfly strike in sheep (Murray and Wilkinson, 1980) and internal parasites in sheep (G. C. de Chaneet, J. R. Edwards and F. C. Wilkinson, unpublished data) and cattle (G. C. de Chaneet *et al.*, 1982).

Surveys in western Victoria (Morley *et al.*, 1979; F.H.W. Morley *et al.*, 1980, unpublished data) have shown that parasite control programmes on many farms differ significantly from current recommendations. No major surveys of control of internal parasites of cattle and sheep were done in this State before this survey.

The Bureau of Agricultural Economics (Brideoake, 1979) surveyed costs of mulesing, jetting and crutching in 1975/76 and between 1975-77 Murray and Wilkinson (1980) studied blowfly strike on 71 selected properties in the south-west of Western Australia. A survey to investigate both economic and technical aspects of blowfly control using a randomly selected number of farms in the south coastal area of Western Australia has not been done.

Since 1981, changes in the direction of the research effort in the south coast area centred around the Albany, Esperance and Katanning Advisory Districts, has resulted in an expanded parasitological research and extension programme. Evaluation of current extension programmes and a baseline for evaluating progress in future research and extension activities are required.

In the past, strategies for the control of internal parasites in cattle have been extended passively or 'on demand'. Since 1981 there has been some promotion of autumn drenching strategies (de Chaneet *et al.*, 1982) for the control of worms in yearling cattle.

Worm control strategies for sheep based on the concept of two 'summer' drenches (Anderson *et al.*, 1976) have been promoted since 1975 (G. C. de Chaneet, personal communication). Progress with this extension objective requires evaluation.

Populations of nematodes of sheep which are resistant to anthelmintics have been found in Western Australia (Edwards and de Chaneet, 1980) and are widespread (Edwards *et al.*, 1985).

Currently practised worm control programmes are likely to be contributing to the development of anthelmintic resistance. Knowledge of current practices is required for planning extension programmes aimed at delaying the development of resistance.

Use of the Mules operation has been an extension objective since the 1960s (Gherardi, 1977). However, since 1979 a 'V' modification of the radical Mules operation has been advocated as the most suitable method to control breech strike while reducing the risk of ovine squamous cell carcinoma (Gherardi *et al.*, 1980). This technique has been mainly introduced to mulesing contractors.

The aim of the survey was to record parasite control strategies currently practised in the south coastal area; evaluate the adoption of currently recommended practices and detect areas of ineffective parasite control. This information will aid in determining research and extension objectives.

Materials and methods

Questionnaires were mailed to 800 randomly selected owners of registered brands from the southern area of Western Australia in July, 1981 (figure 1). The sample was stratified by Shire and selected from the Brands Register of the Department of Agriculture. The survey area was divided into three districts based, in the main, on the Department of Agriculture Advisory Districts. Shires within these survey districts were

- Albany district: Shires of Albany; Denmark; Plantagenet; Cranbrook and the Walpole area of the Manjimup Shire.
- Esperance district: Shires of Esperance and Ravensthorpe.
- Katanning district: Shires of Tambellup; Broomehill; Kojonup; Woodanilling; Wagin; Katanning and Kent. For convenience, the Gnowangerup Shire was included in the Katanning district even though parts of this Shire are within the Advisory Districts of Albany and Esperance. This was because veterinary advice in the Gnowangerup Shire is mainly provided by the Katanning District Office.

There were 4,927 registered brand owners within these survey districts. All owners of livestock, including sheep, cattle, horses, pigs and goats are required to register a brand and so the list of brand owners included persons who did not own either sheep or beef cattle.

The survey area was also divided into climatic (rainfall) zones (figure 2).

- Coastal zone: high rainfall—Shires of Albany, Denmark and the Walpole area of the Manjimup Shire.
- Plantagenet zone: intermediate rainfall—Shire of Plantagenet.
- Moderate rainfall zone: Shires of Cranbrook, Kojonup, Tambellup and Woodanilling.
- Low rainfall zone: Shires of Broomehill, Gnowangerup, Katanning, Kent, Lake Grace and Wagin.
- South-east zone: Shires of Esperance and Ravensthorpe.

The survey districts thus comprised one or more climatic zones.

The questionnaire contained 36 questions, most of which were of the closed multiple choice type. Other questions required numbers or a cross to indicate in which month of the year a procedure was performed (appendix A). Questionnaires were sent to five farmers in each of the three districts for testing before the final version was completed.

The questionnaire was accompanied by an explanatory letter (appendix B) and a stamped return addressed envelope. After four weeks, a reminder letter (appendix C) with a questionnaire and stamped return addressed envelope was sent to non-respondents.

Replies from respondents with $>$ 200 sheep or $>$ 30 cattle were coded for analysis using the statistical package for the social sciences (SPSS) computer package (Nie *et al.*, 1975). Where more than one answer was required for a multiple choice question the 'Mult Response' control card was used. The 'frequencies', 'breakdown' and 'crosstab' control cards were also used. All variables were cross tabulated against the following: Shire; district; rainfall zone; stocking policy (both sheep and cattle or sheep only); total number of sheep and cattle; area; cleared area; area cropped; length of time on the farm and labour available. Only those tables with significant associations, or thought to be of immediate relevance, are presented in the results. Information not presented can be obtained from the authors.

Tables were analysed using χ^2 tests. Components of tables were combined to ensure expected values of at least 1 in all cells. Tables were further reduced where comparisons were planned before examination of the data. Where possible, all percentage figures within the tables have been rounded to the nearest first decimal point.

Note: In this survey, the term 'summer' refers to the months of November to March inclusive. The official seasons are:

Summer—December, January, February.

Autumn—March, April, May.

Winter—June, July, August

Spring—September, October, November.

Figure 1. Survey districts – Albany, Esperance, Katanning. Based mainly on Department of Agriculture Advisory Districts. Shires within the survey districts illustrated.

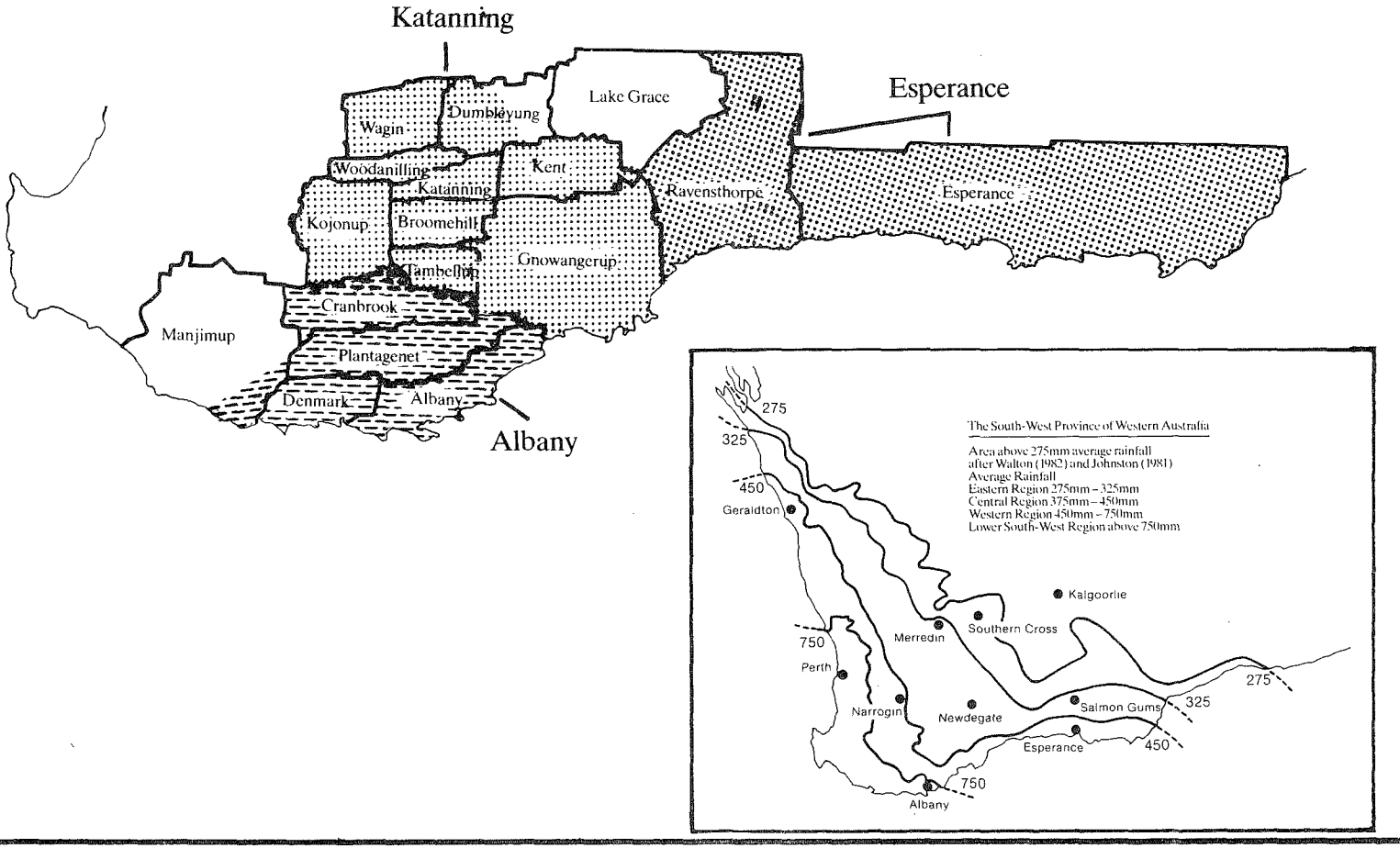
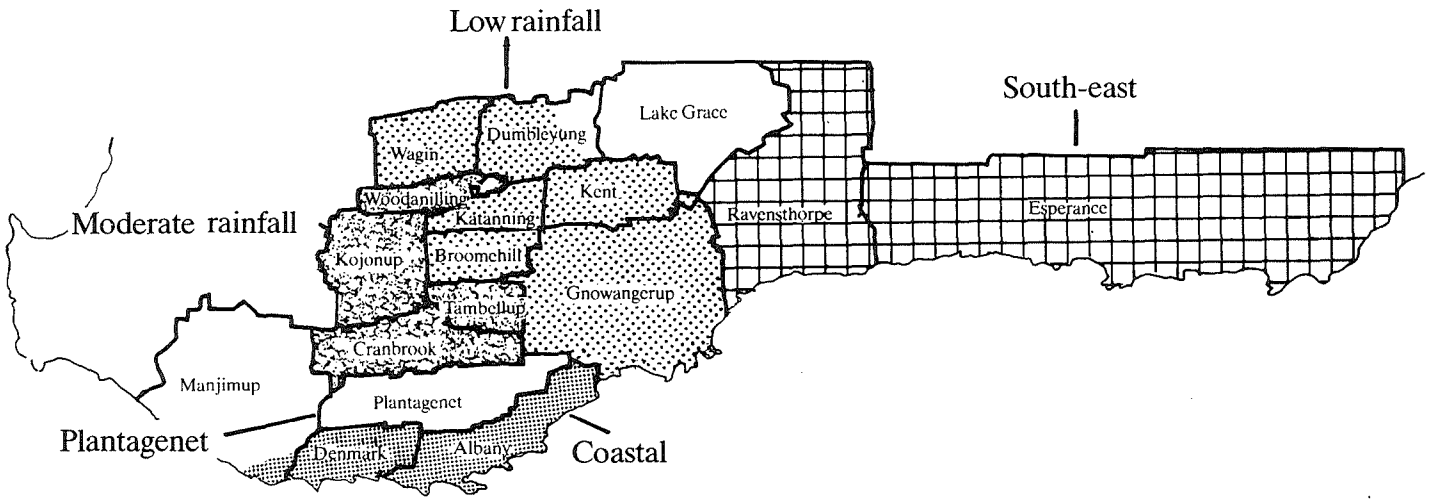


Figure 2. Climatic zones. Coastal – high rainfall; Plantagenet – intermediate rainfall; Moderate rainfall; Low rainfall; South-east. Shires within the climatic zones illustrated.



Results and discussion

Usable replies were received from 463 (58%) of farmers. The total return of questionnaires was 81%. The main reasons for replies being unusable were:—

- returned unclaimed from the post office—8%;
- no sheep or beef cattle—9%;
- insufficient sheep or beef cattle or questionnaire not completed—6%.

No information was received from 19% of the farmers surveyed.

The rate of usable response differed ($P<0.001$) between the Katanning (66%); Esperance (47%) and Albany (56%) districts (appendix 1). There were large differences between Shires within districts ($P<0.001$). Usable responses varied from 45% in Denmark/Walpole and 70% in Cranbrook in the Albany district to from 56% in Kent and 88% in Wagin in the Katanning district.

The distributions of total cattle (appendix 2) and sheep numbers (appendix 3) in the survey population were not statistically different from the distributions provided by the Australian Bureau of Statistics. However, there was a slight tendency for farmers in the survey population to have larger numbers of sheep and cattle.

1. Farm profile

Two hundred and thirty farmers (50%) only had sheep, 167 (36%) had sheep and cattle and 66 (14%) only had cattle. Appendix 4 shows significant differences between districts.

The distribution of total area, cleared area and area cropped is shown in appendix 5. The average area was 1,297 ha (range 11-13,072); cleared area was 1,102 ha (range 0-10,000 ha); and cropped area was 288 ha (range 0-4,822 ha).

The average length of time the owner farmed the main property was 19 years and the distribution is shown in appendix 6. Almost one-third (32%) of farmers had been farming their main property for less than 10 years.

The average units of labour available per farm were: self (0.87), family (0.67) and hired labour (0.38) which totalled 1.92 units (appendix 7). A unit of labour is the equivalent of one full-time person employed.

Farmers rarely used contractors for activities such as jetting (3%), drenching sheep (4%) and drenching cattle (3%), but they were used to a greater extent for shearing (87%), crutching (64%) and the Mules operation (44%) (appendix 8). This figure for the Mules operation includes those farmers who did not mules and is misleading. Correcting, by including only those people who mulesed sheep, shows that 60% used contractors. Appendix 9 shows that most respondents who had both sheep and beef cattle grazed sheep and cattle on the same paddocks (85%). A surprisingly high proportion (60%) reported grazing sheep and cattle together on the same paddock. Previous experience with an interview questionnaire and a similar question (unpublished data) show that many farmers would have answered that they did graze sheep and cattle together. This was because they had at some time grazed sheep and cattle together, although it is not their normal strategy. This suggests that 60% of the respondents had grazed sheep and cattle together at some time.

Grazing strategy.

Q. Do you set stock (the same mob or flock grazing the same paddock throughout the year) the following classes of cattle and sheep? (See appendix A for details of questions)

Most farmers did not set stock any class of sheep or cattle (see appendix 10). On 37% of farms at least some mobs of cows were set stocked, while steers and heifers to be sold (30%) and replacement heifers (29%) were set stocked on a lower proportion of farms. In sheep flocks, wethers were set stocked more often than ewes and weaners (appendix 11).

The proportion of farmers that set stocked ewes ($P < 0.01$), weaners ($P < 0.01$) and wethers ($P < 0.05$) was highest in the Albany, followed by the Katanning and Esperance districts.

Use of cereal stubbles

Q. Do you use cereal stubbles to graze the following classes of sheep?

Most farmers used cereal stubbles to graze weaners (74%), ewes (70%) and wethers (52%) as shown in appendix 12. About 20% of respondents had no cereal stubble.

Use of management strategies in worm control.

Resistance of sheep worms to anthelmintics is widespread in this area (Edwards *et al*, 1985) and has resulted from dependence on drugs in worm control programmes. Alternative strategies are required to reduce reliance on anthelmintics and to prolong the effective life of currently available chemicals.

Programmes can be developed around such strategies as sheep-cattle interchanges (Barger and Southcott, 1975), grazing management and the use of cereal stubbles. Many farmers have sold their cattle since 1980 resulting in only 36% of farmers who were able to use strategies incorporating sheep and cattle. Most farmers had grazed cattle and sheep on the same pastures at the same time or following each other. Provided suitable grazing strategies can be devised, farmers with sheep and cattle are likely to use drenching strategies combining sheep-cattle interchanges.

Set stocking was rarely practised. Results from set stocking experiments may not be directly applied on the majority of farms. However, most farmers use some form of rotation. The availability of 'clean' paddocks for use in worm control will depend on the speed of rotations and the stocking pressure.

In cropping districts, cereal stubbles were widely used, particularly for weaners. Thus, grazing of stubbles can be readily incorporated into 'summer' drenching programmes.

2. Beef cattle

Beef activity

Q. Please describe your beef activity e.g. selling baby beef at weaning, stud breeder, feedlotting etc

Selling baby beef at weaning was listed as the main activity by the majority (71%) of cattle owners (appendix 13). Selling steers and heifers less than 2 years old was the most important secondary activity (43%) which probably represents a carryover of calves which were not sold as baby beef. Appendix 14 shows that selling baby beef at weaning was the most important activity in the Albany district (77%) while in the Katanning district there was a higher proportion of studs (17%) and feedlot activity (7%) than in other districts. In Esperance, steers and heifers for sale at less than 2 years (21%) and steers older than 2 years (11%) were more important than in other districts. These differences between districts were statistically significant ($P < 0.05$).

Cattle numbers

Q. What was the number of stock on your property on 31st March 1981 and the number of stock sold in the 12 months prior to that date?

The distribution of numbers of each class of cattle and the number of cattle sold in the previous 12 months is shown in appendix 15.

Month when mating commenced

Q. Indicate the month when mating commences

Mating commenced on most properties between May and July with a peak in June (appendix 16). The bulls were left with the cows all the year round on 17% of farms.

Appendix 17 shows that although mating tended to be latest in the Esperance district followed by Katanning and Albany these differences were not statistically significant ($P = 0.12$). More farmers in Katanning mated cows all the year round (25%) than Esperance (21%) and Albany (13%).

Seventy-eight per cent of herds which were mated all the year round had a herd size of less than 150 compared with 57% of herds with specific mating periods (appendix 18). Early mating (February to March) herds were less common among herds of 50-149 cattle than among herds of 150-299.

Approach to drenching cattle

Q. When you drenched did you treat?

- *All cattle as part of a routine worming programme*
- *Some cattle on a routine programme*
- *Only mobs with cattle showing signs of worms*
- *Only cattle showing signs of worms*
- *Other—specify*
- *Don't know*
- *Not applicable*

Just over half of the respondents treated all cattle as part of a routine worming programme and a further 11% treated some cattle on a routine programme (appendix 19). The strategy adopted was related to the number of cattle owned ($P < 0.05$) as shown in appendix 20. A greater proportion of the owners of smaller herds (< 150 cattle) drenched all cattle as part of a routine programme, than did the owners of larger herds.

Drenching of cattle is a difficult and time consuming procedure and so farmers may be reluctant to drench large numbers of cattle.

Drench at weaning

Q. Did you drench calves at weaning?

About half (51%) of the farmers gave all or some calves a drench at weaning (appendix 21). More Katanning district farmers (63%) drenched all calves at weaning than those from Esperance (53%) or Albany (31%). In none of the districts has a drench at weaning been recommended. However, in Esperance, routine drenching of weaners in January has been recommended (J. J. Gardner, personal communication), which would sometimes coincide with weaning.

Table 1.

Number of drenches per year given to cattle

No. of drenches per year	Class of cattle									
	Calves		Replacement heifers		Heifers and steers to be sold < 2 years		Steers > 2 years		Cows	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
0 drenches	112	58.0	76	44.7	75	42.1	38	59.4	102	54.3
1 drench	55	28.5	55	32.4	54	30.3	11	17.2	49	26.1
2 drenches	21	10.9	27	15.9	33	18.5	11	17.2	26	13.8
3 drenches	4	2.1	9	5.3	12	6.7	4	6.3	11	5.9
4 drenches	1	0.5	3	1.8	1	0.6	—	—	—	—
5 drenches	—	—	—	—	2	1.1	—	—	—	—
12 drenches	—	—	—	—	1	0.6	—	—	—	—
Total	193	100.0	170	100.0	178	100.0	64	100.0	188	100.0
Mean	0.59		0.87		1.02		0.70		0.71	

$\chi^2_{12} = 22.43$ $P < 0.05$

Number of drenches per year

Table 1 shows that heifers and steers to be sold were drenched more often (1.0 times per year) than replacement heifers (0.9), cows (0.7), steers older than 2 years (0.7) and calves (0.6). The figure for calves is possibly misleading because the calves were not present for a full year.

The proportion of respondents who did not drench at all was 58% for calves, 45% for replacement heifers, 42% for heifers and steers to be sold, 59% for steers older than 2 years and 54% for cows.

The highest proportion of respondents giving one or more drenches to all classes of stock was in the Katanning district followed by Albany and Esperance (table 2). This was most evident for replacement heifers ($P < 0.01$), cows ($P < 0.01$) and steers older than 2 years ($P < 0.1$). Differences between districts for calves ($P = 0.45$) and steers and heifers to be sold ($P = 0.51$) were not significant (appendices 22-26).

A similar trend is evident in appendix 27, where drenching intensity was highest in inland, lower rainfall Shires. This was most obvious for replacement heifers, cows and steers older than 2 years.

The trend for greater frequency of drenching in the Katanning district, which is in the low rainfall zone, is surprising as it would be expected that internal parasites would be of less importance in that area. It is possible that the cattle owners in the high rainfall coastal zone have observed that untreated cattle can survive without showing clinical signs and have come to terms with the disease. In the drier areas, most cattle are owned by farmers whose main experience is with sheep (appendix 4). These sheep owners, accustomed to regular treatment of their sheep, may likewise consider that cattle need regular drenching.

Cows were drenched less by cattle farmers producing baby beef than by other farmers. This can be accounted for by the high proportion of

Table 2

Average number of drenches per year for cattle in the districts of Albany, Esperance and Katanning

District	Average number of drenches per year				
	Calves	Replacement heifers	Heifers and steers to be sold < 2 yrs	Steers >2 years	Cows
Albany	0.5	0.7	1.0	0.6	0.6
Esperance	0.5	0.9	1.0	0.3	0.6
Katanning	0.8	1.2	1.1	1.2	1.1
Mean of all districts	0.6	0.9	1.0	0.7	0.7

Table 3

Number of drenches given from February to May inclusive to yearling steers and heifers in each district

Class of cattle	District	No. and per cent of farmers giving a specified number of drenches from February to May							
		0 drench		1 drench		2 or more drenches		Total No.	
		No.	%	No.	%	No.	%		
Replacement heifers	Albany	71	67.0	32	30.2	3	2.8	106	$\chi^2_2 = 2.68$
	Esperance	15	60.0	10	40.0	0	0.0	25	P= 0.43
	Katanning	21	52.5	17	42.5	2	5.0	40	
	All districts	107	62.6	59	34.5	5	2.9	171	
Steers & heifers to be sold < 2 yrs of age	Albany	74	63.2	36	30.8	7	6.0	117	$\chi^2_4 = 5.11$
	Esperance	15	62.5	9	37.5	0	0.0	24	P= 0.28
	Katanning	19	47.5	19	47.5	2	5.0	40	
	All districts	108	59.7	64	35.9	9	6.0	181	

baby beef producing herds in the Albany district (appendix 14) where the drenching intensity is less. Owners of studs were more likely to give 2 or more drenches to cows ($P < 0.1$) (appendix 28).

Cattle of all classes were drenched in each month of the year (appendix 29). Although there is a slight trend for increased drenching from March to May the χ^2 tests show that differences from expectation could be due to random effects.

In the past, extension of worm control programmes for cattle has been a passive process with advice being given on demand. Strategic drenching has been discouraged except in problem herds with clinical ostertagiasis and in recent years for weaner or yearling cattle. This has arisen from a lack of locally relevant research; a belief that cattle worms were of little economic importance until clinical signs occurred; and, until recently, the lack of effective anthelmintics for the control of immature stages of *Ostertagia* supp. in cattle.

This confused and changing information emanating from advisory services is reflected in the control programmes outlined. They demonstrate that there is misunderstanding of the relative need for worm control in the three districts, the correct timing of treatments, and the high susceptibility of yearling cattle.

Summer/autumn drenching of yearling cattle

Table 3 shows that most farmers gave no drenches to yearling cattle during late summer and autumn. Of the remainder, most gave only one drench during this time. There were no significant differences between districts.

Recent research in the west coastal area of Western Australia (de Chaneet *et al.*, 1982) has demonstrated significant production increases following control of internal parasites of yearling cattle. Average body-weight responses of 45 kg were observed in yearling heifers treated three times at monthly intervals during autumn. These results had not been widely extended at the time of the survey and have not been confirmed experimentally in the area encompassed by the survey.

It is evident that worm control programmes for yearling cattle differ significantly from recently adopted recommendations. Therefore, there is considerable room for improvement in worm control in yearling cattle. Confirmation of the west coast results in the south coast area and positive extension of this aspect of worm control in cattle is required.

Anthelmintics used

Q. What drench(es) did you use to a major extent in the year prior to July 1981 (cross 1, 2 or up to 3 boxes if necessary).

In 63% of responses, the new benzimidazole (BZ) anthelmintics were mentioned and Systamex® and Panacur® were the most commonly used (appendix 30). The levamisole (LVM) group were recorded in 26% of responses of which two-thirds were Nilverm®. The old BZ group only accounted for 9% of responses.

Levamisole anthelmintics were used more in the Albany district (30%) than in Katanning (24%) and Esperance (24%) (appendix 31). The old BZ group was used most in the Katanning district (19%). The new BZ group was used most in the Esperance district (71%) followed by Albany (65%) and Katanning (57%).

The new BZ anthelmintics were used to a greater extent ($P < 0.01$) by respondents with 200 or more cattle (appendix 32). The LVM group was used more by farmers with < 200 cattle.

The high level of old BZ and LVM usage is surprising as the value of the new BZ anthelmintics has been extended widely for the control of type II ostertagiasis.

Cost of drenching.

During 1980/81 an estimated 236,111 worm control treatments were given to cattle in this area which cost $180,534 as calculated by using the following formula:

$$\text{Cost} = N (\overline{X}_D \times (P + L))$$

Where:

Cost = $ spent on drenching in the Albany, Katanning and Esperance districts.

$\overline{X}_D$ = Mean number of drenches per head per year over all classes of cattle = 0.77

P = Price of drench = 55c / dose (Farm Budget Guide, 1982)

L = Cost of labour to drench cattle = 21.3c/hd Calculated assuming 1 man to yard, drench and return 160 cattle/d at Federal Pastoral Award rate of September 28, 1981 $34.1/d)

N = Total number of cattle in the area surveyed (ABS, 1981) 307,287.

3. Sheep

Numbers of sheep

The distribution of total number of sheep, numbers of different classes of sheep and total number of sheep sold appear in appendix 33.

Sheep activity

Wool production was the main activity on 95% of farms (appendix 34). Production of fat lambs and shipping wethers were the principal secondary activities. Fat lambs were a more important main activity in the Albany district (9% of farms) compared to Katanning and Esperance where all respondents listed wool production as their main activity. Fat lambs as a secondary activity was highest in Albany while wethers for export was highest in Esperance (62%) followed by Katanning (48%) and Albany (20%).

Breeds

Merinos were the major breed on 92% of farms for ewes and 80% of farms for rams (appendix 35). Cross-bred ewes comprised only a small (5%) proportion of ewes. British breeds and Poll Dorsets were used more than Merinos as a secondary breed of ram, probably as a terminal sire for fat lamb production. The high proportion of Suffolk and South Suffolk rams (42%) as the second ram breed is surprising when compared with 19% for Poll Dorset and 7% for Border Leicester. The dual purpose breeds Corriedale and Polwarth, were present on few properties as main breeds and were probably used as pure-breds.

The distribution of breeds of ewes and rams within districts is shown in appendix 36. The relative importance of fat lambs in the Albany district is reflected in the higher proportion of respondents with cross-bred ewes as the main ewe component of their flocks and British breed rams as the main ram breed.

Time of mating

Q Indicate the month in the 1981/82 season when mating commenced. If you have a group of breeding ewes that are mated at a different time of the year, use a different set of boxes for each mating date.

Mating took place on most farms from October to February with a peak in November and December (appendix 37). Mating of flocks other than the main flock tended to be later

than for main flocks and the peak occurred in January. These 'other' flocks probably contain cross-bred or British breed ewes which have a markedly seasonal breeding pattern.

Mating tended to commence earliest in the Esperance district, followed by Katanning and Albany (appendix 38). Farmers in the south-east and low rainfall zones, tended to mate ewes earlier in the season (appendix 39) than those in Plantagenet and moderate rainfall zones which, in turn, mated ewes earlier than those in the coastal zone.

With increasing flock size mating was earlier ($P < 0.001$), as shown in appendix 40.

Where fat lambs were produced, mating tended to be later than for wool production (appendix 41). This trend was significant for secondary sheep activity ($P < 0.05$), but not for main sheep activity ($P = 0.16$).

Time of shearing

Q. In which month, during the 12 months prior to June 1981 were most of your sheep shorn?

Sheep were shorn in each month, however, there was a peak in August, September and October (appendix 42).

Shearing commenced earlier (July/August) in the Katanning and Esperance districts and finished later in the Albany district ($P < 0.001$), (appendix 43).

Appendix 44 shows that a greater proportion of farmers in the low rainfall zone commenced shearing earlier than those in the coastal zone. In the south-east zone there was a similar proportion shearing early (36%) as in the low rainfall zone (40%). However, there was a greater proportion shearing in November/December.

Paddocks used for lambing

Q. Which paddocks are used for lambing?

The previous use of paddocks used for lambing are shown in appendix 45. The same, or most of the same, paddocks were used each year by 43% of respondents. Nearly one-third (33%) used only some of the same paddocks each year and almost one-quarter (24%) used different paddocks for lambing each year. The same lambing paddocks were used each year to a greater extent ($P < 0.001$) in the Albany district than in Katanning or Esperance.

The proportion of farmers using the same lambing paddocks each year decreased with changing rainfall zone ($P < 0.001$). The south-east zone was midway between the moderate and low rainfall zones (appendix 46).

Farmers with small flocks (<999 sheep) tended to use the same lambing paddocks each year more often than those with larger flocks (appendix 47). The use of different lambing paddocks increased with flock size except for very large flocks (>10,000) where most or some of the same paddocks were used to a greater extent ($P < 0.001$).

A greater proportion of farmers with fat lambs as a secondary sheep activity used the same lambing paddocks each year ($P < 0.001$) compared with those with wool as a secondary activity (see appendix 48). Presumably these farmers had a greater proportion of ewes and so had ewes lambing on all available paddocks.

Less respondents with Merinos as the main breed of ram used the same lambing paddocks ($P < 0.001$) than those with other breeds (appendix 49). The main and second breed of ewe and second breed of ram were not related to the selection of lambing paddocks.

Appendix 50 shows that a greater proportion of respondents with only sheep used different lambing paddocks each year ($P<0.05$).

The use of different lambing paddocks each year has been recommended for the control of *Nematodirus* spp. in lambs. Morley and Donald (1980) outlined the management difficulties associated with this strategy. The findings in this survey showed that although nearly one-quarter (24%) of the farmers used different paddocks each year and a further 33% used only some of the same paddocks each year, there was considerable variation between districts. Different paddocks were used each year to a greater extent in the low rainfall zone where flock size was larger and wool production was more important than fat lamb production. This was probably an effect of the greater areas cropped (appendix 51). Cropping rotations would make paddocks available for lambing each year which had not been used in the previous year. It is of concern that fat lamb producers were more likely to use the same paddocks than wool producers. It is fat lambs that are most likely to suffer economic effects of parasitism caused by *Nematodirus* spp.

A. Worm control programme

Number of drenches

Q. When did you drench your sheep in the 12 months prior to July 1981? (Please cross the months when drenching occurred for each class of sheep)

Answers were coded in the following way:

(a) Ewes (older than 18 months)

(b) Lambs (drenches given in the first 12 months of life)

(c) Weaners (drenches given in the 12 months from weaning)

(d) Wethers (older than 18 months)

There is an overlap in the drenches given to lambs and weaners when coded in this way.

The distribution of and the mean number of drenches per year given to each class of sheep is in appendix 52. The mean number of drenches was 3.41 ± 0.11 (ewes), 3.70 ± 0.15 (lambs), 3.77 + 0.21 (weaners) and 2.39 ± 0.11 (wethers).

Appendix 53 shows the mean number of drenches per year for ewes, weaners and wethers in each Shire.

The intensity of drenching was higher in the Albany district than in Esperance and Katanning for all classes of sheep (table 4). The highest proportion of farmers not drenching sheep were in the Esperance district, but here the proportion giving seven drenches or more was higher than in Katanning. The mean number of drenches was higher in Esperance than Katanning for all classes of sheep. There was a wide variation in frequency of drenching within each district.

The intensity of drenching decreases from the coastal zone to the low rainfall zone for each class of sheep (appendix 54). The mean number of drenches given in the south-east zone was similar to the moderate rainfall zone, but the range was greater. The broad range of drenching intensity in the south-east Shires of Esperance and Ravensthorpe was probably due to climatic variations between coastal and inland areas within each Shire.

The mean number of drenches given to ewes and wethers was similar to the number currently recommended in most of the area. However, in some Shires (e.g. Kojonup, Tambellup, Plantagenet) the mean number of drenches given to weaner sheep was less than recommended. Weaners are the sheep most susceptible to worms and there are significant production gains to be made from controlling worms in them (Anderson *et al.*, 1976; G. C. de Chaneet *et al.* unpublished data). Although

Table 4.

Drenches given to sheep in each district

District	No. of drenches per year													
	0 drenches		1 or 2 drenches		3 or 4 drenches		5 or 6 drenches		7 or more drenches		Total	Mean		
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%				
Ewes														
Albany	2	1.5	12	9.3	59	45.4	37	28.4	20	15.4	130	4.74	χ^2_8	= 88.1
Esperance	4	6.8	20	33.9	21	35 5	11	18.7	3	5.1	59	3.19		
Katanning	9	5.2	81	47.1	72	41.9	8	4.7	2	1.2	172	2.49	P	< 0.001
Lambs														
Albany	7	6.0	12	10.3	30	25.8	32	27.6	35	30.2	116	5.25	χ^2_8	= 80.2
Esperance	8	14.5	20	36.4	15	27.2	7	12.8	5	9.1	55	2.91		
Katanning	9	5.4	64	38.4	70	41.9	18	10.8	6	3.6	167	2.89	P	< 0.001
Weaners														
Albany	3	4.4	6	8.8	21	30.8	18	26.5	20	29.6	68	5.51	χ^2_8	= 57.1
Esperance	4	8.3	26	54.2	12	25.0	3	6.3	3	6.3	48	2.71		
Katanning	4	5.5	32	43.8	27	37.0	10	13.7	0	0.0	73	2.68	P	< 0.001
Wethers														
Albany	5	4.9	35	34.4	44	43.1	13	12.8	5	5.0	102	3.25	χ^2_8	= 50.6
Esperance	11	21.6	17	33.3	15	29.4	7	13.8	1	2.0	51	2.29		
Katanning	18	12.0	98	65.4	29	19.4	4	2.7	1	0.7	150	1.84	P	< 0.001

there is no local evidence to accurately define the number of drenches required for an optimum economically effective worm control programme this can be extrapolated from other areas. In western Victoria, which has a similar climate to the moderate rainfall zone in this survey, Thompson and Callinan (1981) found that a total of between four and seven drenches per year gave adequate control of nematodiasis. The distribution of these drenches is important and will be discussed later.

Appendix 55 shows that sheep are drenched most frequently on farms where the same paddocks were used for lambing. This trend may be accounted for by the higher use of the same paddocks in the wetter, high rainfall Shires (appendix 46) and where the intensity of drenching was highest (appendix 54). There was a significant relationship between lambing paddock and the drenching intensity for wethers. Wethers should not be affected by the use of the same lambing paddocks and so we would not expect a relationship between intensity of drenching and the selection of lambing paddocks.

All classes of sheep were drenched more often on farms where body strike was considered more important and less often on farms where breech strike was more important (appendix 56). Drenching intensity was intermediate on farms where 'both are equally important' or 'neither is a problem' except for wethers where a greater proportion of farmers who gave no drenches to wethers considered that 'neither is a problem'. These differences were significant for ewes ($P < 0.001$), lambs ($P < 0.001$) and wethers ($P < 0.01$) but not for weaners ($P = 0.18$). This association is supported by the high frequency of drenching in the Albany district where body strike is considered more important (appendix 75).

'Summer' drenches

'Summer' drenches were defined as drenches given from November to March (5 months). Weaners were given the most 'summer' drenches followed by lambs, ewes and wethers (appendix 58). About one-quarter of the wethers and lambs received no 'summer' drench. The low figure for lambs could be accounted for by lambs which were sold at weaning and were not present during the 'summer'. The percentage of respondents who had not given at least two drenches in 'summer' was 50% for ewes, 48% for lambs, 40% for weaners and 70% for wethers. The mean number of 'summer' drenches was highest in the Albany district followed by Esperance and Katanning. For Esperance and Katanning the number of farmers giving two 'summer' drenches was reversed for weaners.

The mean number of 'summer' drenches used was related to rainfall zone for each class of sheep (appendix 59). The number of 'summer' drenches given decreased from the high rainfall coastal shires to the low rainfall Shires. The south-east zone was similar to the moderate rainfall zone except for weaners where the number of 'summer' drenches was similar to the low rainfall zone.

Table 5 shows drenching programmes itemised into the number of 'summer' drenches in relation to the total number of drenches given.

Table 5

Drenching programme for ewes, lambs and wethers. 'Summer' drenches compared with the total number of drenches for the year

Drenching programme	Ewes	Lambs (1st 12 months)	Wethers
	%	%	%
Two 'summer' drenches Drenches/year			
7 or more	6.6	13.3	2.3
5 or 6	14.7	14.4	7.9
3 or 4	23.5	19.8	14.2
2 only	5.3	3.3	5.9
Cumulative total	50.1	51.8	30.4
One 'summer' drench Drenches/year			
7 or more	0.3	0.3	—
5 or 6	0.8	1.2	—
3 or 4	17.7	10.9	14.2
2	13.3	5.0	20.1
1 only	8.0	4.4	12.5
Cumulative total	90.3	73.7	77.2
No 'summer' drenches Drenches/year			
5 or 6	—	0.3	—
3 or 4	0.8	3.3	0.7
1 or 2	4.7	15.7	10.9
0	4.2	7.1	11.2
Cumulative total	100.0	100.0	100.0
Total	361	338	303

Table 6

Reasons offered as to why no double 'summer' drench was given to ewes, weaners and wethers

Reasons why no double summer drench	Ewes		Weaners		Wethers	
	No.	%	No.	%	No.	%
Insufficient time	3	1.7	2	1.6	5	2.7
Could not afford to buy drench at this time	1	0.6	2	1.6	1	0.5
Reluctant to muster	2	1.1	0	0.0	2	1.1
Sheep showing no sign of worms	66	37.7	49	38.9	75	40.5
On holiday	4	2.3	4	3.2	4	2.2
Drenching at this time conflicts with other farm activity	7	4.0	4	3.2	4	2.2
Summer drenches not necessary	3	1.7	2	1.6	3	1.6
One drench in 'summer' is enough	39	22.3	31	24.6	47	25.4
Two drenches in 'summer' are not enough	14	8.0	15	11.9	9	4.9
Could not organize labour	0	0.0	0	0.0	1	0.5
Haven't needed to drench at this time in the past	21	12.0	8	6.3	21	11.4
Other	14	8.0	8	6.3	12	6.5
Don't know	1	0.6	1	0.8	1	0.5
Total	175	100.0	126	100.0	185	100.0

Reason why 'summer' drenches not given

Q. If any of your sheep did not receive a double 'summer' drench (Two broad spectrum drenches between the beginning of November 1980 and the end of March 1981) please indicate the two most important reasons for each class of sheep

For each class of sheep the main reasons for not giving two 'summer' drenches were 'showing no sign of worms', followed by 'one drench in 'summer' is enough' and 'haven't needed to drench at this time in the past' (table 6). The reasons listed were divided into three categories These were:

- Not convinced of the value of two 'summer' drenches
- Would have given two 'summer' drenches but prevented from doing so
- Two 'summer' drenches not enough

Most farmers (74% for ewes, 71% for weaners and 79% for wethers) who did not give two 'summer' drenches were not convinced of the value of this strategy. Only a small percentage of farmers (10% for ewes, 10% for weaners, 9% for wethers) would have given 'summer' drenches, but were prevented from doing so. Of farmers who did not give two 'summer' drenches in the Katanning district most were not convinced of the value of two 'summer' drenches (appendix 60).

The proportion responding that 'two 'summer' drenches is not enough' was greatest in the Albany district followed by Esperance and Katanning. This is understandable as in Albany and Esperance haemonchosis can be a problem in the 'summer' months (de Chaneet and Mayberry, 1978).

Most farmers in the moderate and low rainfall zones were not convinced of the value of two 'summer' drenches (appendix 61). A large proportion of coastal farmers considered two 'summer' drenches insufficient followed by a smaller number of farmers in the Plantagenet and south-east zone. The highest proportion who would have given two 'summer' drenches, but were prevented for some reason from doing so, were in the Plantagenet zone.

Research at Mt Barker (de Chaneet *et al.*, unpublished data) and in western Victoria (Anderson *et al*, 1976) suggests that two broad spectrum drenches given in 'summer' are the basis of an effective worm control programme for ewes and weaners. In high rainfall areas, additional drenches will be required and in low rainfall areas two 'summer' drenches may be all

that is required. Since 1976, the concept of two 'summer' drenches for the control of nematodiasis has been promoted in all Advisory Districts.

A high proportion of farmers were not giving sheep two drenches in 'summer' and of these most did not believe that two 'summer' drenches were necessary. This suggests one of the following:

- Two drenches in 'summer' are not necessary. This may be true in some cases such as for wethers in the low rainfall zone, or;
- Farmers are unaware of the preventive philosophy behind 'summer' drenching and the production effects of subclinical worm damage and so do not see the need for further treatment in the absence of clinical disease.

A change in the promotion of the two 'summer' drench concept is required. There is a need to convince farmers of the value of two drenches in 'summer' before the programme itself will be adopted.

This is also a need to demonstrate the advantage of two 'summer' drenches over a single 'summer' drench in the drier areas. Most farmers were giving at least one drench in 'summer' which may have been effective. There are no relevant local research findings to counter this argument.

Drenches used

Q. What drenches did you use to a major extent in the year July 1980 to June 1981? (Cross a maximum of 3 boxes)

The anthelmintics used by respondents are listed in appendix 62. Narrow spectrum drenches were little used (1.5%). The newer BZ drenches were used by 41.4% of respondents, the LVM group used 36.7% and the older BZ group by 20.1%. Of individual trade names the most used were Nilverm®, Thibenzole®, Ripercol®, Panacur®, and Systamex®. The figure for Ripercol®looks high because it was temporarily withdrawn from the market at the time of the survey. However, it should be remembered that the data collected was for 1980/81 and that the drenches listed were one of a maximum of three that farmers may have used during the year. Farmers may have had stocks of drench on hand which were purchased in the previous year.

New BZ group drenches were used most often in the Albany district, old BZ group drenches in the Katanning district and the LVM group in the Esperance district ($P < 0.001$, table 7).

LVM anthelmintics were used more in the south-east and coastal zones than in the moderate and low rainfall zones where the old BZ group was most popular (appendix 63). The new BZ group was used most in the Plantagenet and coastal zones ($P < 0.001$).

Farmers with sheep only, tended to use more of the old BZ group (appendix 64) and farmers with both sheep and cattle used more of the new BZ group anthelmintics ($P < 0.05$). This is to be expected as cattle farmers would be aware of the advantages of the new BZ group for cattle and would probably use the same anthelmintic for sheep.

The reason for using more than one type of drench

Q. If you crossed more than one box in Question 23 what was the reason for using more than one type of drench? (cross only one box)

Table 7

The anthelmintic groups used to drench sheep in each district

District	No. of farms using various anthelmintic groups								
	Narrow spectrum		Levamisole		Old benzimidazole		New benzimidazole		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
Albany	6	2.1	105	36.1	31	10.7	149	51.2	291
Esperance	2	1.7	56	47.1	19	16.0	42	35.3	119
Katanning	3	0.9	116	33.7	102	29.7	123	35.8	344
All districts	11	1.4	277	36.7	152	20.1	314	41.4	754

$\chi^2_6 = 45.8$ $P < 0.001$

Half the farmers rotated drenches either on a regular or irregular basis. Twenty per cent bought the cheapest drench available (appendix 65). In this survey we did not ask whether rotations were between groups or between individual drenches within groups. Therefore, less than half would be rotating between anthelmintic groups.

Shortly before the survey commenced, extension programmes began which aimed to promote the use of slow rotations between drench groups (Prichard *et al.*, 1980) to reduce the development of resistance to anthelmintics. These results show that both the LVM and BZ anthelmintic groups were being used and that only half the respondents were alternating drenches.

Cost of drenching

During 1980/81 an estimated 34.7 million drenches were given to sheep in this area which cost $3,594,149. This figure includes labour ($1.2m). Costs were calculated using the following formula and assumptions.

$$\text{Cost} = N (\bar{X}_D \times (P + L))$$

Where cost = $ spent on drenching in the Albany, Katanning and Esperance districts.

X_D = Mean number of drenches per head per year for all classes of sheep = 3.52

P = Price of drench = 6.9c/dose (Farm Budget Guide, 1982)

L = Cost of labour to drench sheep = 3.45c/hd (3.5% using contract rate 5c/head (Farm Budget Guide 1982) and remaining 96.5% at 3.45c/head calculated from 1,000 sheep yarded, drenched and returned per day by one man at the Federal Pastoral Award rate of 28th September 1981 = $34.10/day.

N = Total number of sheep in the area surveyed (ABS, 1981) 9,865,364.

B. Blowfly control

Perception of blowfly strike as a problem

Q. If you took no action to prevent blowfly strike do you think that flystrike would be a problem in your flock? (Action includes time of shearing, mulesing, crutching, jetting etc)

Most farmers (71%) considered that blowfly strike would be a major problem (appendix 66). The perception of blowfly strike varied between Shires ($P < 0.1$) (appendix 67) and between Shires grouped into rainfall zones ($P < 0.01$) (appendix 68). The proportion who considered blowfly strike would be a problem was lower in the coastal zone Shires of Albany, Denmark and the Walpole area of the Manjimup Shire. This may be due to the lower proportion of Merino sheep (71%) in this zone (appendix 36) even though the frequency of flystrike is greater in this wetter area. It was surprising that a high proportion of farmers (77%) in the low rainfall zone considered flystrike to be a major problem.

Of farmers with < 1,000 sheep, only 51% felt that blowfly strike would be a major problem compared to 78% of farmers with 1,000 to 6,000 sheep and 70% for larger sheep flocks (appendix 69).

Appendix 70 shows that where Merinos were the major breed of ewe, flystrike was perceived as a greater problem than where other sheep were the major breed of ewe ($P < 0.01$). Small numbers of other breeds make it difficult to detect differences between these other breeds. The perception of flystrike being a major problem for farms with Merino rams (74%) was not different from other ram breeds (71%). Where Merinos were the major breed of ram, many of these other breeds of ram would have been used in the terminal matings and so explain the difference between breeds of ewes and rams.

A greater proportion of farmers who crutched ewes or wethers once or more, thought blowfly strike would be a major problem if they took no preventive action (appendix 71). There was no such relationship between the number of times lambs, weaners and rams were crutched and the perception of blowfly strike.

More farmers who jetted ewes once or more, thought that blowfly strike would be a major problem if they took no preventive action than those who did not jet ewes (appendix 72). There was no such relationship for the number of times lambs, weaners and wethers were jetted.

Relative importance of body and breech strike

Q. Which do you consider to be the more important problem in your flock, body strike or breech strike?

Appendix 73 shows farmers' opinions as to the relative importance of breech and body strike. Body strike was considered to be equally or more important than breech strike on 55% of properties.

Body strike was considered more important on a greater proportion of farms where mating commenced early (October) or late (January/February) in the season (appendix 74). Breech strike was thought more important by a greater proportion of farmers whose sheep were mated early (October/November). Body and breech strike were considered equally important by most farmers whose sheep were mated from December to February inclusive. A higher proportion (18%) thought neither was a problem where mating was early (October) and a lower proportion (2%) where mating was late (February).

Appendix 75 shows differences in the relative importance of body and breech strike between Shires. A greater proportion of farmers in the Albany district thought body strike was more important than in the Katanning and Esperance districts where breech strike was considered to be more important.

In Katanning, a higher proportion of farmers than elsewhere felt that neither form of blowfly strike was a problem. There was also an effect of climatic zone. Body strike was more important in the coastal zone and Plantagenet Shire while in the south-east, moderate and low rainfall zones, breech strike was thought to be more important ($P < 0.001$).

Farmers with sheep and cattle were more likely to consider body strike to be equally or more important than those who had sheep only (appendix 76). This probably reflects the greater number of mixed farming enterprises in the high rainfall coastal zone.

A greater percentage of farmers who shear between March and October thought breech strike was more important while more of those who shear between November to February considered body strike was more important (appendix 77).

Farmers who considered that neither body nor breech strike was a problem did not jet (appendix 78). A greater proportion of farmers who thought breech strike was more important did not jet ewes, lambs, weaners and wethers.

Proportion of farms on which sheep were mulesed

Q. Were any of your sheep (including lambs and weaners) mulesed during 1980?

One-quarter of respondents did not have their sheep mulesed during 1980 (table 8). Most farmers with Merino sheep (87%) mulesed all or some of their lambs (appendix 85).

Table 8

The percentage of farmers who had their sheep mulesed in 1980

	No.	%
Not mulesed	96	24.9
All lambs mulesed	248	64.2
Some lambs mulesed	30	7.8
Weaners mulesed	7	1.8
Other	5	1.3
Total	386	100.0

The proportion of farms where sheep were mulesed varied between Shires (appendix 79). Shires in the Albany district had a far greater proportion of farmers whose sheep were not mulesed (43%) than Esperance (21%) and Katanning (12%) ($P < 0.001$). In the coastal Shires, the proportion whose sheep were not mulesed was higher than in the low rainfall Shires (appendix 80). This can be explained, in part, by the lower proportion of Merino sheep in the coastal areas (appendix 36).

A greater percentage of farmers who had sheep only had their lambs mulesed ($P < 0.05$) than those who had both sheep and cattle (appendix 81). A far greater percentage of farmers with small numbers of sheep did not use the Mules operation compared with those with larger numbers of sheep ($P < 0.001$) (appendix 82). The proportion of farmers who mulesed all or some of their lambs increased ($P < 0.01$) with the amount of labour available (appendix 83).

Of farmers whose main sheep activity was fat lamb production, 92% did not mules any sheep compared with 20% of farmers whose main activity was wool growing (appendix 84). There was also a greater proportion of farmers where fat lambs were a secondary sheep activity who mulesed some of their lambs (18%).

Only 10% of farmers with Merinos as the main breed did not mules sheep compared with 67% for Corriedales and Polwarths and 84% for British breed sheep ($P < 0.001$) (appendix 85). Eight per cent of farmers with British breeds as the main breed mulesed all lambs. Although there is evidence to show that the Mules

Table 9

Category of persons who did the Mules operation on farms in each district

Category of persons who did the Mules operation	Albany		Esperance		Katanning		All districts	
	No.	%	No.	%	No.	%	No.	%
Contractor	40	50.6	36	72.0	75	48.7	151	53.4
Self	27	34.2	11	22.0	67	43.5	105	37.1
Neighbour	8	10.1	0	0.0	8	5.2	16	5.7
Other	4	5.0	3	6.0	4	2.6	11	3.9
Total	79	100.0	50	100.0	154	100.0	283	100.0

$\chi^2_6 = 16.14 \quad P < 0.05$

operation can result in significant reduction in breech strike in Corriedale and crossbred sheep (Reid and Jones, 1976), these breeds are not mulesed on most farms. This is understandable when lambs are to be marketed at an early age as prime lambs.

However, there is no reason why sheep of these breeds, which are retained for breeding, should not be mulesed.

A smaller proportion of farmers who shear early in the season (July to October) do not mules their sheep, than those who shear after October ($P < 0.1$) (appendix 86).

It is evident that there were very few farmers with Merino sheep who did not mules sheep and this indicates a higher rate of adoption than in western Victoria (Morley *et al.*, 1979). This shows widespread acceptance of the Mules operation as a method for the prevention of breech strike.

Time of mulesing

Q. When were these sheep mulesed in 1980?

The majority of lambs (84%) were mulesed at lamb marking (appendix 87). Except for some flocks with spring lambing, lamb marking was done during a period when blowflies were inactive. Coupled with the ease of handling and ease of mulesing, this provides an explanation of why most lambs were mulesed at marking time.

Who did the Mules operation

Q. Who did the Mules operation on your sheep in 1980?

Some 53% of farmers employed contractors to mules their sheep (table 9). A high proportion of farmers (37%) did the Mules operation themselves. Appendix 88 shows the category of persons who did the Mules operation on farms in each Shire durng 1980. In the Esperance district (table 9) more farmers (72%) used contractors than did farmers in Albany (51%) and Katanning (49%). In the latter districts many farmers mulesed their own sheep (34% Albany and 44% Katanning).

A low percentage of farmers with properties between 500 and 1,000 ha used a contractor to mules sheep (appendix 89). Many of these farmers mulesed their own sheep. Farmers with < 500 ha are more likely to use neighbours or others to mules their sheep ($P < 0.001$).

A lower percentage of farmers with small flocks (< 1,500 sheep) mulesed their own sheep than those with larger flocks (appendix 90). These farmers were also more likely to have neighbours or people other than contractors do the Mules operation for them.

Respondents with total farm labour of one labour unit or less, were more likely to use neighbours or people other than contractors to mules their sheep (appendix 91). Most farmers with 2 to 3 labour units (63%) used contractors while a greater proportion of farmers with four or more labour units did the Mules operation themselves.

Type of Mules operation

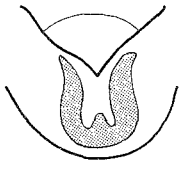
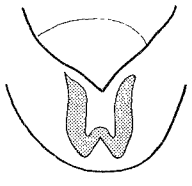
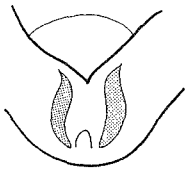
Q. What type of Mules operation was done in 1980? Please cross the box for the diagram which best describes the Mules operation performed on your sheep

Almost half the respondents used Mules A which is close to the conventional radical Mules operation (table 10). Only 28% used Mules C which is the 'V'-mules recommended by the Department of Agriculture (Gherardi *et al.*, 1980) and the National Working Party on Blowfly Strike set up by the the Australian Wool Corporation.

Appendix 92 shows the type of Mules operation used in 1980 in each Shire. Adoption of the recommended Mules C was highest in the Kent and Esperance Shires. In the Esperance district, adoption of Mules C was higher than in Albany and Katanning. Mules B (conventional plus tail stripping) was used more in Esperance than in the other two districts ($P = 0.05$).

Table 10

The type of Mules operations done in 1980.

Type of Mules operation		No. of farms	%
A.		134	46.7
B.		51	17.8
C.		79	27.5
D.		11	3.8
E.	Other (please draw in space provided)	9	3.1
F.	Don't know	3	1.0
Total		287	100.0

Owners of large flocks (> 10,000) tended to use Mules C (appendix 93) while owners of small flocks (> 1,000) tended to use type D or other types of Mules operation. A higher percentage of farmers with 5,000-9,999 sheep used the type Mules A operation.

More of the farmers with four or more labour units available had adopted the Mules C operation than farmers where less labour was available. Over half the respondents with 1-4 labour units available used the type Mules A operations compared to only 19% of respondents with more labour. Farms with one unit of labour or less used a greater proportion of type B, type D and other types of Mules operation than those with more labour (appendix 94).

Appendix 95 shows that farmers themselves did more of Mules A while contractors and neighbours did more of Mules B with neighbours doing significantly less of Mules C ($P < 0.05$). Adoption of Mules C was highest with 'other' operators.

Reason for not mulesing sheep.

Q. If you did not Mules could you please indicate the reason(s) why? Cross no more than two (2) boxes

Most farmers (56%) produced fat lambs to be sold at weaning or bought in replacement sheep which were already mulesed or considered too old to mules (table 11). Nineteen per cent gave reasons that indicated that they thought that the Mules operation would be of no value in their flock. The remaining 14% gave reasons which indicated that they were prevented from doing the Mules operation even though they thought it would be of value.

A greater proportion of farmers in the Albany and Esperance districts than in Katanning gave reasons for not mulesing sheep which indicated they did not believe in the value of the Mules operation (appendix 96). In addition, these districts had a greater proportion of farmers who did not mules because they raised fat lambs for sale at weaning. More farmers in Katanning gave answers indicating that they were prevented from mulesing than were farmers in other districts. Farmers in Albany and Katanning bought in replacement sheep to a greater extent than in Esperance.

Appendix 97 shows that many farmers (56%) who gave reasons which indicated that they did not believe in the value of the Mules operation considered flystrike to be of minor or no problem. All of those (100%) who thought the

Table 11

Reasons for not mulesing lambs

Reason	No. of responses	%
Flystrike is not a problem in my flock	12	7.8
I produce fat lambs to be sold at weaning	34	22.2
Mules operation of no benefit to my breed of sheep	10	6.5
Mules operation is cruel	6	3.9
Mules operation does not prevent body strike	7	4.6
Mulesing is difficult to organize	6	3.9
Shortage of labour or contractors	6	3.9
Too risky becasue of flystrike in wounds	3	2.0
I buy in replacement sheep too old to mules	11	7.2
I buy in replacement sheep already mulesed	41	26.8
Other—specify	14	9.1
Don't know	3	2.0
Total	153	100.0

operation would be of value, but did not mules for reasons preventing them from mulesing, perceived blowfly strike as a major problem ($P < 0.01$). More respondents who gave reasons preventing them from mulesing, cut lambs tails level with the top of vulva than those who gave other reasons for not mulesing (appendix 98).

Length of tails

Q. To what length do you dock your lambs' tails?

Three-quarters of the farmers docked ewe lambs' tails (or equivalent in wethers) at a level equal to the tip of the vulva (appendix 99). Of the 4% of farmers who responded with 'other' docking lengths most indicated that they docked lambs' tails at the 2nd or 3rd joint or even longer than the tip of the vulva.

Evaluation of extension

Adoption of the Mules operation in this area was high and of those people not mulesing sheep, most had valid reasons for not doing so.

The 'V'-mules (Gherardi *et al.*, 1980), which is currently recommended by the National Working Party on Blowfly Strike, was poorly adopted. This survey followed an extension campaign during 1980 to promote the 'V'-mules among mulesing contractors. The low proportion of farmers employing contractors to do the Mules operation (53%) was unexpected and indicates that the owners and others who mulesed on 47% of properties were not contacted during the campaign.

The direction of mulesing extension needs to be modified to include owners as well as contractors. Contractors had not adopted the 'V'-mules to a greater extent than non-contractors indicating a resistance to using the technique. The 'V'-mules technique is more complicated and time consuming than other methods. This will require flock owners to persuade contractors to use this method. Owners who use contractors should therefore be aware of the technique.

Frequency of jetting

Q. When did you jet your sheep in the 12 months prior to June 1981? Please indicate for each class of sheep

The majority of respondents did not jet ewes (69%), lambs (74%), weaners (74%) or wethers (81%). Ewes were jetted most frequently followed by weaners, lambs and wethers (table 12).

For all classes of sheep, the frequency of jetting was highest in the Albany district followed by Esperance and Katanning (appendix 101). For weaners, the difference in frequency between Katanning and Esperance was very small. A similar trend was evident in the various rainfall zones where jetting was more frequent in the high rainfall coastal Shires than in the inland Shires.

For all classes of sheep, jetting was more frequent in those flocks where mating was late (January to March) (appendix 102). This trend was significant for ewes ($P < 0.005$), lambs ($P = 0.01$), weaners ($P < 0.01$), but not for wethers ($P = 0.10$).

Sheep were jetted in all months of the year except July. However, the bulk of jetting was done in September to November with a peak in October (appendix 103).

Table 12

Number of times each class of sheep was jetted in the 12 months before June, 1981

No. of times jetted	Ewes		Lambs		Weaners		Wethers	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
0	246	69.3	253	73.5	250	74.0	247	80.5
1	79	22.3	72	20.9	64	18.9	47	15.3
2	24	6.8	16	4.7	16	4.7	10	3.3
3	5	1.4	2	0.6	6	1.8	3	1.0
4	1	0.03	1	0.04	2	0.06	0	0.0
Total	355	100.0	344	100.0	338	100.0	307	100.0
Mean		0.411		0.331		0.361		0.248
Standard error		0.037		0.033		0.039		0.032

$\chi^2_6 = 14.88 \quad P < 0.05$

In view of the stated importance of body strike (appendix 78) the low frequency of jetting is surprising. It is probable that farmers are using management procedures such as spring shearing and dipping to control blowfly strike in spring and early summer when most strikes occur (Monzu, 1979).

Method of jetting.

Q. How were the sheep jetted?

Thirty per cent of farmers had used a jetting race to jet sheep (appendix 104). There was a tendency to greater use of jetting races in the Esperance district followed by the Katanning and Albany districts ($P < 0.1$). 'Other' methods were used more often in the Albany district. The most commonly used 'other' technique was adaption of fire fighting apparatus. This probably reflects the number of smaller farms in this district.

Appendix 105 shows that 'other' methods were used more often on smaller farms. Jetting races were little used (8%) on farms with small flocks (< 1,000 sheep) and were often used (50%) on farms with > 10,000 sheep.

A greater percentage of farmers shearing in July/August (40%) and November/December (38%) used jetting races than farmers shearing at other times (appendix 106). Of farmers shearing in March to June, 33% used methods other than hand wand or jetting race.

The prevalence of resistance of blowflies to jetting chemicals is lower in Western Australia than in other States. In most areas, jetting with organophosphate chemicals still gives 4-6 weeks protection (Monzu *et al.*, 1980). The low frequency of jetting found in this survey (table 12) will have contributed to this difference.

Insecticide used for jetting

Q. Which jetting insecticide(s) did you use during the 12 months prior to July 1981? Cross up to 3 boxes if required

Table 13 shows the jetting chemicals used. The three diazinon formulations had been used to a major extent on 30% of farms. Lucijet® (Fenthion ethyl) was the most used single formulation (27%). The new insecticide Vetrazin® had been used by 26% of farmers at the time of response in July 1981. At this time, Vetrazin ® had only been available for the autumn 1981 flywave and would currently be used by more farmers than shown by this survey.

For the purpose of analysis, the commercial preparations have been grouped into their chemical groups.

There was no significant difference in jetting formulations used between districts ($P = 0.53$). However, there were some differences ($P < 0.1$) in jettting chemical used between climatic zones (appendix 107). Vetrazin® was

Table 13

Chemicals used for jetting.

Jetting formulation used	No. of responses	%
Diazadip®	20	11.4
Dipjet®	22	12.6
Dizon 80®	10	5.7
Lucijet®	48	27.4
Suprex 100®	15	8.6
Vetrazin®	46	26.3
Other	10	5.7
Don't remember	4	2.3
Total	175	100.0

in greatest use in the south-east Shires of Esperance and Ravensthorpe while in the coastal shires around Albany, diazinon usage was greatest. In the Plantagenet Shire the use of Lucijet ® was highest and Suprex 100 ® was not used at all. The differences between zones did not follow the rainfall trend and probably reflect retailing activity in the zones.

Crutching

Q. Indicate the month(s) when crutching was done during the 12 months prior to July 1981. Cross as many boxes as required for each class of sheep

All ages of sheep except lambs were crutched at least once on most farms (appendix 108). Ewes were crutched most often (mean = 1.11 ± 0.03) which reflects the common use of crutching before lambing. Wethers received an average of 0.96 ± 0.03 crutchings, while weaners and rams were crutched 0.93 ± 0.03 and 0.87 ± 0.03 times respectively.

Most sheep were crutched between February and May with a peak in March. A smaller peak also occurred in September (appendix 109).

There were significant associations between district and number of times sheep were crutched (appendix 110) for ewes ($P < 0.05$), weaners ($P < 0.001$) and wethers ($P < 0.001$). For each class, a greater proportion of respondents in the Katanning district crutched sheep at least once, than in the other two districts and the proportion who crutched sheep twice or more was highest in the Albany district. A similar relationship with Shires grouped into climatic zones was evident (appendix 110). The Plantagenet, moderate and low rainfall zones had the greater proportion crutching at least once compared to the coastal and south-east zones. The highest proportion crutching sheep twice or more was in the Plantagenet Shire.

Appendix 111 demonstrates the significant associations between flock size and the frequency of crutching for ewes ($P < 0.001$), lambs ($P = 0.06$), weaners ($P < 0.05$) and wethers ($P < 0.05$). The proportion of farms where sheep were not crutched increased with decreasing flock size (except for lambs). A greater number of farms with > 10,000 sheep crutched twice or more.

Appendix 112 shows the relationship between time of shearing and the number of times crutched for each class of sheep.

Costs of blowfly control.

The costs of blowfly control have been calculated as:

Costs = Mulesing + jetting + crutching, using similar assumptions as Brideoake (1979).

(a) Mulesing costs = Number of lambs* x proportion mulesed (contract mulesing charge) + (labour for mustering)
= 3,145,604 x 0.751 (19.38 + 3.41)

Total cost = $538,379

Cost per lamb = 17.12c/lamb

Cost per sheep = 5.5c/sheep

Assumptions

1 man day = mustering, handling and returning 1,000 lambs
= $34.1/day
= 3.41c/lamb

(b) Jetting costs = Number of sheep* x average number of jettings x cost of jetting chemicals+ + (labour for mustering and jetting)
= 9,865,364 x 0.353 x (7.99 + 6.82)

Total cost = $515,754

Cost per sheep = 5.23c

Assumptions

1 man day = mustering, jetting and returning 500 sheep
= 34.1/day
= 6.82c/sheep

(c) Crutching costs = Number of sheep* x proportion of crutchings for blowfly control x average number of crutchings x contract crutching charges+ + labour for musterings‡).
= 9,865,364 x 0.75 x 0.988 (29.63 + 3.10)

Total cost = $2,392,640

Cost per sheep = 24.3c

Assumptions:

1 man day = 1,100 sheep for crutching, mustering, penning and returning
= $34.1/day‡
= 3.10c/sheep

75% of crutchings done for blowfly control (Brideoake, 1979).

The total cost of blowfly control in the area is $3.5m which is 35c per sheep.

* Australian Bureau of Statistics

+ Farm Budget Guide, Western Australian Department of Agriculture

‡ Federal Pastoral Industry Award Rates, September 28, 1981.

Conclusions

1. There is an increasing need to integrate drenching with management strategies. Only one-third of properties had both cattle and sheep. On these properties, most farmers had grazed sheep and cattle alternately or together. Most farmers in the lower rainfall, cereal growing areas already used cereal stubbles for grazing weaners and other classes of sheep and were more likely to use different lambing paddocks each year. Farmers rarely set stock sheep or cattle which indicates differences between experimental and farm management conditions.

2. Worm control strategies for cattle differed from expectation. There was confusion about the intensity of drenching required in different rainfall zones, the times when drenching was required and insufficient drenches were given to yearling cattle. There is a need for research to develop effective worm control strategies for each class of cattle for each rainfall zone and to confirm the effect of worms as seen in yearlings on the west coast.

There is a need to show producers that there are economic gains to be made from controlling worms in yearling cattle. The advantage of using new BZ group anthelmintics for cattle compared with the LVM and old BZ group anthelmintics requires further extension.

3. Although the average number of drenches given per year to sheep in most areas approximates current advice for all ages except for weaner sheep, there is considerable variation in drenching frequency. The adoption of the use of two 'summer' drenches is far from optimal and most farmers who did not give two drenches in 'summer' did not believe in, or did not understand, the concept. There is a need for further research to confirm that two 'summer' drenches is a suitable basis for worm control in all areas for all classes of sheep. A change in promotion of the two 'summer' drench concept is needed. Farmers need to be convinced that the effects of worms can be prevented by drenching in 'summer' and that subclinical worm damage is worth preventing especially in weaner sheep where production losses are greatest.

4. Drenches from both groups of broad spectrum anthelmintics were being used to a significant extent. Less than half the farmers surveyed used slow rotations between drench groups. This was the currently recommended strategy for delaying the development of anthelmintic resistance by worms.

5. Most farmers (87%) had adopted the Mules operation, were docking tails at the correct length (79%) and performed the operation at lamb marking time. The 'V'-mules had been poorly adopted (27.5%), particularly in the Albany and Katanning districts. Contractors were only used to mules sheep on 53.4% of properties. An extension campaign carried out in 1980 and aimed at mulesing contractors may have missed the significant number of farmers who mules their own sheep. The extension programme needs to be re-directed to include farmers who mules their own or neighbours' sheep and to show others the type of Mules operation that they should be demanding from the contractors they employ.

6. Jetting is little used except in the high rainfall zone. Spray races are mainly used on larger farms.

7. Diazinon jetting preparations are used on most farms. Vetrazin® has only been used by 26.3% of farmers. At the time of the survey Vetrazin® had only been available for the 1981 autumn flywave and would currently hold a bigger share of the market.

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APPENDICES

Appendix A — Survey questionnaire

Appendix B — Letter to owners or managers in the districts surveyed

Appendix C — As above - reminder notice

Appendix number 1 to 112 — Tabular results to survey questions.

Appendix A

Code .....

Department of Agriculture W.A.

Survey of Cattle and Sheep Parasite Control Practices 1981

Please answer all questions except where indicated otherwise. Where numbers are requested, please use nearest approximation when exact numbers are not known. Elsewhere, please indicate with a cross (X) in the box provided. Except where indicated, only ONE answer per question is required.

If you have no sheep or beef cattle, please indicate in the following box and return the questionnaire.

No sheep or beef cattle ☐

Section A—General

1. What is the area of your holding? This includes any properties or blocks in the same district as your home property?

Total area.....ha .....acre

Cleared area.....ha .....acre

2. What is the total area sown to crops in 1981?

.....ha

.....acre

None sown ☐

3. What was the number of stock on your property on *31st March 1981* and the number of stock sold in the *12 months prior* to that date?

	Number	Number sold
(a) *Beef Cattle*		
Cows (older than 2 years)		
Unweaned calves		
Replacement heifers (up to 2 yrs)		
Heifers and steers to be sold (under 2 yrs)		
Steers over 2 years old		
Bulls		
(b) *Sheep*		
Ewes (older than 18 months)		
Wethers (older than 18 months)		
Weaners (up to 18 months)		
Unweaned lambs		
Rams		

4. How long have you been farming your main property? .....years.

5. What is the number of persons who work on your property and the proportion of their time spent working on the property? Please indicate for each category of worker.

	Number of persons working on the farm (use whole numbers)	The proportion of their time spent working on the farm (use fractions)
Self		
Family members		
Hired labour		

6. For which of the following activities do you use contractors?
(Cross as many boxes as required).

- ☐ Mulesing sheep
- ☐ Jetting for blowfly control
- ☐ Drenching cattle
- ☐ Drenching sheep
- ☐ Shearing sheep
- ☐ Crutching sheep

7. Do you graze sheep and cattle on the same paddocks?

- ☐ No
- ☐ Both sheep and cattle grazed together on the same paddock
- ☐ One species follows the other
- ☐ Don't own cattle
- ☐ Don't own sheep

8. Do you set stock (the same mob or flock grazing the same paddock throughout the year) the following classes of cattle and sheep?

Cattle	Yes	No	Some mobs	Don't know
Cows	☐	☐	☐	☐
Steers and heifers to be sold	☐	☐	☐	☐
Replacement heifers	☐	☐	☐	☐

☐ Don't own cattle

Sheep	Yes	No	Some mobs	Don't know
Weaners	☐	☐	☐	☐
Ewes	☐	☐	☐	☐
Wethers	☐	☐	☐	☐

☐ Don't own sheep

9. Do you use cereal stubbles to graze the following classes of sheep?

	Yes	No	Some flocks	Don't know
Weaners	☐	☐	☐	☐
Ewes	☐	☐	☐	☐
Wethers	☐	☐	☐	☐

☐ Don't have cereal stubbles

Section B—Beef cattle enterprise

If you have no beef cattle please proceed to section C (page 5).

10. Please describe your beef activity, e.g. selling baby beef at weaning, stud breeder, feedlotting etc.

_____

_____

_____

11. Indicate the month when mating commences. (If bulls are with the cows all year round draw a line through all boxes).

☐ Not applicable

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Not sure
Mating commences	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

12. When did you drench your beef cattle in the 12 months prior to July 1981? Please cross for each class of cattle the months when drenching occurred.

(a) Unweaned calves

☐ Calves not drenched

☐ Don't own calves

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't Remember
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

(b) Replacement heifers

☐ Heifers not drenched

☐ Don't own heifers

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't Remember
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

(c) Heifers and steers to be sold (under 2 years old)

☐ Heifers and steers not drenched

☐ Don't own heifers or steers

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't Remember
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

(d) Steers over 2 years old

☐ Steers over 2 years not drenched

☐ Don't run steers over 2 years old

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't Remember
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

(e) Females over 2 years old

☐ Females over 2 years old not drenched

☐ Don't own females over 2 years old

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't Remember
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

13. When you drenched did you treat:

☐ All cattle as part of a routine worming programme

☐ Some cattle on a routine programme

☐ Only mobs with cattle showing signs of worms

☐ Only cattle showing signs of worms

☐ Other: specify .....

☐ Don't know

☐ Not applicable

14. Did you drench calves at weaning?

☐ All calves

☐ Some calves: specify .....

☐ Nil calves drenched

☐ Don't know

☐ Not applicable

15. What drench(es) did you use to a major extent in the year prior to July 1981 (cross 1, 2 or up to 3 boxes if necessary)

- ☐ Neguvon
- ☐ Premier
- ☐ Rintal
- ☐ Nemafax
- ☐ Panacur
- ☐ Telmin
- ☐ Camben
- ☐ Systamex
- ☐ Other: specify .....
- ☐ Can't remember
- ☐ Levasole
- ☐ Valbazen
- ☐ Broadspec
- ☐ Ripercol
- ☐ Wormguard
- ☐ Topclip
- ☐ Nilverm
- ☐ Thibenzole
- ☐ Synanthic
- ☐ Not applicable

Have you any other comments to make on parasite control in cattle?

_____

_____

_____

Section C—Sheep enterprise

If you have no sheep please proceed to the end of the questionnaire.

16. Please describe your sheep activity (e.g. wool production, fat lambs etc.).

_____

_____

17. Sheep breeds

(a) What is your major ewe breed? _____

Not applicable ☐

(b) Other ewe breeds (if any)? _____

(c) What is your major ram breed? _____

Not applicable ☐

(d) Other ram breeds (if any)? _____

18. Indicate the month in the 1980/81 season when mating commenced. If you have a group of breeding ewes that are mated at a different time of the year, use a different set of boxes for each mating date.

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Unsure
Mating 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mating 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Not applicable ☐

19. Which paddocks are used for lambing paddocks?

Same paddock(s) used each year ☐

Most of the same paddock(s) used each year ☐

Some of the same paddock(s) used each year ☐

Different paddock(s) used each year ☐

Don't know ☐

20. In which month, during the 12 months prior to June 1981 were most of your sheep shorn?

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't know
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

21. Indicate the month(s) when crutching was done during the 12 months prior to July 1981. Cross as many boxes as required for each class of sheep.

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't know
Ewes (older than 18 mths)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Lambs (up to 18 mths)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Weaners (weaning to 18 mths)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Wethers (older than 18 mths)	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Rams	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

☐ None crutched

22. When did you drench your sheep in the 12 months prior to July 1981? (Please cross the months when drenching occurred for each class of sheep).

(a) Ewes (older than 18 months)

☐ Ewes not drenched

☐ Don't own ewes

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't Remember
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

(b) Lambs (up to weaning)

☐ Lambs (up to weaning) not drenched

☐ Don't own lambs

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't Remember
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

(c) Weaners (weaning to 18 months)

☐ Weaners (weaning to 18 months) not drenched

☐ Don't own weaners

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't Remember
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

(d) Wethers (older than 18 months)

☐ Wethers not drenched

☐ Don't own wethers

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Don't Remember
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

23. What drenches did you use to a major extent in the year from July 1980 to June 1981? (Cross a maximum of 3 boxes)

Narrow spectrum:

☐ M.S.D. Barbers Pole drench

☐ Rametin H

☐ Ranide

☐ Bayer management drench

Broad spectrum:

☐ Valbazen

☐ Camben

☐ Rintal

☐ Levasole

☐ Synanthic

☐ Panacur

☐ Premier

☐ Systamex

☐ Thibenzole

☐ Ripercol

☐ Nemafax

☐ Topclip

☐ Wormguard

☐ Nilverm

☐ Broadspec

☐ Others, please specify.....

24. If you crossed more than one box in question 23 what was the reason for using more than one type of drench (cross only one box)

- ☐ Rotate drenches at regular intervals.
- ☐ Use different drenches for different types of worms
- ☐ Previous drench wasn't working
- ☐ Rotate drenches at irregular intervals
- ☐ Bought cheapest drench available
- ☐ Use different drenches on different types of sheep
- ☐ Thought it was about time for a change
- ☐ Other, please specify .....
- ☐ Not applicable

25. If any of your sheep did not receive a double 'summer' drench. (Two broad spectrum drenches between the beginning of November 1980 and the end of March 1981) please indicate the two most important reasons for each class of sheep.

	Ewes	Weaners	Wethers
Not applicable	☐	☐	☐
Had insufficient time for drenching	☐	☐	☐
Could not afford to buy the drench at this time	☐	☐	☐
Reluctant to muster at this time	☐	☐	☐
Sheep were showing no sign of worms	☐	☐	☐
On holiday	☐	☐	☐
Drenching at this time conflicts with other farm activity	☐	☐	☐

	Ewes	Weaners	Wethers
Summer drenches are not necessary	☐	☐	☐
One drench in 'summer' is enough	☐	☐	☐
Two drenches in 'summer' are not enough	☐	☐	☐
Could not organise labour	☐	☐	☐
Haven't needed to drench at this time in the past	☐	☐	☐
Other: specify	☐	☐	☐
Don't know	☐	☐	☐

26. If you took no action to prevent blowfly strike do you think that flystrike would be a problem in your flock? (Action includes time of shearing, mulesing, crutching, jetting etc.).

☐ Major problem

☐ Minor problem

☐ No problem

☐ Don't know

☐ Other: specify .....

27. Which do you consider to be the more important problem in your flock? Body strike or breech strike?

☐ Body strike is more important

☐ Breech strike is more important

☐ Both are equally important

☐ Neither is a problem

☐ Don't know

28. Were any of your sheep (including lambs and weaners) mulesed during 1980?

- ☐ None mulesed
- ☐ All lambs mulesed
- ☐ Some lambs mulesed
- ☐ Weaners mulesed
- ☐ Other: specify .....
- ☐ Don't remember

If you did not mules any sheep in 1980 please proceed to question 32.

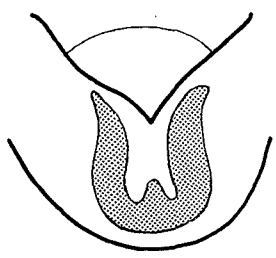
29. When were these sheep mulesed in 1980?

- ☐ Not applicable
- ☐ At lamb marking
- ☐ Between marking and weaning
- ☐ At weaning
- ☐ After weaning
- ☐ Other: specify .....

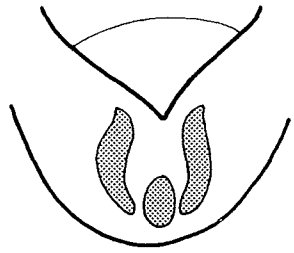
30. Who did the Mules operation on your sheep in 1980?

- ☐ Not applicable
- ☐ Contractor
- ☐ Self (including family)
- ☐ Farm employee
- ☐ Neighbour
- ☐ Other: specify .....

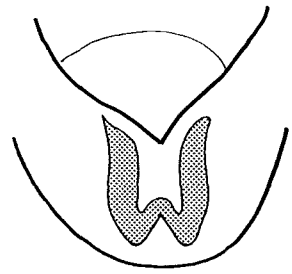
31. What type of Mules operation was done in 1980? Please cross the box for the diagram which best describes the Mules operation performed on your sheep.



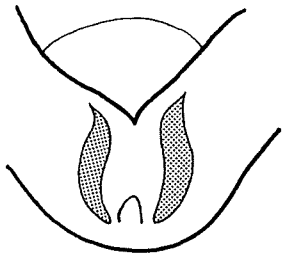
A ☐



B ☐



C ☐



D ☐

E Other ☐
(please draw in this space provided)

F Don't know ☐

32. If you did not Mules could you please indicate the reason(s) why? Cross no more than two (2) boxes.

☐ Flystrike is not a problem in my flock

☐ I produce fat lambs to be sold at weaning

☐ Mules operation is of no benefit to my breed of sheep

☐ Mules operation is cruel

☐ Mules operation does not prevent body strike

☐ Mulesing is difficult to organise

☐ Shortage of labour or contractors

- ☐ Too risky because of flystrike in wounds
- ☐ I buy in replacement sheep too old to mules
- ☐ I buy in replacement sheep already mulesed
- ☐ Don't know
- ☐ Other: specify .....

33. To what length do you dock your lambs' tails?

- ☐ As short as possible
- ☐ First (1st) joint
- ☐ Tip of vulva (or equivalent in wethers)
- ☐ Don't know
- ☐ Other: specify .....

34. When did you jet your sheep in the 12 months prior to June 1981? (Please indicate for each class of sheep.)

(a) Ewes (older than 18 months)

- ☐ Ewes not jetted
- ☐ Don't own ewes

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Not sure
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

(b) Lambs (up to weaning)

☐ Lambs not jetted

☐ Don't own lambs

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Not sure
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

(c) Weaners (weaning up to 18 months)

☐ Weaners not jetted

☐ Don't own weaners

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Not sure
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

(d) Wethers (older than 18 months)

☐ Wethers not jetted

☐ Don't own wethers

July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Not sure
☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

35. Which jetting insecticide(s) did you use during the 12 months prior to July 1981? (Cross up to 3 boxes if required).

☐ Diazadip®

☐ Dipjet®

☐ Dizon 80®

☐ Lucijet®

☐ Neguvon soluble powder®

- ☐ Suprex 100®
- ☐ Vetrazin®
- ☐ Other: specify .....
- ☐ Don't remember
- ☐ Not applicable

36. How were the sheep jetted?

- ☐ Hand wand
- ☐ Automatic jetting race
- ☐ Other: specify .....
- ☐ Don't know
- ☐ Not applicable

Do you have any further comments to make on worm and blowfly control in sheep?

This completes the questionnaire.
Thank you very much for your co-operation.
Could you please return the questionnaire as soon as possible?
Thank you.

Appendix B

To the Owner or Manager

Western Australian
Department of Agriculture
July 1981
BASJ

Dear Sir/Madam,

Parasitic diseases of sheep and cattle can cause significant production losses. In recent research at Mt. Barker, worms in weaner sheep reduced fleece weights by 0.85 kg per head and body weight by 7.5 kg. At Wokalup, 35-45 kg body weight losses have been recorded in untreated yearling beef cattle. Blowfly strike in sheep causes deaths and production losses and the costs of control are high. In addition worms and blowflies which are resistant to chemicals have been found in this region. There is a continuing need to develop worm control programmes which ensure optimum production while minimising the development of resistant strains of worms.

The Department of Agriculture has acknowledged this need by appointing a Veterinary Parasitologist to the Regional Veterinary Laboratory at Albany. He will be responsible for investigating parasite problems and control programmes for the whole south coast region (Albany, Katanning, Jerramungup and Esperance districts). This questionnaire is being sent to 800 farmers in the south coastal region of Western Australia. It has been designed by research staff in the region with the assistance of 15 farmers from the region.

The information from this survey of cattle and sheep parasite control practices will be used to:

1. Determine priorities for future research and extension.
2. Determine where parasite control as currently practised on farms can be improved. We will be able to pinpoint areas where costs can be cut and efficiency increased.

The accuracy and value of such a questionnaire to the agricultural community is dependent on the number of responses. Therefore every reply is extremely important.

The questionnaire is designed to be completed in approximately 30 minutes and returned in the stamped addressed envelope provided. Individual answers will be treated with confidence and each questionnaire is identified by a code number so that they can be recorded on return. A reminder will be sent at a later date if we have received no reply. A summary of results will be sent to each participating farmer when the results have been analysed.

I sincerely hope that you will assist with this survey which will be used for improving parasite control within the region.

If you have any questions arising from the survey please contact one of the following:

Roy Gwynn	Albany	Telephone: 412166
John Edwards		
Richard Norris	Katanning	211599
Grant Morrow		
Gavin Dalton-Morgan	Esperance	712088

Thanking you in anticipation of your reply.

Yours faithfully,

J. M. ARMSTRONG
Chief Veterinary Surgeon

Appendix C

To the Owner or Manager

Western Australian
Department of Agriculture
BASJ

Dear Sir/Madam,

Cattle and Sheep Parasite Control Questionnaire

During July we posted to you and other stock owners a survey questionnaire on cattle and sheep parasite control and the response so far has been most gratifying.

However, our records indicate that your reply has not been received to date.

Enclosed is a new questionnaire in case you have misplaced the previous one. Each reply is of particular importance in increasing the accuracy and value of this survey. Could you please complete the questionnaire and return in the stamped addressed envelope provided.

If you have recently posted your completed questionnaire please disregard this further request.

Yours faithfully

J. M. ARMSTRONG,
Chief Veterinary Surgeon

Appendix 1

Variation in response to the survey between districts and between Shires

Shire	Number of questionnaires sent	Questionnaires returned		Questionnaires usable		Questionnaires usable per district.
		No.	%	No.	%	%
Albany	154	115	74.7	79	51.3	
Cranbrook	40	33	82.5	28	70.0	Albany
Denmark/Walpole	60	40	66.7	27	45.0	56.0
Plantagenet	121	93	76.9	76	62.8	
Esperance	112	68	60.7	51	45.5	Esperance
Ravensthorpe	35	24	68.6	18	51.4	46.9
Broomehill	17	13	76.5	13	76.5	
Gnowangerup	90	64	71.1	60	66.7	
Katanning	32	22	68.8	18	56.3	
Kent	27	19	70.4	15	55.6	Katanning
Kojonup	71	59	83.1	49	69.0	66.2
Tambellup	21	14	66.7	13	61.9	
Wagin	8	7	87.5	7	87.5	
Woodanilling	12	10	83.3	9	75.0	
Total	800	581	72.6	463	57.9	

$\chi^2_{11} = 35.4$ $P < 0.001$ $\chi^2_{11} = 15.6$ $P < 0.001$

Appendix 2

Distribution of total numbers of beef cattle per farm recorded in the survey compared with numbers from the Lower Great Southern and Dundas Statistical Division of the Australian Bureau of Statistics (ABS)

No. of cattle	Survey		ABS statistics*	
	No. of farms	%	No. of farms	%
30— 49	35	16.1	200	13.8
50— 69	24	11.0	181	12.5
70— 99	34	15.6	224	15.4
100— 149	36	16.5	250	17.2
150— 199	19	8.7	171	11.8
200— 299	29	13.3	184	12.7
300— 399	9	4.1	86	5.9
400— 499	8	3.7	55	3.8
500— 699	7	3.2	54	3.7
700— 999	7	3.2	15	1.0
1,000—1,499	4	1.8	15	1.0
1,500—1,999	3	1.4	7	0.5
2,000—4,999	3	1.4	7	0.5
>5,000	—	—	1	0.07
Total	218	100.0	1450	100.0

$\chi^2_{11} = 16.3$ $P = 0.13$

* 31st March 1981

Appendix 3

Distribution of sheep numbers, Lower Great Southern Statistical Division. Comparison of survey data with that of the Australian Bureau of Statistics

No. of sheep	Survey		ABS statistics*	
	No. of farms	%	No. of farms	%
100-499	34	10.6	221	9.5
500-999	23	7.2	217	9.3
1,000-1,499	20	6.4	207	8.9
1,500-1,999	21	6.5	197	8.4
2,000-2,999	50	15.6	428	18.3
3,000-3,999	50	15.6	336	14.4
4,000-4,999	33	10.3	233	10.0
5,000 plus	90	28.0	497	21.3
Total	321	100.0	2336	100.0

$\chi^2_7 = 12.6$ $P < 0.1$

*31st March, 1981

Appendix 4

Difference in stocking policy between districts

District	Sheep		Cattle		Sheep and cattle		Total
	No. of farms	%	No. of farms	%	No. of farms	%	
Albany	61	29.0	62	29.5	87	41.4	210
Esperance	36	52.2	4	5.8	29	42.0	69
Katanning	133	72.3	0	0.0	51	27.7	184

$\chi^2_4 = 106.9$ $P = < 0.001$

Appendix 5

Distribution of farms within categories of total area, cleared area and area cropped

Area ha	Total area		Cleared area		Area cropped	
	No. of farms	%	No. of farms	%	No. of farms	%
0—9	0	0.0	1	0.2	126	27.5
10—19	1	0.2	5	1.2	10	2.1
20—29	5	1.1	4	0.9	8	1.7
30—39	3	0.7	5	1.1	14	3.1
40—49	10	2.2	9	2.0	16	3.5
50—74	13	2.8	17	3.9	20	4.4
75—99	8	1.7	9	2.0	22	4.8
100—124	9	2.0	16	3.6	16	3.5
125—149	5	1.1	4	0.9	9	2.0
150—199	13	2.8	16	3.6	23	5.0
200—249	22	4.8	21	4.8	25	55.5
250—299	18	3.9	10	2.3	19	4.1
300—399	17	3.7	27	6.1	29	6.3
400—499	23	5.0	24	5.4	34	7.4
500—749	43	9.4	45	10.2	40	8.7
750—999	53	11.6	49	11.1	20	4.4
1,000—1,999	126	27.5	112	25.4	23	5.0
2,000—2,999	54	11.8	39	8.8	2	0.4
3,000—3,999	12	2.6	13	2.9	1	0.2
4,000—4,999	12	2.6	9	2.0	1	0.2
5,000—9,999	8	1.7	5	1.1	0	0.0
> 10,000	3	0.7	1	0.2	0	0.0
Total	458	100.0	441	100.0	458	100.0

Appendix 6

Number of years respondent had been farming main property

Years	No. of farms	%
1—5	81	18.4
6—10	61	13.9
11—15	56	12.7
16—20	86	19.5
21—25	50	11.4
26—30	43	9.8
> 30	63	14.3
Total	440	100.0

Appendix 7

The units of labour working on the farm including a breakdown into proportions of self, family and hired labour

Units of labour	Total labour		Self		Family		Hired Labour	
	No. of farms	%	No of farms	%	No. of farms	%	No. of farms	%
0	0	0.0	20	4.5	167	37.9	285	66.9
0.01-0.49	29	6.9	45	10.2	64	14.5	35	8.2
0.5-0.99	44	10.5	90	20.5	68	15.4	28	6.6
1.0	47	11.2	271	61.6	79	17.9	48	11.3
1.01-1.5	65	15.5	—	—	6	1.4	4	0.9
1.51-2.0	123	29.3	11	2.5	32	7.3	15	3.5
2.01-3.0	71	16.9	2	0.5	17	3.9	4	0.9
3.01-4.0	23	5.5	—	—	6	1.4	2	0.5
4.01-5.0	11	2.6	1	0.2	2	0.5	1	0.2
5.01-10.0	7	1.7	—	—	—	—	4	0.9
Total	420	100.0	440	100.0	441	100.0	426	100.0
Mean	1.896 ± 0.06		0.867 ± 0.12		0.666 ± 0.04		0.384 ± 0.05	

Appendix 8

Use of contractors for stock activities

Use of contractors	Activity											
	Mules operation		Jetting		Drench cattle		Drench sheep		Shear sheep		Crutch sheep	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Contractor not used	221	55.8	385	97.0	240	96.8	381	96.5	50	12.6	144	6.3
Contractor used	175	44.2	12	3.0	8	3.2	14	3.5	347	87.4	253	63.7
Total	396	100.0	397	100.0	248	100.0	395	100.0	397	100.0	397	100.0

Appendix 9

Number of positive responses to the question 'Do you graze sheep and cattle on the same paddocks?'

Grazing strategy	No. of farms	%
Sheep and cattle not grazed on same paddocks	25	15.0
Both sheep and cattle grazed together on the same paddock	90	53.9
One species follows the other	42	25.1
Both grazing together and one species follows the other	10	6.0
Total	167	100.0

Appendix 10

Grazing strategies used for cattle in each district

District	Cows						Steers and heifers for sale						Replacement heifers					
	Set stocked		Some mobs set stocked		Not set stocked		Set stocked		Some mobs set stocked		Not set stocked		Set stocked		Some mobs set stocked		Not set stocked	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Albany	35	24.3	13	9.0	96	66.7	23	19.0	9	7.4	89	73.6	20	18.0	6	5.4	85	76.6
Esperance	6	19.4	7	22.6	18	58.1	4	15.4	3	11.5	19	73.1	7	26.9	2	7.7	17	65.4
Katanning	18	31.0	7	12.1	33	56.9	17	32.1	4	7.5	32	60.4	12	26.1	2	4.3	32	69.6
Total	59	25.3	27	11.6	147	63.1	44	22.0	16	8.0	140	70.0	39	21.3	10	5.5	134	73.2

$\chi^2_4 = 6.1$ $P = 0.19$ $\chi^2_4 = 4.88$ $P = 0.3$ $\chi^2_4 = 2.2$ $P = 0.7$

Appendix 11

Grazing strategies used for sheep in each district

District	Ewes						Weaners						Wethers					
	Set stocked		Some mobs set stocked		Not set stocked		Set stocked		Some mobs set stocked		Not set stocked		Set stocked		Some mobs set stocked		Not set stocked	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Albany	37	28.7	16	12.4	76	58.9	31	23.7	10	7.6	90	68.7	44	35.8	11	8.9	68	55.3
Esperance	9	14.5	5	8.1	48	77.4	10	15.9	3	4.8	50	79.4	11	17.7	6	9.7	45	72.6
Katanning	22	13.4	26	15.9	116	70.7	17	10.7	24	15.1	118	74.2	32	20.5	24	15.4	100	64.1
Total	68	19.2	47	13.2	240	67.6	58	16.4	37	10.5	258	73.4	87	25.5	41	12.0	213	62.5

$\chi^2_4 = 14.4$ $P < 0.01$ $\chi^2_4 = 14.3$ $P < 0.001$ $\chi^2_4 = 12.9$ $P < 0.05$

Appendix 12

Use of cereal stubbles by sheep

Use of cereal stubbles	Ewes		Weaners		Wethers	
	No. of farms	%	No. of farms	%	No. of farms	%
Cereal stubbles used	209	59.5	263	69.6	122	41.1
Cereal stubbles not used	34	9.7	17	4.5	81	27.3
Some flocks only on cereal stubble	37	10.5	20	5.3	32	10.8
No cereal stubble	71	20.2	78	20.6	62	20.9
Total	351	100.0	378	100.0	297	100.0

$\chi^2_6 = 102.8$ $P < 0.001$

Appendix 13

Main and secondary beef production activities

Production activity	Beef production main activity		Beef production secondary activity	
	No. of farms	%	No. of farms	%
Baby beef	152	71.0	9	16.7
Steers and heifers < 2 years old	23	10.7	23	42.6
Steers > 2 years old	12	5.6	7	13.0
Trading	4	1.9	2	3.7
Breed calves for feedlot	7	3.3	7	13.0
Buy in for feedlot	—	—	2	3.7
Stud	16	7.5	4	7.4
Total	214	100.0	54	100.0

Appendix 14

The main beef production activity of farms in each district

Production activity	District					
	Albany		Esperance		Katanning	
	No. of farms	%	No. of farms	%	No. of farms	%
Baby beef	108	77.1	18	64.3	26	56.5
Steers and heifers for sale < 2 years of age	11	7.9	6	21.4	6	13.0
Steers > 2 years	6	4.3	3	10.7	3	6.5
Trading	4	2.9	0	0.0	0	0.0
Breed for feedlot	3	2.1	1	3.6	3	6.5
Stud	8	5.7	0	0.0	8	17.4
Total	140	100.0	28	100.0	46	100.0

$\chi^2_{10} = 21.2$ $P < 0.05$

Appendix 15

Number of cattle as at March 31, 1981

Cattle number categories	No. of cattle Total		No. of cows		No. of calves		No. of replacement heifers		No. of steers and heifers for sale < 2 years		No. of steers > 2 years		No. of cattle sold	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
0	3	1.3	11	4.8	76	32.9	79	34.2	66	28.6	186	80.5	39	17.0
1— 29	10	4.3	45	19.5	73	31.6	116	50.2	76	32.9	33	14.3	55	23.9
30— 49	35	15.2	48	20.8	29	12.6	10	4.3	36	15.6	3	1.3	34	14.8
50— 69	24	10.4	40	17.3	14	6.1	9	3.9	14	6.1	4	1.7	18	7.8
70— 99	34	14.7	24	10.4	15	6.5	6	2.6	12	5.2	2	0.9	25	10.9
100— 149	36	15.6	19	8.2	7	3.0	2	0.9	5	2.2	1	0.4	18	7.8
150— 199	19	8.2	13	5.6	4	1.7	3	1.3	4	1.7	—	—	14	6.1
200— 299	29	12.6	16	6.9	8	3.5	5	2.2	6	2.6	1	0.4	11	4.8
300— 399	9	3.9	6	2.6	—	—	—	—	4	1.7	1	0.4	4	1.7
400— 499	8	3.5	2	0.9	2	0.9	1	0.4	3	1.3	—	—	3	1.3
500— 699	7	3.0	2	0.9	2	0.9	—	—	5	2.2	—	—	4	1.7
700— 999	7	3.0	4	1.7	1	0.4	—	—	—	—	—	—	3	1.3
1,000—1,499	4	1.7	1	0.4	—	—	—	—	—	—	—	—	2	0.9
1,500—1,999	3	1.3	—	—	—	—	—	—	—	—	—	—	—	—
2,000—4,999	3	1.3	—	—	—	—	—	—	—	—	—	—	—	—
Total	231	100.0	231	100.0	231	100.0	231	100.0	231	100.0	231	100.0	231	100.0
Mean	231.8		102.5		44.6		20.9		52.8		6.4		96.7	
Minimum	0		0		0		0		0		0		0	
Maximum	2486		1100		800		400		340		340		1209	

Appendix 16

Month mating commenced for cattle

Month	No. of farms	%
Jan.	—	—
Feb.	2	0.9
Mar.	8	3.7
Apr.	9	4.2
May	43	19.9
June	76	35.2
July	32	14.8
Aug.	5	2.3
Sept.	1	0.5
Oct.	1	0.5
Nov.	2	0.9
Dec.	—	—
All year	36	16.7
Not sure	1	0.5
Total	216	100.0

Appendix 17

Month mating commenced for cattle on farms in each district

Month mating commenced	Albany		Esperence		Katanning	
	No. of farms	%	No. of farms	%	No. of farms	%
Feb.-Apr.	14	10.1	3	10.3	2	4.1
May	34	24.6	2	6.9	7	14.3
June	47	34.1	9	31.0	20	40.8
July	17	12.3	7	24.1	8	16.3
Aug.-Nov.	7	5.1	2	6.9	0	0.0
All year	18	13.0	6	20.7	12	24.5
Total	138	100.0	29	100.0	49	100.0

$\chi^2_{10} = 15.3$ $P = 0.12$

Appendix 18

Association between total number of cattle and the month when mating commenced

No. of cattle	Commencement of mating							
	Early (Feb. to May)		Middle (June to July)		Late (Aug. to Nov.)		All year	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
<50	12	19.4	11	10.3	2	22.2	11	30.6
50 - 149	18	29.0	54	50.5	4	44.4	17	47.2
150 - 299	19	30.6	17	15.9	1	11.1	8	22.2
300 - 500	6	9.7	10	9.3	0	0.0	0	0.0
>500	7	11.3	15	14.0	2	22.2	0	0.0
Total	62	100.0	107	100.0	9	100.0	36	100.0

$\chi^2_{12} = 26.0$ $P < 0.05$

Appendix 19

Programme for drenching cattle

Drenching programme	No. of farms	%
All cattle drenched as part of a routine worming programme	85	52.5
Some cattle drenched on a routine programme	17	10.5
Only herds drenched with cattle showing signs of worms	19	11.7
Only cattle drenched showing signs of worms	33	20.4
Other	7	4.3
Don't know	1	0.6
Total	162	100.0

Appendix 20

Relationship between total number of cattle on farms and drenching programme

No. of cattle per farm	Drenching programme								
	All cattle drenched as part of routine programme		Some cattle drenched as part of routine programme		Only drenched herds with cattle showing signs of worms		Only drenched cattle showing signs of worms		Total no. of farms
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
< 50	16	66.7	0	0.0	4	16.7	4	16.4	24
50—149	40	65.6	6	9.8	3	4.9	12	19.7	61
150—299	19	47.5	3	7.5	9	22.5	9	22.5	40
300—500	2	16.7	4	33.3	1	8.4	5	8.4	12
>500	8	50.0	4	25.0	2	12.5	2	12.5	16

$\chi^2_{15} = 29.9$ $P < 0.05$

Appendix 21

Number of farmers in each district giving calves a weaning drench

Weaning drench	Albany		Esperance		Katanning		Total	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
All calves	55	31.0	10	55.6	24	63.2	69	40.0
Some calves	15	13.3	1	5.6	1	2.6	17	10.1
None drenched at weaning	63	55.8	7	38.9	13	34.2	83	49.1
Total	113	100.0	18	100.0	38	100.0	169	100.0

$\chi^2_4 = 15.0$ $P<0.01$

Appendix 22

Number of drenches given to calves in each district

No. of drenches	District					
	Albany		Esperance		Katanning	
	No. of farms	%	No. of farms	%	No. of farms	%
Nil	75	60.0	18	66.7	19	46.3
1	35	28.0	6	22.2	14	34.1
2 or more	15	12.0	3	11.1	8	19.5
Total	125	100.0	27	100.0	41	100.0
Mean ± S.E.	0.54 ± 0.07		0.76 ± 0.13		0.52 ± 0.18	

$\chi^2_4 = 3.7$ $P = 0.45$

Appendix 23

Number of drenches given to replacement heifers in each district

No. of drenches	District					
	Albany		Esperance		Katanning	
	No. of farms	%	No. of farms	%	No. of farms	%
Nil	53	50.5	14	56.0	9	22.5
1	33	31.4	6	24.0	16	40.0
2 or more	19	18.1	5	20.0	15	37.5
Total	105	100.0	25	100.0	40	100.0
Mean ± S.E.	0.73 ± 0.09		0.88 ± 0.25		1.23 ± 0.14	

$\chi^2_4 = 19.2$ $P < 0.001$

Appendix 24

Number of drenches given to heifers and steers < 2 years of age in each district.

No. of drenches	District					
	Albany		Esperance		Katanning	
	No. of farms	%	No. of farms	%	No. of farms	%
Nil	53	46.1	11	45.8	11	28.2
1	33	28.7	6	25.0	15	38.5
2	19	16.5	4	16.7	10	25.6
3 or more	10	8.7	3	12.5	3	7.7
Total	115	100.0	24	100.0	39	100.0
Mean ± S.E.	0.99 ± 0.14		1.0 ± 0.24		1.13 ± 0.15	

$\chi^2_6 = 5.3$ $P = 0.51$

Appendix 25

Number of drenches given to steers older than 2 years in each district

No. of drenches	District					
	Albany		Esperance		Katanning	
	No. of farms	%	No. of farms	%	No. of farms	%
Nil	25	64.1	9	81.8	4	28.6
1	5	12.8	1	9.1	5	35.7
2 or more	9	23.1	1	9.1	5	35.7
Total	39	100.0	11	100.0	14	100.0
Mean ± S.E.	0.64 ± 0.15		1.21 ± 0.28		0.27 ± 0.20	

$\chi^2_4 = 8.8$ $P < 0.1$

Appendix 26

Number of drenches given to cows in each district

No. of drenches	District					
	Albany		Esperance		Katanning	
	No. of farms	%	No. of farms	%	No. of farms	%
Nil	70	58.3	17	68.0	15	34.9
1	34	28.3	3	12.0	12	27.9
2	10	8.3	3	12.0	13	30.2
3	6	5.0	2	8.0	3	7.0
Total	120	100.0	25	100.0	43	100.0
Mean ± S.E.	0.60 ± 0.08		0.60 ± 0.20		1.09 ± 0.15	

$\chi^2_6 = 17.9$ $P<0.01$

Appendix 27

Number of drenches per annum given to cattle in each climatic zone

Class of cattle	No. of drenches per year	Climatic zone				
		Coastal	Plantagenet	Moderate rainfall	Low rainfall	South-east
		No. of farms %	No. of farms %	No. of farms %	No. of farms %	No. of farms %
Calves	Nil	50 66.7	18 46.2	17 53.1	9 45.0	18 66.7
	1	18 24.0	15 38.5	10 31.3	6 30.0	6 22.2
	2	5 6.7	5 12.8	5 15.6	4 20.0	2 7.4
	3 or more	2 2.7	1 2.6	0 0.0	1 5.0	1 3.7
	Total	75 100.0	39 100.0	32 100.0	20 100.0	27 100.0
	Mean ± S.E.	0.453 ± 0.086	0.718 ± 0.127	0.625 ± 0.133	0.850 ± 0.209	0.519 ± 0.180 P = 0.56
Replacement heifers	Nil	37 58.7	12 37.5	9 29.0	4 21.1	14 56.0
	1	19 30.2	11 34.4	12 38.7	7 36.8	6 24.0
	2	5 7.9	8 25.0	7 22.6	7 36.8	0 0.0
	3 or more	2 3.2	1 3.1	3 9.7	1 5.3	5 20.0
	Total	63 100.0	32 100.0	31 100.0	19 100.0	25 100.0
	Mean ± S.E.	0.571 ± 0.105	0.938 ± 0.155	1.161 ± 0.186	1.263 ± 0.186	0.880 ± 0.254 P < 0.005
Steers < 2 years	Nil	32 48.5	14 37.8	13 39.4	5 27.8	11 45.8
	1	20 30.3	11 29.7	11 33.3	6 33.3	6 25.0
	2	8 12.1	9 24.3	6 18.2	6 33.3	4 16.7
	3 or more	6 9.1	3 8.1	3 9.1	1 5.6	3 12.5
	Total	66 100.0	37 100.0	33 100.0	18 100.0	24 100.0
	Mean ± S.E.	0.455 ± 0.205	1.081 ± 0.187	1.030 ± 0.202	1.167 ± 0.218	1.000 ± 0.241 P = 0.85
Steers > 2 years	Nil	17 77.3	5 38.5	6 50.0	1 16.7	9 81.8
	1	2 9.1	3 23.1	2 16.7	3 50.0	1 9.1
	2 or more	3 13.6	5 38.5	4 33.3	2 33.3	1 9.1
	Total	22 100.0	13 100.0	12 100.0	6 100.0	11 100.0
	Mean ± S.E.	0.409 ± 0.182	1.077 ± 0.288	0.917 ± 0.313	1.333 ± 0.422	0.273 ± 0.195 P < 0.1
Cows	Nil	47 65.3	17 47.2	14 40.0	7 35.0	17 68.0
	1	18 25.0	12 33.3	11 31.4	5 25.0	3 12.0
	2	3 4.2	5 13.9	8 22.9	7 35.0	3 12.0
	3 or more	4 5.6	2 5.6	2 5.7	1 5.0	2 8.0
	Total	72 100.0	36 100.0	35 100.0	20 100.0	25 100.0
	Mean ± S.E.	0.50 ± 0.097	0.778 ± 0.150	0.943 ± 0.159	1.100 ± 0.216	0.600 ± 0.200 P < 0.05

Appendix 28

Relationship between the main beef production activity and the number of drenches given to cows

No. of drenches given to cows	Main production activity					
	Baby beef		Steers, heifers trading and feedlot		Studs	
	No. of farms	%	No. of farms	%	No. of farms	%
Nil	75	56.4	16	48.5	6	40.0
1	38	28.6	7	21.2	3	20.0
2 or more	20	15.0	10	30.3	6	40.0
Total	133	100.0	33	100.0	15	100.0

$\chi^2_4 = 8.1$ $P < 0.1$

Appendix 29

Number of farmers drenching different classes of cattle in different months

Month	Calves		Heifers		Heifers and steers for sale < 2 years		Steers <2 years		Cows	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
July	19	16.0	11	7.4	15	8.2	2	4.3	13	9.7
Aug.	8	6.7	9	6.0	15	8.2	6	13.0	9	6.7
Sept.	7	5.9	6	4.0	10	5.4	2	4.3	6	4.5
Oct.	5	4.2	5	3.4	9	4.9	4	8.7	4	3.0
Nov.	6	5.0	8	5.4	9	4.9	2	4.3	4	3.0
Dec.	5	4.2	11	7.4	7	3.8	3	6.5	8	6.0
Jan.	6	5.0	18	12.1	21	11.4	2	4.3	11	8.2
Feb.	8	6.7	11	7.4	16	8.7	3	6.5	16	11.9
Mar.	12	10.1	18	12.1	23	12.5	8	17.4	14	10.4
Apr.	11	9.2	16	10.7	24	13.0	4	8.7	18	13.4
May	17	14.3	24	16.1	21	11.4	5	10.9	15	11.2
June	15	12.6	12	8.1	14	7.6	5	10.9	16	11.9
Total	119	100.0	149	100.0	184	100.0	46	100.0	134	100.0
	$\chi^2_{11} = 12.1$ P = 0.36		$\chi^2_{11} = 13.3$ P = 0.27		$\chi^2_{11} = 12.8$ P = 0.31		$\chi^2_{11} = 4.8$ P = 0.94		$\chi^2_{11} = 13.4$ P = 0.27	

Appendix 30

Drenches used for cattle by respondents during the previous 12 months. Up to three drenches used were listed by each respondent

Drenches	No. of responses	%	
Neguvon®	1	0.4	2.0 Other
Premier®	4	1.6	25.8 Levamisole
Nilverm®	42	17.2	
Ripercol®	21	8.6	
Thibenzole®	15	6.1	8.9 Old benzimidazole
Broadspec®	1	0.4	
Wormguard®	1	0.4	
Telmin®	1	0.4	
Topclip®	2	0.8	
Camben®	2	0.8	
Valbazen®	33	13.5	63.0 New benzimidazole
Rintal®	14	5.7	
Panacur®	51	20.9	
Systamex®	53	21.7	
Synanthic®	3	1.2	
Total	244	100.0	

Appendix 31

The number of respondents using various anthelmintic groups for cattle in each district

Anthelmintic group	Albany		Esperance		Katanning	
	No. of responses	%	No. of responses	%	No. of responses	%
Levamisole	46	29.7	5	23.8	16	23.9
Old benzimidazole	8	5.2	1	4.8	13	19.4
New benzimidazole	101	65.2	15	71.4	38	56.7
Total	155	100.0	21	100.0	67	100.0

$\chi^2_4 = 12.4$ $P < 0.05$

Appendix 32

Relationship between the use of anthelmintic groups and the total number of cattle on farms

Anthelmintic group	Total number of cattle											
	1-49		50-99		100-199		200-299		300-499		> 500	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Levamisole	10	29.4	19	35.2	22	35.5	5	13.5	4	18.2	6	18.8
Old benzimidazole	6	17.6	6	11.1	5	8.1	3	8.1	1	4.5	1	3.1
New benzimidazole	18	52.9	29	53.7	35	56.5	29	78.4	17	77.3	25	78.1
Total	34	100.0	54	100.0	62	100.0	37	100.0	22	100.0	32	100.0

$\chi^2_{10} = 16.6$ $P < 0.1$

$\chi^2_2 = 9.4^*$ $P < 0.01$

*Pooled into total number of cattle < 200 and > 200.

Appendix 33

Number of sheep as at 31st March 1981

Flock size	Total sheep		Ewes		Wethers		Weaners		Lambs		Rams		Total sheep sold	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Nil	2	0.5	21	5.4	96	24.7	48	12.4	282	72.9	46	11.9	100	25.8
1-99	3	0.8	13	3.4	21	5.4	24	6.2	23	5.9	293	75.7	12	3.1
100-499	38	9.8	44	11.3	70	18.0	74	19.1	30	7.8	43	11.1	58	15.0
500-999	28	7.2	57	14.7	79	20.4	94	24.2	24	6.2	4	1.0	73	18.9
1,000-1,499	25	6.5	65	16.8	44	11.3	71	18.3	11	2.8	0	0.0	54	14.0
1,500-1,999	25	6.5	56	14.4	23	5.9	28	7.2	10	2.6	1	0.3	36	9.3
2,000-2,999	62	16.0	65	16.8	29	7.5	29	7.5	5	1.3	0	0.0	25	6.5
3,000-3,999	57	14.7	35	9.0	11	2.8	11	2.8	0	0.0	0	0.0	14	3.6
4,000-4,999	45	11.6	17	4.4	8	2.1	3	0.8	1	0.3	0	0.0	8	2.1
5,000-5,999	30	7.8	2	0.5	2	0.5	5	1.3	0	0.0	0	0.0	2	0.5
6,000-6,999	16	4.1	4	1.0	1	0.3	1	0.3	1	0.3	0	0.0	1	0.3
7,000-7,999	14	3.6	2	0.5	1	0.3	0	0.0	0	0.0	0	0.0	—	—
8,000-8,999	11	2.8	1	0.3	1	0.3	0	0.0	0	0.0	0	0.0	2	0.5
9,000-9,999	9	2.3	3	0.8	0	0.0	0	0.0	0	0.0	0	0.0	—	—
10,000-14,999	14	3.6	3	0.8	1	0.3	0	0.0	0	0.0	0	0.0	2	0.5
15,000-19,999	5	1.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	—	—
>20,000	3	0.8	0	0.0	1	0.3	0	0.0	0	0.0	0	0.0	—	—
Total	387	100.0	388	100.0	388	100.0	388	100.0	388	100.0	387	100.0	387	100.0
Mean + S.E.	3,972 ± 204		1,772 ± 86		975 ± 94		963 ± 52		198 ± 29		60 ± 6			

S.E. = Standard error

Appendix 34

Sheep production of farms in each district

Production activity	Sheep production main activity								Sheep production secondary activity							
	Albany		Esperance		Katanning		All districts		Albany		Esperance		Katanning		All districts	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Wool	113	86.3	58	92.1	169	96.0	340	91.6	6	7.1	1	2.6	2	2.4	9	4.3
Shipping wethers	4	3.1	5	7.9	2	1.1	11	3.0	17	20.0	24	61.5	41	48.2	82	39.2
Weaners and hoggets for sale	0	0.0	0	0.0	1	0.6	1	0.3	1	1.2	1	2.6	6	7.1	8	3.8
Wool stud	0	0.0	0	0.0	3	1.7	3	0.8	0	0.0	1	2.6	5	5.9	6	2.9
Fat lambs	10	7.6	0	0.0	0	0.0	10	2.7	57	67.1	11	28.2	28	32.9	96	45.9
Fat lamb stud	2	1.5	0	0.0	0	0.0	2	0.5	3	3.5	0	0.0	2	2.4	5	2.4
Other	2	1.5	0	0.0	1	0.6	3	0.8	1	1.2	1	2.6	1	1.2	3	1.4
Total	131	100.0	63	100.0	176	100.0	370	100.0	85	100.0	39	100.0	85	100.0	209	100.0

$\chi^2_4 = 30.3$ $P < 0.001$ $\chi^2_4 = 32.1$ $P < 0.001$

Appendix 35

Breeds of ewes and rams

Breed	Major breed of ewe		Minor breed of ewe		Major breed of ram		Minor breed of ram	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Merino	340	91.9	5	9.1	286	80.3	11	9.7
Cross-bred	17	4.6	18	32.7	4	1.1	1	0.9
Border Leicester	3	0.8	6	10.9	10	2.8	8	7.1
Corriedale	7	1.9	3	5.5	9	2.5	2	1.8
Polwarth	1	0.3	—	—	3	0.8	—	—
Poll Dorset	—	—	8	14.5	11	3.1	21	18.6
Dorset Horn	—	—	3	5.5	8	2.2	8	7.1
Suffolk and South Suffolk	1	0.3	8	14.5	12	3.4	47	41.6
Romney	—	—	2	3.6	5	1.4	5	4.4
Southdown	1	0.3	1	1.8	4	1.1	5	4.4
Other	—	—	1	1.8	3	0.8	5	4.4
Total	370	100.0	55	100.0	356	100.0	113	100.0

Appendix 36

Breeds of sheep in each district

	Breed											
	Merino		Cross-bred		Corriedale/ Polwarth		British breed		Poll Dorset		Total	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%		
Major breed of ewe												
Albany	109	82.0	15	11.3	4	3.1	5	3.9	—	—	133	$\chi^2_6 = 33.1$
Esperance	58	95.1	1	1.6	2	3.3	0	0.0	—	—	61	
Katanning	173	98.3	1	0.6	2	1.1	0	0.0	—	—	176	$P < 0.001$
Second breed of ewe												
Albany	5	15.6	11	34.4	1	3.1	12	37.5	3	9.4	32	$\chi^2_8 = 24.1$
Esperance	0	0.0	3	42.9	3	42.9	0	0.0	1	14.3	7	
Katanning	0	0.0	4	23.5	0	0.0	9	53.0	4	23.5	17	$P < 0.005$
Major breed of ram												
Albany	76	59.8	2	1.6	7	5.5	36	28.3	6	4.7	127	$\chi^2_6 = 62.8$
Esperance	50	86.2	1	1.7	3	5.2	1	1.7	3	5.2	58	
Katanning	160	94.2	1	0.6	2	1.2	6	3.5	2	1.2	171	$P < 0.001$
Second breed of ram												
Albany	7	12.7	1	1.8	0	0.0	38	69.1	9	16.4	55	$\chi^2_4 = 5.0$
Esperance	1	5.9	0	0.0	2	11.8	8	47.1	6	35.3	17	
Katanning	3	7.3	0	0.0	0	0.0	32	78.0	6	14.6	41	$P = 0.21$

Appendix 37

Month mating commenced for ewes during the previous 12 months

Month mating commenced	Main flock		Secondary flock	
	No. of farms	%	No. of farms	%
July	3	0.8	—	—
Aug.	—	—	1	1.4
Sept.	3	0.8	1	1.4
Oct.	35	9.7	5	6.8
Nov.	103	28.6	7	9.5
Dec.	112	31.1	14	18.9
Jan.	52	14.4	24	32.4
Feb.	30	8.3	14	18.9
Mar.	5	1.4	5	6.8
Apr.	—	—	1	1.4
May	1	0.3	—	—
June	4	1.1	—	—
All year	5	1.4	—	—
Don't know	6	1.7	2	2.7
Total	359	100.0	74	100.0

Appendix 38

Comparison of the month mating commenced for each district.

Month mating commenced	District					
	Albany		Esperance		Katanning	
	No. of farms	%	No. of farms	%	No. of farms	%
July-Sept.	0	0.0	6	3.0	2	2.7
Oct.	7	4.7	23	11.4	10	13.5
Nov.	29	19.5	58	28.7	23	31.1
Dec.	49	32.9	52	25.7	25	33.8
Jan.	39	26.2	29	14.4	8	10.8
Feb.	17	11.4	24	11.9	3	4.1
Mar.-June	5	3.4	9	4.5	2	2.7
All year	3	2.0	1	0.5	1	1.4
Total	149	100.0	202	100.0	74	100.0

$\chi^2_{14} = 30.7$ $P < 0.01$

Appendix 39

Relationship between month mating commenced and Shires grouped by climatic zone

Month mating commenced	Shires grouped by climatic zone									
	Coastal		Plantagenet		Mod. rainfall		Low rainfall		South-east	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
July-Sept.	0	0.0	0	0.0	0	0.0	6	4.8	2	2.7
Oct.	2	4.7	4	5.1	3	2.9	21	16.8	10	13.5
Nov.	2	4.7	22	27.8	24	23.1	39	31.2	23	31.1
Dec.	14	32.6	28	35.4	37	35.6	22	17.6	25	33.8
Jan.	15	34.9	16	20.3	17	16.3	20	16.0	8	10.8
Feb.	8	18.6	5	6.3	16	15.4	12	9.6	3	4.1
Mar.-June	0	0.0	3	3.8	6	5.8	5	4.0	2	2.7
All year	2	4.7	1	1.3	1	1.0	0	0.0	1	1.4
Total	43	100.0	79	100.0	104	100.0	125	100.0	74	100.0

$\chi^2_{16} = 50.6$ $P < 0.001$

Appendix 40

Relationship between the month mating commenced and flock size

Month mating commenced	Flock size									
	1—999		1,000—1,999		2,000—4,999		5,000—9,999		> 10,000	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
July-Sept.	0	0.0	1	1.6	6	3.2	1	1.2	0	0.0
Oct./Nov.	9	20.0	21	33.3	71	37.4	37	44.0	10	47.6
Dec.	12	26.7	22	34.9	58	30.5	21	25.0	8	38.1
Jan.	13	28.9	9	14.3	36	18.9	13	15.5	3	14.3
Feb.-June	6	13.3	10	15.9	19	10.0	12	14.3	0	0.0
All year	5	11.1	0	0.0	0	0.0	0	0.0	0	0.0
Total	45	100.0	63	100.0	190	100.0	84	100.0	21	100.0

$\chi^2_{16} = 54.6$ $P < 0.001$

Appendix 41

Relationship between the month mating commenced and main and secondary sheep production activity

Month mating commenced	Sheep production main activity				Sheep production secondary activity			
	Wool production (including sale of shipping wethers)		Fat lamb production		Wool production (including sale of shipping wethers)		Fat lamb production	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
July-Sept.	9	2.3	0	0.0	5	4.3	0	0.0
Oct.	39	10.0	1	6.3	16	13.8	9	7.1
Nov.	102	26.2	1	6.3	28	24.1	28	22.0
Dec.	114	29.2	3	18.8	27	23.3	39	30.7
Jan.	68	17.4	6	37.5	21	18.1	31	24.4
Feb.	41	10.5	2	12.5	13	11.2	18	14.2
Mar.-June	14	3.6	1	6.3	5	4.3	1	0.8
All year	3	0.8	2	12.5	1	0.8	1	0.8
Total	390	100.0	16	100.0	116	100.0	127	100.0
	$\chi^2_5 = 7.9$		P = 0.16		$\chi^2_5 = 11.2$		P < 0.05	

Appendix 42

Month shearing commenced for the majority of sheep

Month shearing commenced	No. of farms	%
July	38	10.6
Aug.	60	16.7
Sept.	71	19.7
Oct.	80	22.2
Nov.	28	7.8
Dec.	20	5.6
Jan.	21	5.8
Feb.	16	4.4
Mar.	10	2.8
Apr.	5	1.4
May	6	1.7
June	2	0.6
Don't know	2	0.6
Total	359	100.0

Appendix 43

Distribution of the months shearing commenced for farms in each district

Month shearing commenced	District					
	Albany		Esperance		Katanning	
	No. of farms	%	No. of farms	%	No. of farms	%
July/Aug.	19	14.4	22	36.1	57	34.8
Sept./Oct.	59	44.7	20	32.8	72	43.9
Nov./Dec.	31	23.5	10	16.4	7	4.3
Jan./Feb.	15	11.4	4	6.6	18	11.0
Mar./June	8	6.1	5	8.2	10	6.1
Total	132	100.0	61	100.0	164	100.0

$\chi^2_8 = 36.6 \quad P < 0.001$

Appendix 44

Distribution of shearing date for Shires grouped in climatic zones

Month shearing commenced	Shires grouped according to climatic zone									
	Coastal		Plantagenet		Mod. rainfall		Low rainfall		South-east	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
July/Aug.	4	8.9	9	14.1	24	26.7	39	40.2	22	36.1
Sept./Oct.	20	44.4	30	46.9	41	45.6	40	41.2	20	32.8
Nov./Dec.	11	24.4	18	28.1	6	6.7	3	3.1	10	16.4
Jan./Feb.	5	11.1	6	9.4	14	15.6	8	8.2	4	6.6
Mar./June	5	11.1	1	1.6	5	5.6	7	7.2	5	8.2
Total	45	100.0	64	100.0	90	100.0	97	100.0	61	100.0

$\chi^2_{16} = 52.8 \quad P < 0.001$

Appendix 45

The lambing histories of paddocks used for lambing in each district

Paddocks used for lambing	District							
	Albany		Esperance		Katanning		Total	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Same paddock(s) used each year	31	26.3	5	8.5	9	5.4	45	13.0
Most of the same paddock(s) used each year	49	41.5	15	25.4	41	24.4	105	30.4
Some of the same paddock(s) used each year	28	23.7	22	37.3	63	37.5	113	32.8
Different paddock(s) used each year	10	8.5	17	28.8	55	32.7	82	23.8
Total	118	100.0	59	100.0	168	100.0	345	100.0

$\chi^2_6 = 54.0$ $P < 0.001$

Appendix 46

The lambing histories of paddocks used for lambing for Shires grouped in climatic zones

Paddocks used for lambing	Shires grouped in climatic zones									
	Coastal		Plantagenet		Mod. rainfall		Low rainfall		South-east	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Same paddock(s) used each year	12	30.8	15	27.3	11	12.1	2	2.0	5	8.5
Most of the same paddock(s) used each year	15	38.5	23	41.8	38	41.8	14	13.9	15	25.4
Some of the same paddock(s) used each year	7	17.9	15	27.3	29	31.9	40	39.6	22	37.3
Different paddock(s) used each year	5	12.8	2	3.6	13	14.3	45	44.6	17	28.8
Total	39	100.0	55	100.0	91	100.0	101	100.0	59	100.0

$\chi^2_{12} = 83.8$ $P < 0.001$

Appendix 47

Relationship between flock size and the lambing histories of paddocks used for lambing.

Paddocks used for lambing	Flock size									
	1-999		1,000-1,999		2,000-4,999		5,000-9,999		>10,000	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Same paddock(s) used each year	16	34.0	6	13.3	16	10.6	2	2.7	1	5.3
Most of the same paddock(s) used each year	11	23.4	14	31.1	43	28.5	26	34.7	10	52.6
Some of the same paddock(s) used each year	13	27.7	14	31.1	55	36.4	25	33.3	5	26.3
Different paddock(s) used each year	7	14.9	11	24.4	37	24.5	22	29.3	3	15.8
Total	47	100.0	45	100.0	151	100.0	75	100.0	19	100.0

$\chi^2_{12} = 33.9$ $P < 0.001$

Appendix 48

Relationship between lambing histories of paddocks used for lambing and main and secondary sheep production activity.

Paddocks used for lambing	Sheep main activity				Sheep secondary activity			
	Wool		Fat lambs		Wool		Fat lambs	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Same paddock(s) used each year	42	13.2	1	11.1	4	4.4	24	24.7
Most of same paddock(s) used each year	96	30.1	4	44.4	28	30.8	27	27.8
Some of same paddock(s) used each year	105	32.9	3	33.3	32	35.2	29	29.9
Different paddock(s) used each year	76	23.8	1	11.1	27	29.7	17	17.5
Total	319	100.0	9	100.0	91	100.0	97	100.0

$\chi^2_3 = 1.2$ $P = 0.75$ $\chi^2_3 = 16.5$ $P < 0.001$

Appendix 49

Relationship between lambing histories of paddocks used for lambing and main breed of ram.

Paddocks used for lambing	Main breed of ram									
	Merino		Poll Dorset		Suffolk and South Suffolk		Other British breeds		Other	
	No. of farms	%	No. of farms	%	No. of Farms	%	No. of farms	%	No. of Farms	%
Same paddock(s) used each year	22	8.2	3	30.0	5	45.5	7	28.0	6	33.3
Most of the same paddock(s) used each year	79	29.5	4	40.0	4	36.4	10	40.0	4	22.2
Some of same paddock(s) used each year	97	36.2	1	10.0	2	18.2	5	20.0	3	16.7
Different paddock(s) used each year	70	26.1	2	20.0	0	0.0	3	12.0	5	27.8
Total	268	100.0	10	100.0	11	100.0	25	100.0	18	100.0

$\chi^2_{12} = 38.4$ $P < 0.001$

Appendix 50

Relationship between stocking policy and lambing histories of paddocks used for lambing

Paddocks used for lambing	Stocking policy			
	Sheep only		Sheep and cattle	
	No. of farms	%	No. of farms	%
Same paddock(s) used each year	25	12.3	20	14.1
Most of the same paddock(s) used each year	53	26.1	52	36.6
Some of the same paddock(s) used each year	67	33.0	46	32.4
Different paddock(s) used each year	58	28.6	24	16.9
Total	203	100.0	142	100.0

$\chi^2_3 = 8.0$ $P < 0.05$

Appendix 51

The relationship between the area used for cropping and the lambing histories of paddocks used for lambing

Area cropped (ha)	Paddocks used for lambing								
	Same paddock(s) used each year		Most of the same paddock(s) used each year		Some of the same paddock(s) used each year		Different paddock(s) used each year		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
0-4	20	42.6	16	34.0	9	19.1	2	4.3	47
5-49	12	28.6	18	42.9	10	23.8	2	4.8	42
50-249	11	10.8	44	43.1	33	32.4	14	13.7	102
250-999	1	0.8	25	19.7	51	40.2	50	39.4	127
>1,000	0	0.0	1	4.3	10	43.5	12	52.2	23
Total	44	100.0	104	100.0	113	100.0	80	100.0	341

$\chi^2_{12} = 121.5 \quad P < 0.001$

Appendix 52

Number of drenches per annum given to sheep

No. of drenches	Class of sheep							
	Ewes		Lambs		Weaners		Wethers	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
0	15	4.2	24	7.1	11	6.1	34	11.2
1	40	11.1	52	15.4	28	15.6	62	20.5
2	73	20.2	44	13.0	26	14.5	88	29.0
3	89	24.7	64	18.9	31	17.3	62	20.5
4	63	17.5	51	15.1	29	16.2	26	8.6
5	31	8.6	29	8.6	17	9.5	13	4.3
6	25	6.9	28	8.3	14	7.8	11	3.6
7	9	2.5	15	4.4	7	3.9	2	0.7
8	7	1.9	10	3.0	5	2.8	2	0.7
9	1	0.3	8	2.4	1	0.6	0	0.0
10	1	0.3	5	1.5	1	0.6	0	0.0
11	0	0.0	0	0.0	0	0.0	0	0.0
12	7	1.9	8	2.4	9	5.0	3	1.0
Total	361	100.0	338	100.0	179	100.0	303	100.0
Mean S.E.	3.41 ±	0.11	3.70 ±	0.15	3.77 ±	0.21	2.39 ±	0.11

Appendix 53

Number of drenches per annum for sheep in each Shire

Shire	No. of drenches per year					
	Ewes		Weaners		Wethers	
	Mean	± SE	Mean	± SE	Mean	± SE
Albany	5.44	0.49	5.86	0.73	3.33	0.55
Broomehill	2.67	0.19	3.33	0.71	3.10	1.00
Cranbrook	4.29	0.27	5.54	0.80	3.22	0.32
Denmark	4.71	1.47	6.50	2.50	3.67	1.23
Esperance	3.35	0.32	2.79	0.39	2.51	0.29
Gnowangerup	2.28	0.18	2.79	0.32	1.68	0.20
Katanning	2.24	0.30	2.80	0.37	1.54	0.29
Kent	1.93	0.23	2.00	0.33	1.64	0.17
Kojonup	2.80	0.17	2.79	0.33	1.78	0.17
Plantagenet	4.53	0.28	5.13	0.56	3.18	0.26
Ravensthorpe	2.64	0.56	2.50	0.10	1.13	0.35
Tambellup	3.15	0.53	2.33	0.88	2.78	0.55
Wagin	2.71	1.92	—	—	1.57	0.37
Woodanilling	2.25	0.31	2.33	1.45	1.56	0.34
All Shires	3.41	0.11	3.77	0.21	2.39	0.11

Appendix 54

Number of drenches per annum for each class of sheep in each climatic zone

Climatic zone	No. of drenches per year															
	Nil		1 or 2		3 or 4		5 or 6		7 or more		Total	Mean	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%			
Ewes													
Coastal	1	2.3	5	11.4	16	36.4	13	29.5	9	20.5	44	5.27	$\chi^2_{16} = 78.3$
Plantagenet	1	1.6	6	9.6	29	46.7	17	27.4	9	14.5	62	4.53	
Moderate rainfall	0	0.0	32	36.0	41	46.1	13	14.6	3	3.3	89	3.20	
Low rainfall	9	9.3	40	41.2	45	46.4	2	2.1	1	1.0	97	2.30	
South-east	4	6.8	20	33.9	21	35.5	11	18.7	3	5.1	59	3.19	$P < 0.001$
Lambs													
Coastal	4	12.5	2	6.3	10	31.3	7	21.9	9	28.1	32	5.13	$\chi^2_{16} = 66.8$
Plantagenet	3	4.9	9	14.8	13	21.3	17	27.8	19	31.1	61	5.26	
Moderate rainfall	3	3.5	25	29.0	32	37.2	15	17.5	11	12.8	86	3.69	
Low rainfall	6	5.8	40	38.5	45	43.3	11	10.6	2	2.0	104	2.79	
South-east	8	14.5	20	36.4	15	27.2	7	12.8	5	9.1	55	2.91	$P < 0.001$
Weaners													
Coastal	1	4.0	2	8.0	7	28.0	8	32.0	7	28.0	25	5.96	$\chi^2_{16} = 41.5$
Plantagenet	2	6.7	3	10.0	9	30.0	7	23.3	9	30.0	30	5.13	
Moderate rainfall	1	2.6	11	28.9	16	42.2	6	15.8	4	10.4	38	3.66	
Low rainfall	3	6.3	22	45.9	16	33.4	7	14.6	0	0.0	48	2.69	
South-east	4	10.5	16	42.1	12	31.6	3	7.9	3	7.9	38	2.71	$P < 0.001$
Wethers													
Coastal	4	13.3	9	30.0	9	30.0	5	16.7	3	10.0	30	3.4	$\chi^2_{16} = 40.6$
Plantagenet	1	2.0	18	36.7	24	49.0	4	8.2	2	4.0	49	3.18	
Moderate rainfall	6	7.3	44	53.7	26	31.7	6	7.3	0	0.0	82	2.27	
Low rainfall	12	13.2	62	68.2	14	15.4	2	2.2	1	1.1	91	1.80	
South-east	11	21.6	17	33.3	15	29.4	7	13.8	1	2.0	51	2.29	$P < 0.001$

Appendix 55

Relationship between the paddocks used for lambing and the number of drenches given to each class of sheep per annum.

Paddocks used for lambing	No. of drenches										
	0		1 or 2		3 or 4		5 or 6		7 or more		Total	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%		
Ewes												
Same paddocks	0	0.0	6	14.0	20	46.5	7	16.3	10	23.3	43	$\chi^2_{12} = 43.0$
Most of same paddocks	3	3.0	28	27.7	37	36.6	25	24.8	8	8.0	101	
Some of same paddocks	7	6.4	34	30.9	52	47.3	13	11.8	4	3.6	110	
Different paddocks	3	3.8	34	43.5	33	42.3	6	7.7	2	2.6	78	$P < 0.001$
Lambs												
Same paddocks	1	2.6	8	21.1	13	34.2	6	15.8	10	26.3	38	$\chi^2_{12} = 31.4$
Most of same paddocks	6	6.3	25	26.0	24	25.0	20	20.9	21	21.9	96	
Some of same paddocks	11	10.1	27	24.8	43	39.4	16	14.7	12	11.0	109	
Different paddocks	3	4.2	29	40.2	29	40.3	10	13.9	1	1.4	72	$P = 0.01$
Weaners												
Same paddocks	0	0.0	1	5.0	7	35.0	2	10.0	10	50.0	20	$\chi^2_{12} = 37.4$
Most of same paddocks	1	2.2	12	26.1	16	34.7	12	26.0	5	10.8	46	
Some of same paddocks	5	10.6	15	31.9	15	31.9	7	14.9	5	10.7	47	
Different paddocks	4	8.9	17	37.7	14	31.1	9	20.0	1	2.2	45	$P < 0.001$
Wethers												
Same paddocks	0	0.0	8	32.0	11	44.0	3	12.0	3	12.0	25	$\chi^2_{12} = 47.2$
Most of same paddocks	8	9.6	35	42.2	25	30.1	15	18.0	0	0.0	83	
Some of same paddocks	15	17.0	45	51.2	25	28.5	2	2.3	1	1.1	88	
Different paddocks	5	7.7	40	61.5	17	26.2	3	4.6	0	0.0	65	$P < 0.001$

Appendix 56

Relationship between perception of the importance of blowfly strike and the number of drenches given to each class of sheep per annum

Perception of the importance of blowfly strike	No. of drenches per year											
	0		1 or 2		3 or 4		5 or 6		7 or more		Total	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%		
Ewes												
Body strike more important	0	0.0	21	28.4	26	35.1	19	25.7	8	10.8	74	$\chi^2_{12} = 48.2$
Breech strike more important	9	7.8	47	40.8	44	38.2	11	9.6	4	3.5	115	
Both equally important	0	0.0	27	23.1	53	45.3	25	21.4	12	9.3	117	
Neither is a problem	4	9.5	12	28.5	24	57.1	1	2.4	1	2.4	42	$P < 0.001$
Lambs												
Body strike more important	5	7.2	11	15.9	22	31.8	13	18.8	18	25.9	69	$\chi^2_{12} = 39.1$
Breech strike more important	10	9.0	43	38.7	35	31.5	18	16.2	5	4.5	111	
Both equally important	4	3.7	26	23.8	39	35.8	23	21.1	17	15.6	109	
Neither is a problem	3	7.9	13	34.2	13	34.3	3	7.9	6	15.7	38	$P < 0.001$
Weaners												
Body strike more important	2	5.7	8	22.9	9	25.7	7	20.0	9	25.7	35	$\chi^2_{12} = 16.4$
Breech strike more important	4	6.7	25	41.7	20	33.3	9	15.0	2	3.4	60	
Both equally important	1	1.7	14	24.1	21	36.2	12	20.7	10	17.2	58	
Neither is a problem	1	5.6	5	27.8	7	38.9	3	16.7	2	11.2	18	$P = 0.18$
Wethers												
Body strike more important	2	3.2	27	43.5	19	30.7	10	16.2	4	6.4	62	$\chi^2_{12} = 26.7$
Breech strike more important	12	12.4	53	54.6	28	28.8	3	3.1	1	1.0	97	
Both equally important	10	10.8	42	45.1	30	32.3	9	9.7	2	2.2	93	
Neither is a problem	8	21.6	18	48.6	9	24.3	2	5.4	0	0.0	37	$P < 0.01$

Appendix 57

Number of farmers drenching different classes of sheep in each month of the year

Month drenched	Class of sheep							
	Ewes		Lambs		Weaners		Wethers	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
July	103	8.4	110	8.7	60	5.1	66	9.1
Aug.	87	7.1	90	7.1	41	3.5	45	6.2
Sept.	88	7.1	115	9.1	63	5.3	47	6.5
Oct.	94	7.6	101	8.0	89	7.5	47	6.5
Nov.	115	9.3	121	9.5	111	9.4	61	8.4
Dec.	86	7.0	96	7.6	109	9.2	51	7.0
Jan.	131	10.6	127	10.0	147	12.4	88	12.1
Feb.	113	9.2	92	7.2	111	9.4	67	9.2
Mar.	125	10.1	119	9.4	141	11.9	94	13.0
Apr.	107	8.7	97	7.6	113	9.6	64	8.8
May	96	7.8	90	7.1	92	7.8	47	6.5
June	87	7.1	112	8.8	104	8.8	48	6.6
Not drenched	15		24		11		34	
Total response	1247	100.0	1294	100.0	1192	100.0	759	100.0
	$\chi^2_{11} = 12.7$		$\chi^2_{11} = 8.8$		$\chi^2_{11} = 61.8$		$\chi^2_{11} = 22.6$	
	$P = 0.31$		$P = 0.64$		$P < 0.001$		$P = 0.05$	

Appendix 58

Number of 'summer' drenches per annum given to each class of sheep in each district

District	No. of 'summer' drenches										Total	Mean	
	0		1		2		3		4 or more				
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%			
Ewes													
Albany	10	7.7	33	25.4	56	43.1	22	16.9	9	6.9	130	1.95	$\chi^2_8 = 42.8$
Esperance	8	13.6	22	37.2	23	39.0	5	8.5	1	1.7	59	1.49	
Katanning	17	9.9	90	52.3	59	34.3	4	2.3	2	1.2	172	1.33	
All districts	35	9.7	145	40.2	138	38.2	31	8.6	12	3.3	361	1.58	$P < 0.001$
Lambs													
Albany	22	18.8	14	12.0	34	29.1	26	22.2	21	17.9	117	2.20	$\chi^2_8 = 43.8$
Esperance	23	41.8	11	20.0	11	20.0	7	12.7	3	5.4	55	1.22	
Katanning	44	26.2	50	29.8	54	32.1	14	8.3	6	3.6	168	1.35	
All districts	89	26.2	75	22.1	99	29.1	47	13.8	28	8.8	340	1.62	$P < 0.001$
Weaners													
Albany	7	6.9	16	15.8	42	41.6	19	18.8	17	16.8	101	2.34	$\chi^2_8 = 40.6$
Esperance	14	26.4	11	20.8	18	34.0	8	15.1	2	3.8	53	1.51	
Katanning	16	10.8	55	37.2	56	37.8	16	10.8	5	3.4	148	1.61	
All districts	37	12.3	82	27.2	116	38.4	43	14.2	24	8.0	302	1.83	$P < 0.001$
Wethers													
Albany	12	11.8	44	43.1	34	33.3	7	6.9	5	4.9	102	1.52	$\chi^2_8 = 23.5$
Esperance	15	29.4	20	39.2	12	23.5	3	5.9	1	2.0	51	1.12	
Katanning	42	28.0	78	52.0	22	14.7	6	4.0	2	1.4	150	0.99	
All districts	69	22.8	142	46.9	68	22.4	16	5.3	8	2.7	303	1.19	$P < 0.01$

Appendix 59

Number of 'summer' drenches per annum given to each class of sheep in each climatic zone

Climatic zone	Number of 'summer' drenches															
	0		1		2		3		4 or more		Total	Mean	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%			
Ewes													
Coastal	5	11.4	6	13.6	21	47.7	5	11.4	7	15.9	44	2.18	$\chi^2_{16} = 61.8$
Plantagenet	5	8.1	19	30.6	25	40.3	11	17.7	2	3.2	62	1.81	
Moderate rainfall	2	2.2	44	49.4	35	39.3	8	9.0	0	0.0	89	1.55	
Low rainfall	15	14.0	54	50.5	34	31.8	2	1.9	2	1.9	107	1.27	
South-east	8	13.6	22	37.3	23	39.0	5	8.5	1	1.7	59	1.49	$P < 0.001$
Lambs													
Coastal	7	21.2	2	6.1	11	33.3	7	21.2	6	18.2	33	2.21	$\chi^2_{16} = 44.2$
Plantagenet	14	23.0	7	11.5	17	27.9	12	19.7	11	18.1	61	2.10	
Moderate rainfall	13	15.1	25	29.1	28	32.6	12	14.0	8	9.3	86	1.79	
Low rainfall	32	30.5	30	28.6	32	30.5	9	8.6	2	1.9	105	1.23	
South-east	23	41.8	11	20.0	11	20.0	7	12.7	3	5.4	55	1.22	$P < 0.001$
Weaners													
Coastal	2	6.5	4	12.9	13	41.9	6	19.4	6	19.3	31	2.48	$\chi^2_{16} = 43.3$
Plantagenet	4	7.8	7	13.7	22	43.1	10	19.6	8	15.6	51	2.29	
Moderate rainfall	8	11.4	22	31.4	24	34.3	9	12.9	7	10.0	70	1.86	
Low rainfall	9	9.3	38	39.2	39	40.2	10	10.3	1	1.0	97	1.55	
South-east	14	26.4	11	20.8	18	34.0	8	15.1	2	3.8	53	1.51	$P < 0.001$
Wethers													
Coastal	6	20.0	10	33.3	10	33.3	0	0.0	4	13.3	30	1.57	$\chi^2_{16} = 40.0$
Plantagenet	3	6.1	25	51.0	17	34.7	3	6.1	1	2.0	49	1.49	
Moderate rainfall	19	23.2	38	46.3	18	22.0	7	8.5	0	0.0	82	1.16	
Low rainfall	26	28.6	49	53.8	11	12.1	3	3.3	2	2.2	91	0.98	
South-east	15	29.4	20	39.2	12	23.5	3	5.9	1	2.0	51	1.12	$P < 0.001$

Appendix 60

Reason two 'summer' drenches per annum were not given to each class of sheep in each district

District	Reason two 'summer' drenches not given									
	Would have given 2 'summer' drenches but prevented		Not convinced of value of 2 'summer' drenches		2 'summer' drenches not enough		Other		Total	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%		
Ewes										
Albany	5	13.9	19	52.8	8	22.2	4	11.1	36	$\chi^2_6 = 22.9$
Esperance	4	11.8	23	67.6	5	14.7	2	5.9	34	
Katanning	8	7.7	87	83.7	1	1.0	8	7.7	104	$P < 0.001$
Weaners										
Albany	2	8.7	11	47.8	7	30.4	3	13.0	23	$\chi^2_6 = 17.9$
Esperance	3	9.7	21	67.7	6	19.4	1	3.2	31	
Katanning	7	9.9	58	81.7	2	2.8	4	5.6	71	$P < 0.01$
Wethers										
Albany	3	8.6	22	62.9	5	14.3	5	14.3	35	$\chi^2_6 = 23.2$
Esperance	5	14.7	24	70.6	4	11.8	1	2.9	34	
Katanning	9	7.8	100	87.0	0	0.00	6	5.2	115	$P < 0.001$

Appendix 61

Reason two 'summer' drenches per annum were not given to each class of sheep in each climatic zone

Climatic zone	Reason two 'summer' drenches not given									
	Would have given 2 'summer' drenches but prevented		Not convinced of value of 2 'summer' drenches		2 'summer' drenches not enough		Other		Total	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%		
Ewes										
Coastal	0	0.0	6	42.9	6	42.9	2	14.3	14	
Plantagenet	5	29.4	9	52.9	2	11.8	1	5.9	17	
Moderate rainfall	1	2.6	33	84.6	0	0.0	5	12.8	39	$\chi^2_{12} = 47.4$
Lower rainfall	7	10.0	58	82.9	1	1.4	4	5.7	70	
South-east	4	11.8	23	67.6	5	14.7	2	5.9	34	$P < 0.001$
Weaners										
Coastal	0	0.0	3	33.3	5	55.6	1	11.1	9	
Plantagenet	2	16.7	7	58.3	2	16.7	1	8.3	12	
Moderate rainfall	0	0.0	21	87.5	0	0.0	3	12.5	24	$\chi^2_{12} = 32.1$
Low rainfall	7	14.9	38	77.6	2	4.1	2	4.1	49	
South-east	3	9.7	21	67.7	6	19.4	1	3.2	31	$P < 0.01$
Wethers										
Coastal	0	0.0	5	55.6	4	44.4	0	0.0	9	
Plantagenet	3	16.7	10	55.6	1	5.6	4	22.2	18	
Moderate rainfall	3	6.0	43	86.0	0	0.0	4	8.0	50	$\chi^2_{12} = 53.8$
Low rainfall	6	8.2	64	87.7	0	0.0	3	4.1	73	
South-east	5	14.7	24	70.6	4	11.8	1	2.9	34	$P < 0.001$

Appendix 62

Number of respondents using various sheep drenches to a major extent during the previous 12 months. Up to three drenches used were listed by each respondent

Trade name	Drench group	No. of responses		%
MSD Barbers Pole drench®	Narrow spectrum	4	0.5	1.5
Rametin H®		5	0.7	
Ranide®		1	0.1	
Bayer Management®		1	0.1	
Thibenzole®	Old benzimidazole	139	18.4	20.1
Camben®		3	0.4	
Topclip®		3	0.4	
Wormguard®		4	0.5	
Broadspec®		2	0.3	
Nemafax®		1	0.1	
Valbazen®	New benzimidazole	63	8.3	41.4
Synanthic®		41	5.4	
Systamex®		97	12.8	
Panacur®		69	9.1	
Rintal®		44	5.8	
Levasole®	Levamisole	1	0.1	36.7
Ripercol®		123	16.3	
Nilverm®		141	18.7	
Premier®		12	1.6	
Other		1	0.1	
Total		755	100.0	

Appendix 63

Number of respondents using various anthelmintic groups for sheep in each climatic zone

Climatic zone	Anthelmentic groups								
	Narrow spectrum		Levamisole		Old benzimidazole		New benzimidazole		
	No. of responses	%	No. of responses	%	No. of responses	%	No. of responses	%	Total
Coastal	3	3.1	41	41.8	7	7.1	47	48.0	98
Plantagenet	3	2.3	38	28.8	15	11.4	76	57.6	132
Moderate rainfall	1	0.5	72	35.5	61	30.0	69	34.0	203
Low rainfall	2	1.0	70	34.7	50	24.8	80	39.6	202
South-east	2	1.7	56	47.1	19	16.0	42	35.3	119
Total	11	100.0	277	100.0	152	100.0	314	100.0	754

$\chi^2_{12} = 50.2$ $P<0.001$

Appendix 64

Relationship between stocking policy and the use of various anthelmintic groups in sheep

Stocking policy	Anthelmintic groups								
	Narrow spectrum		Levamisole		Old benzimidazole		New benzimidazole		Total
	No. of responses	%	No. of responses	%	No. of responses	%	No. of responses	%	
Sheep only	9	2.1	161	37.1	99	22.8	165	38.0	434
Sheep and cattle	2	0.1	116	36.3	53	16.6	149	46.6	320
Total	11		277		152		314		754

$\chi^2_3 = 9.5$ $P < 0.05$

Appendix 65

Reason given for using more than one type of drench for sheep

Reason	No. of farms	%
Rotate drenches at regular intervals	59	24.1
Use different drenches for different types of worms	13	5.3
Previous drench wasn't working	4	1.6
Rotate drenches at irregular intervals	64	26.1
Bought the cheapest drench available	48	19.6
Use different drenches on different types of sheep	16	6.5
Thought it was time for a change	21	8.6
Other	20	8.2
Total	245	100.0

Appendix 66

If you took no action to prevent blowfly strike do you think that fly-strike would be a problem in your flock?

Perception of importance of blowfly strike	No. of farms	%
Major problem	252	70.8
Minor problem	79	22.2
No problem	21	5.9
Other	3	0.8
Don't know	1	0.2
Total	356	100.0

Appendix 67

Perception of the importance of blowfly strike by farmers in each Shire

Shire	Perception of blowfly strike				
	Major problem		Minor or no problem		Total
	No. of farms	%	No. of farms	%	
Albany	27	69.2	12	30.7	39
Broomehill	7	58.3	5	41.7	12
Cranbrook	13	56.5	10	43.5	23
Denmark/Walpole	5	55.6	4	44.4	9
Esperance	37	80.4	9	19.6	46
Gnowangerup	38	79.2	10	20.8	48
Katanning/Kent	27	87.1	4	12.9	31
Kojonup	25	58.1	18	41.9	43
Plantagenet	47	77.0	14	23.0	61
Ravensthorpe	9	64.3	5	35.7	14
Tambellup	9	75.0	3	25.0	12
Wagin/Woodanilling	8	57.1	6	42.9	14

$\chi^2_{11} = 18.9$ $P < 0.1$

Appendix 68

Perception of the importance of blowfly strike by farmers in each climatic zone

Perception of the importance of blowfly strike	Climatic zone									
	Coastal		Plantagenet		Mod. rainfall		Low rainfall		South-east	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Major problem	32	66.7	47	77.0	52	61.2	75	76.5	46	76.7
Minor problem	13	27.1	13	21.3	26	30.6	14	14.3	13	21.7
No problem	3	6.3	1	1.6	7	8.2	9	9.2	1	1.7
Total	48	100.0	61	100.0	85	100.0	98	100.0	60	100.0

$\chi^2_8 = 14.4$ $P < 0.1$

Appendix 69

Relationship between total size of sheep flock and the perception of blowfly strike

Perception of blowfly strike	Flock size					
	< 1,000		1,000—6,000		> 6,000	
	No. of farms	%	No. of farms	%	No. of farms	%
Major problem	28	50.9	171	77.7	46	69.7
Minor problem	20	36.4	39	17.7	18	27.3
No problem	7	12.7	10	4.5	2	3.0
Total	55	100.0	220	100.0	66	100.0

Appendix 70

Relationship between main breed of ewe and main breed of ram and the perception of blowfly strike importance

Perception of blowfly strike importance	Major breed of ewe								Major breed of ram							
	Merino		Corriedale/ Polwarth		Cross-bred		British breed		Merino		Corriedale/ Polwarth		Poll Dorset		British breed	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Major problem	228	75.0	4	66.6	5	45.5	2	40.0	189	74.1	6	66.6	9	100.0	24	64.9
Minor or no problem	76	25.0	2	33.3	6	54.5	3	60.0	66	25.9	3	33.3	0	0.0	13	35.1
Total	304	100.0	6	100.0	11	100.0	5	100.0	255	100.0	9	100.0	9	100.0	37	100.0

$\chi^2_1 = 6.55$ $P < 0.01$ (Merino c.f. other breeds pooled)

$\chi^2_3 = 4.93$ $P = 0.18$

Appendix 71

Relationship between number of times ewes and wethers were crutched per annum and the perception of blowfly strike importance

Perception of blowfly strike importance	Number of times ewes crutched						Number of times wethers crutched					
	0		1		2 or more		0		1		2 or more	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Major problem	7	43.8	99	75.1	36	76.6	22	55.0	175	74.2	16	69.6
Minor or no problem	9	56.2	66	24.9	11	23.4	18	45.0	61	25.8	7	30.4
Total	16	100.0	265	100.0	47	100.0	40	100.0	236	100.0	23	100.0

$\chi^2_2 = 6.80$ $P < 0.05$

$\chi^2_2 = 6.16$ $P < 0.05$

Appendix 72

Relationship between the number of times ewes were jetted and the perception of blowfly strike importance

Perception of blowfly strike	Number of times ewes jetted					
	0		1		2 or more	
	No. of farms	%	No. of farms	%	No. of farms	%
Major problem	151	69.6	64	84.2	21	77.8
Minor problem	53	24.4	11	14.5	6	22.2
No problem	13	6.0	1	1.3	0	0.0
Total	217	100.0	76	100.0	27	100.0

$\chi^2_2 = 6.5$ $P < 0.05$ (pooled minor problem and no problem)

Appendix 73

Which do you consider to be the more important problem in your flock, body strike or breach strike?

Relative importance of body and breech strike	No. of responses	%
Body strike is more important	81	21.1
Breech strike is more important	124	32.5
Both are equally important	128	33.5
Neither is a problem	46	12.0
Don't know	3	0.8
Total	382	100.0

Appendix 74

Relationship between the month mating commenced and the relative importance of body and breech strike

Relative importance of body and breech strike	Month mating commenced											
	October		November		December		January		February		Other	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Body strike more important	10	25.0	19	17.9	20	16.7	20	27.0	13	30.2	4	13.3
Breech strike more important	16	40.0	45	42.5	34	28.3	17	23.0	13	30.2	11	36.7
Both equally important	7	17.5	32	30.2	48	40.0	30	40.5	16	37.2	11	36.7
Neither is a problem	7	17.5	10	9.4	18	15.0	7	9.5	1	2.3	4	13.3
Total	40	100.0	106	100.0	120	100.0	74	100.0	43	100.0	30	100.0

$\chi^2_1 = 24.8$ $P = 0.05$

Appendix 75

The relative importance of breech and body strike in each district and shire

Shire	Body strike more important		Breech strike more important		Both equally important		Neither is a problem		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
Albany	13	31.0	3	7.1	24	57.1	2	4.8	42
Cranbrook	6	22.2	8	29.6	7	25.9	6	22.2	27
Denmark/Walpole	4	44.4	1	11.1	3	33.3	1	11.1	9
Plantagenet	22	33.8	12	18.5	27	41.5	4	6.2	65
Albany district	45	31.5	24	16.8	61	42.7	13	9.1	143
Esperance	8	16.7	20	41.7	16	33.3	4	9.3	48
Ravensthorpe	2	13.3	5	33.3	6	40.0	2	13.3	15
Esperance district	10	15.9	25	39.7	22	34.9	6	9.5	63
Broomehill	2	15.4	4	30.8	5	38.5	2	15.4	13
Gnowangerup	10	18.5	24	44.4	14	25.9	6	11.1	54
Katanning/Kent	2	6.1	18	54.5	3	9.1	10	30.0	33
Kojonup	8	17.8	12	26.7	18	40.0	7	15.6	45
Tambellup	2	15.4	9	69.2	2	15.4	0	0.0	13
Wagin/Woodanilling	2	13.3	8	53.3	3	20.0	2	13.3	15
Katanning district	26	15.0	75	43.4	45	26.0	27	15.6	173

Appendix 76

Relationship between stocking policy and the relative importance of breech and body strike

Relative importance of breech and body strike	Stocking policy			
	Sheep only		Sheep and cattle	
	No. of farms	%	No. of farms	%
Body strike more important.	39	17.6	42	26.8
Breech strike more important	84	37.8	40	25.5
Both equally important	64	28.8	64	40.8
Neither is a problem	35	15.8	11	7.0
Total	222	100.0	157	100.0

$\chi^2_3 = 17.6$ $P < 0.001$

Appendix 77

Relationship between time of shearing and the relative importance of body and blowfly strike

Month shearing commenced	Body strike more important		Breech strike more important		Both equally important		Neither is a problem		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No.of farms	%	
July/Aug.	17	18.7	35	38.5	26	28.6	13	14.3	91
Sept./Oct.	26	17.9	54	37.2	46	31.7	19	13.1	145
Nov./Dec.	16	34.8	9	19.6	19	41.3	2	4.3	46
Jan./Feb.	13	37.1	6	17.1	12	34.3	4	11.4	35
Mar./June	0	0.0	9	40.9	9	40.9	4	18.2	22

$\chi^2_{12} = 26.3$ $P < 0.01$

Appendix 78

Relationship between the number of times sheep were jetted and the relative importance of body and breech strike

Relative importance of body and breech strike	Number of times jetted							
	0		1		2 or more		Total	
	No. of farms	%	No. of farms	%	No. of farms	%		
Ewes								
Body strike more important	40	58.0	22	31.9	7	10.1	69	$\chi^2_6 = 34.3$
Breech strike more important	88	76.5	17	14.8	10	8.7	115	$P < 0.001$
Both equally important	67	56.8	38	32.2	13	11.0	118	
Neither is a problem	40	100.0	0	0.0	0	0.0	40	
Lambs								
Body strike more important	46	67.6	18	26.5	4	5.9	68	$\chi^2_6 = 36.2$
Breech strike more important	92	82.9	12	10.8	7	6.3	111	$P < 0.001$
Both equally important	67	58.3	40	34.8	8	7.0	115	
Neither is a problem	38	100.0	0	0.0	0	0.0	38	
Weaners								
Body strike more important	44	67.7	17	26.2	4	6.1	65	
Breech strike more important	90	80.4	13	11.6	9	8.1	112	$\chi^2_6 = 30.6$
Both equally important	67	60.4	34	30.6	10	9.0	111	$P < 0.001$
Neither is a problem	39	100.0	0	0.0	0	0.0	39	
Wethers								
Body strike more important	44	74.6	12	20.3	3	5.1	59	
Breech strike more important	83	85.6	8	8.2	6	6.2	98	$\chi^2_6 = 23.3$
Both equally important	70	70.0	26	26.0	4	4.0	100	$P < 0.001$
Neither is a problem	38	100.0	0	0.0	0	0.0	38	

Appendix 79

Number and per cent of farmers in each Shire and district who had their sheep mulesed

Shire	Not mulesed		All lambs mulesed		Some lambs mulesed		Other		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
Albany	25	58.1	13	30.2	4	9.3	1	2.3	43
Cranbrook	4	16.0	19	76.0	2	8.0	0	0.0	25
Denmark/Walpole	8	88.9	1	11.1	0	0.0	0	0.0	9
Plantagenet	25	37.9	28	42.4	10	15.2	3	4.5	66
Albany district	62	43.4	61	42.7	16	11.2	4	2.8	143
Esperance	6	12.8	32	68.1	7	14.9	2	4.3	47
Ravensthorpe	7	43.8	8	50.0	0	0.0	1	6.3	16
Esperance district	13	20.6	40	63.5	7	11.1	3	4.8	63
Broomehill	2	15.4	11	84.6	0	0.0	0	0.0	13
Gnowangerup	8	13.3	52	86.7	0	0.0	0	0.0	60
Katanning	2	11.8	14	82.4	1	5.9	0	0.0	17
Kent	1	6.7	12	80.0	1	6.7	1	6.7	15
Kojonup	4	8.7	37	80.4	3	6.5	2	4.3	46
Tambellup	3	23.1	10	76.9	0	0.0	0	0.0	13
Wagin/Woodanilling	1	6.3	11	68.8	2	12.5	2	12.5	16
Katanning district	21	11.7	147	81.7	7	3.9	5	2.8	180

Appendix 80

Number and per cent of farmers who had their sheep mulesed in Shires grouped into climatic zones

Climatic zone	Not mulesed		All lambs mulesed		Some lambs mulesed		Other		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
Coastal	33	63.5	14	26.9	4	7.7	1	1.9	52
Plantagenet	25	37.9	28	42.4	10	15.2	3	4.5	66
Moderate rainfall	12	12.9	72	77.4	5	5.4	4	4.4	93
Low rainfall	13	11.6	94	83.9	4	3.6	1	0.9	112
South-east	13	20.6	40	63.5	7	11.1	3	4.8	63

$\chi^2_{12} = 7.0$ $P < 0.001$

Appendix 81

Number and per cent of farmers who had their sheep mulesed related to stocking policy

Stocking policy	Not mulesed		All lambs mulesed		Some lambs mulesed		Other		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
Sheep only	49	21.9	157	70.1	11	4.9	7	3.1	224
Sheep and cattle	47	29.0	91	56.2	19	11.7	5	3.1	162

$\chi^2_3 = 10.4$ $P < 0.05$

Appendix 82

Relationship between number and per cent of farmers who had their sheep mulesed and flock size

Flock size	Not mulesed		All lambs mulesed		Some lambs mulesed		Other		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
< 500	32	82.1	5	12.8	1	2.6	1	2.6	39
500-1,000	19	73.1	4	15.4	3	11.5	0	0.0	26
1,000-2,000	14	28.0	31	62.0	3	6.0	2	4.0	50
2,000-5,000	22	13.7	116	72.0	17	10.6	6	3.7	161
5,000-10,000	4	5.1	67	84.8	6	7.6	2	2.5	79
>10,000	1	4.8	20	95.2	0	0.0	0	0.0	21

$\chi^2_{15} = 143.9$ $P < 0.001$

Appendix 83

Relationship between number and per cent of farmers who had their sheep mulesed and the units of labour available

Labour available on farm (units of labour)	Not mulesed		All lambs mulesed		Some lambs mulesed		Others		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
1 or less	32	38.1	42	50.0	5	6.0	5	6.0	84
1 to 2	46	27.2	105	62.1	13	7.7	5	3.0	169
2 to 4	11	12.9	66	77.6	7	8.2	1	1.2	85
>4	2	11.1	16	88.9	0	0.0	0	0.0	18

$\chi^2_9 = 24.4$ $P < 0.01$

Appendix 84

Relationship between sheep production activity and the number of farmers who mulesed their sheep

Sheep activity	Not mulesed		All lambs mulesed		Some lambs mulesed		Other		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
Sheep main activity									
Wool	70	20.2	236	86.2	29	8.4	11	3.2	346
Fat lambs	11	91.7	0	0.0	0	0.0	1	8.3	12
Sheep secondary activity									
Wool	16	16.2	77	77.8	3	3.0	3	3.0	99
Fat lambs	36	36.0	44	44.0	18	18.0	2	2.0	100

Appendix 85

Relationship between main breed of ram and the number and per cent of farmers who mulesed their sheep

Breed	Not mulesed		All lambs mulesed		Some lambs mulesed		Other		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
Merino	28	9.8	229	80.4	20	7.0	8	2.8	285
Corriedale/Polwarth	8	66.6	2	16.7	2	16.7	0	0.0	12
British Breed	32	84.2	3	7.9	1	2.6	2	5.3	38
Other	7	46.7	2	13.3	4	26.7	2	13.3	15

$\chi^2_9 = 156.9$ $P \lesssim 0.001$

Appendix 86

Relationship between per cent of farmers who mulesed lambs and shearing time

Month shearing commenced	Not mulesed		All lambs mulesed		Some lambs mulesed		Other		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
July/Aug	16	17.0	68	72.3	5	5.3	5	5.3	94
Sept./Oct	34	23.1	97	66.0	13	8.8	3	2.0	147
Nov./Dec	18	38.3	25	53.2	4	8.5	0	0.0	47
Jan./Feb	10	27.8	21	58.3	4	11.1	1	2.8	36
Mar. to June	7	30.4	11	47.8	2	8.7	3	13.0	23

$\chi^2_{12} = 20.5$ $P = 0.06$

Appendix 87

Time when lambs were mulesed in 1980

Time of mulesing	No. of farms	%
At lamb marking	231	83.7
Between marking and weaning	30	10.9
At weaning	3	1.1
After weaning	10	3.6
Other	2	0.7
Total	276	100.0

Appendix 88

Category of persons who mulesed sheep in each Shire

Shire	Category of persons who mulesed sheep								
	Contractor		Self		Neighbour		Other		Total
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
Albany/Denmark	9	50.0	6	33.3	2	11.1	1	5.6	18
Cranbrook	10	47.6	7	33.3	4	19.0	0	0.0	21
Plantagenet	21	52.5	14	35.0	2	5.0	3	7.5	40
Broomehill	6	54.5	5	45.5	0	0.0	0	0.0	11
Gnowangerup	30	57.7	18	34.6	2	3.8	2	3.8	52
Katanning	8	57.1	6	42.9	0	0.0	0	0.0	14
Kent	5	35.7	8	57.1	1	7.1	0	0.0	14
Kojonup	13	33.3	21	53.8	4	10.3	1	2.6	39
Tambellup	4	44.4	4	44.4	1	11.1	0	0.0	9
Wagin/Woodanilling	9	60.0	5	33.3	0	0.0	1	6.7	15
Esperance	32	78.0	7	17.1	0	0.0	2	4.9	41
Ravensthorpe	4	44.4	4	44.4	0	0.0	1	11.1	9

Appendix 89

Relationship between area of holding and who did the mules operation.

Who did Mules operation	Area of holding (ha)											
	0 - 500		500 - 749		750 - 999		1,000 - 1,999		2,000 - 2,999		>3,000	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Contractor	14	51.9	12	42.9	16	44.4	63	58.3	27	57.4	18	58.1
Self	3	11.1	13	46.4	20	55.6	36	33.3	18	38.3	11	35.5
Neighbour	6	22.2	3	10.7	0	0.0	5	4.6	2	4.3	0	0.0
Other	4	14.8	1	3.6	0	0.0	4	3.7	0	0.0	2	6.5
Total	27	100.0	28	100.0	36	100.0	108	100.0	47	100.0	31	100.0

$\chi^2_{15} = 41.26$ P. < 0.001

Appendix 90

Relationship between flock size and who did the Mules operation

Who did the Mules operation.	Flock size									
	< 1,500		1,500-3,000		3,000-5,000		5,000-10,000		>10,000	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Contractor	15	51.7	32	48.5	51	56.7	41	54.7	9	45.0
Self	5	17.2	27	40.9	33	36.7	31	41.3	9	45.0
Neighbour	5	17.2	6	9.1	4	4.4	1	1.3	0	0.0
Other	4	13.8	1	1.5	2	2.2	2	2.7	2	10.0
Total	29	100.0	66	100.0	90	100.0	75	100.0	20	100.0

$\chi^2_{12} = 27.8$ < 0.01

Appendix 91

Relationship between labour available and who did the Mules operation.

Persons who did the Mules operation	Labour available (labour units)							
	1 or less		1-2		2-3		> 4	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Contractor	24	50.0	60	50.4	48	63.2	7	43.8
Self	14	29.2	46	38.7	27	35.5	7	43.8
Neighbour	6	12.5	8	6.7	1	1.3	0	0.0
Other	4	8.3	5	4.2	0	0.0	2	12.5
Total	48	100.0	119	100.0	76	100.0	16	100.0

Appendix 92

Type of Mules operation done on farms in each Shire and district

Shire	Type of Mules operation										Total
	A		B		C		D		E		
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
Albany/Denmark	9	50.0	5	27.8	3	16.7	1	5.6	0	0.0	18
Cranbrook.	11	50.0	1	4.5	8	36.4	0	0.0	2	9.1	22
Plantagenet	18	45.0	8	20.0	11	27.5	2	5.0	1	2.5	40
Albany district	38	47.5	14	17.5	22	27.5	3	3.8	3	3.8	80
Esperance	8	19.0	11	26.2	1	42.9	2	4.8	3	7.2	42
Ravensthorpe	4	44.4	3	33.3	0	0.0	1	11.1	1	11.1	9
Esperance district	12	23.5	14	27.5	18	35.3	3	5.9	4	7.8	51
Broomehill	5	45.5	2	18.2	3	27.3	0	0.0	1	9.1	11
Gnowangerup	22	42.3	11	21.2	15	28.8	2	3.8	2	3.8	52
Katanning	9	60.0	3	20.0	3	20.0	0	0.0	0	0.0	15
Kent	7	50.0	1	7.1	6	42.9	0	0.0	0	0.0	14
Kojonup	24	61.5	3	7.7	9	23.1	2	5.1	1	2.6	39
Tambellup	7	70.0	0	0.0	2	20.0	0	0.0	1	10.0	10
Wagin/Woodanilling	10	66.7	3	20.0	1	6.7	1	6.7	0	0.0	15
Katanning district	84	53.8	23	14.7	39	25.0	5	3.2	5	3.2	156

$\chi^2_8 = 15.3$ P = 0.05

Appendix 93

Relationship between flock size and type of Mules operation

Flock size	Type of Mules operation								Total
	A		B		C		D, E, F		
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
<1,000	3	23.1	1	7.7	4	30.8	5	38.5	13
1,000—1,999	14	40.0	10	28.6	9	25.7	2	5.7	35
2,000—4,999	64	45.7	26	18.6	41	29.3	9	6.4	140
5,000—9999	45	60.0	8	10.7	16	21.3	6	8.0	75
>10,000	6	30.0	5	25.0	8	40.0	1	5.0	20

$\chi^2_{12} = 29,.9$ $P < 0.01$

Appendix 94

Relationship between type of Mules operation and amount of labour available

Amount of labour available (units of labour)	Types of Mules operation								Total
	A		B		C		D, E, F		
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
< 1	15	30.6	14	28.6	13	26.5	7	14.3	49
1 to 2	62	51.2	19	15.7	32	26.4	8	6.6	121
2 to 4	42	55.3	11	14.5	18	23.7	5	6.6	76
> 4	3	18.8	3	18.8	10	62.5	0	0.0	16

$\chi^2_9 = 22.9$ $P<0.01$

Appendix 95

Relationship between who did the Mules operation and type of Mules performed

Who did the Mules operation?	Type of Mules operation								Total
	A		B		C		Other (incl. Mules D)		
	No.	%	No.	%	No.	%	No.	%	
Contractor	64	42.4	36	23.8	41	27.2	10	6.6	151
Self	57	54.3	8	7.6	31	29.5	9	8.6	105
Neighbour	7	43.8	5	31.3	2	12.5	2	12.5	16
Other	4	36.4	1	9.1	4	36.4	2	18.2	11

$\chi^2_9 = 17.5$ $P<0.05$

Appendix 96

Reason why sheep were not mulesed in each district

Reason not mulesed	District					
	Albany		Esperance		Katanning	
	No. of farms	%	No. of farms	%	No. of farms	%
Don't believe mulesing is of value	25	27.8	6	19.4	4	26.7
Fat lambs to be sold at weaning	26	28.9	3	9.7	5	33.3
Believe in value of Mules operation, but prevented from mulesing	2	2.2	10	32.3	3	20.0
Buy in replacement sheep	37	41.1	12	38.7	3	20.0
Total	90	100.0	31	100.0	15	100.0

$\chi^2_6 = 26.1$ $P < 0.01$

Appendix 97

Relationship between the reason for not mulesing and perception of the importance of blowfly strike

Reasons for not mulesing	Perception of importance of blowfly strike				Total
	Major problem		Minor or no problem		
	No. of farms	%	No. of farms	%	
Don't believe in value of mulesing	12	44.4	15	55.6	27
Fat lambs to be sold at weaning	24	77.4	7	22.6	31
Believe in value of Mules operation, but prevented from mulesing	12	100.0	0	0.0	12
Buy in replacement sheep	35	72.9	13	27.1	48

$\chi^2_3 = 14.6$ $P < 0.01$

Appendix 98

Relationship between length of tail and the reason for not mulesing

Reason for not mulesing	Length of tail						Total
	Short as possible		First joint		Tip of vulva		
	No. of farms	%	No. of farms	%	No. of farms	%	
Doesn't believe mulesing of value	3	11.1	10	37.0	14	51.9	27
Fat lambs to be sold at weaning	5	14.7	8	23.5	21	61.8	34
Believe in value of Mules operation, but prevented from mulesing	1	7.1	0	0.0	13	92.1	14
Buy in replacement sheep	8	22.9	9	25.7	18	51.4	35

$\chi^2_6 = 19.7$ $P < 0.1$

Appendix 99

Length to which lamb tails were docked

Length of tail	No. of farms	%
Short as possible	14	3.8
First joint	60	16.4
Tip of vulva (or equivalent in wethers)	274	74.9
Other	16	4.4
Don't know	2	0.5
Total	366	100.0

Appendix 100

The percentage of farmers and the frequency of jetting per annum in each Shire.

Shire	Ewes					Lambs					Weaners					Wethers				
	0 %	1 %	2 or more %	Mean	± SE	0 %	1 %	2 or more %	Mean	± SE	0 %	1 %	2 or more %	Mean	± SE	0 %	1 %	2 or more %	Mean	± SE
Albany	45.9	32.4	21.6	0.86	0.17	63.9	19.4	16.7	0.61	0.17	65.7	17.1	17.2	0.63	0.18	75.9	17.2	6.9	0.31	0.11
Broomehill	58.3	41.7	0.0	0.42	0.15	54.5	45.5	0.0	0.45	0.18	58.3	41.7	0.0	0.42	0.15	50.0	50.0	0.0	0.50	0.17
Cranbrook	69.6	30.4	0.0	0.30	0.10	77.3	22.7	0.0	0.23	0.09	62.5	37.5	0.0	0.38	0.10	79.2	20.8	0.0	0.21	0.08
Denmark/ Walpole	33.3	22.2	44.4	1.33	—	50.0	33.3	16.7	0.83	—	40.0	20.0	40.0	1.40	—	16.7	50.0	33.3	1.50	0.50
Esperance	70.5	25.0	4.5	0.34	0.09	68.2	27.3	4.5	0.36	0.09	75.6	17.8	6.6	0.38	0.12	80.0	10.0	10.0	0.30	0.10
Gnowangerup	85.2	11.1	3.7	0.19	0.07	90.6	7.5	1.9	0.11	0.05	79.6	13.0	7.4	0.28	0.08	91.7	6.3	2.1	0.10	0.05
Katanning	76.5	5.9	17.7	0.47	0.23	82.4	11.8	5.9	0.24	0.14	76.5	11.8	11.8	0.41	0.21	86.7	6.7	6.7	0.27	0.21
Kent	92.9	7.1	0.0	0.07	0.07	85.7	14.3	0.0	0.14	0.10	100.0	0.0	0.0	0.00	0.00	100.0	0.0	0.0	0.00	0.00
Kojonup	81.4	18.6	0.0	0.19	0.06	81.0	19.0	0.0	0.19	0.06	80.0	17.5	2.5	0.23	0.08	90.2	9.8	0.0	0.10	0.05
Plantagenet	51.7	36.7	11.7	0.60	0.09	53.4	37.9	8.6	0.55	0.09	60.4	30.2	9.4	0.49	0.09	66.0	29.8	4.3	0.38	0.08
Ravensthorpe	92.3	7.7	0.0	0.08	0.08	91.7	8.3	0.0	0.08	0.08	100.0	0.0	0.0	0.00	0.00	87.5	12.5	0.0	0.13	0.13
Tambellup	61.5	15.4	23.1	0.62	0.24	84.6	0.0	15.4	0.13	0.21	75.0	16.7	8.3	0.33	0.19	66.7	22.2	11.1	0.44	0.24
Wagin/ Woodanilling	87.5	6.3	6.3	0.19	—	81.3	12.5	6.3	0.25	—	93.8	6.3	0.0	0.06	—	100.0	0.0	0.0	0.00	0.00

S. E. = Standard error

Appendix 101

Number of times sheep were jetted per annum in each district

District	Number of times jetted						Total	Mean ± SE	
	0		1		2 or more				
	No. of farms	%	No. of farms	%	No. of farms	%			
Ewes									
Albany	67	51.9	43	33.3	19	14.8	129	0.67	0.07
Esperance	43	75.4	12	21.1	2	3.5	57	0.28	0.07
Katanning	136	80.5	24	14.2	9	5.3	169	0.25	0.04
	$\chi^2_4 = 30.7$ P < 0.001								
Lambs									
Albany	74	60.7	36	29.5	12	9.8	122	0.52	0.07
Esperance	41	73.2	13	23.2	2	3.6	56	0.30	0.07
Katanning	138	83.1	23	13.9	5	3.0	166	0.20	0.04
	$\chi^2_4 = 19.6$ P < 0.001								
Weaners									
Albany	72	61.5	32	27.4	13	11.1	117	0.55	0.08
Esperance	45	80.4	8	14.3	3	5.4	56	0.30	0.10
Katanning	133	80.6	24	14.5	8	4.8	165	0.25	0.04
	$\chi^2_4 = 14.5$ P < 0.01								
Wethers									
Albany	73	68.9	27	25.5	6	5.7	106	0.39	0.06
Esperance	39	81.3	5	10.4	4	8.3	48	0.27	0.09
Katanning	135	88.2	15	9.8	3	2.0	153	0.14	0.04
	$\chi^2_4 = 18.1$ P < 0.001								

Appendix 102

The relationship between frequency per annum of jetting and time of mating.

Number of times jetted	Month mating commenced											
	Sept./Oct.		Nov.		Dec.		Jan.		Feb./Mar.		Other	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Ewes												
Nil	26	65.0	86	79.6	81	69.8	39	55.7	28	52.8	12	92.3
Once	11	27.5	15	13.9	24	20.7	27	38.6	17	32.1	0	0.0
Twice or more	3	7.5	7	6.5	11	9.5	4	5.7	8	15.1	1	7.7
Total	40	100.0	108	100.0	116	100.0	70	100.0	53	100.0	13	100.0
	$\chi^2_{10} = 27.2$ P < 0.01											
Lambs												
Nil	29	72.5	89	82.4	83	73.5	39	57.4	32	61.5	11	84.6
Once	8	20.0	14	13.0	25	22.1	26	38.2	14	26.9	1	7.7
Twice or more	3	7.5	5	4.6	5	4.4	3	4.4	6	11.5	1	7.7
Total	40	100.0	108	100.0	113	100.0	68	100.0	52	100.0	13	100.0
	$\chi^2_{10} = 22.6$ P < 0.01											
Weaners												
Nil	29	72.5	86	81.9	81	73.6	37	56.1	31	66.0	12	92.3
Once	6	15.0	14	13.3	21	19.1	25	37.9	11	23.4	0	0.0
Twice or more	5	12.5	5	4.8	8	7.3	4	6.1	5	10.6	1	7.7
Total	40	100.0	105	100.0	110	100.0	66	100.0	47	100.0	13	100.0
	$\chi^2_{10} = 24.1$ P < 0.01											
Wethers												
Nil	28	77.8	82	89.1	77	79.4	34	68.0	31	72.1	10	90.9
Once	5	13.9	7	7.6	15	15.5	14	28.0	9	20.9	0	0.0
Twice or more	3	8.3	3	3.3	5	5.2	2	4.0	3	7.0	1	9.1
Total	36	100.0	92	100.0	97	100.0	50	100.0	43	100.0	11	100.0
	$\chi^2_{10} = 16.0$ P = 0.10											

Appendix 103

The month, age, and sex of sheep jetted

Month of jetting	Ewes		Lambs		Weaners		Wethers	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
July	0	0.0	0	0.0	0	0.0	0	0.0
Aug.	9	6.2	6	5.2	8	6.6	5	6.6
Sept.	31	21.2	30	26.1	22	18.0	15	19.7
Oct.	47	32.2	41	35.7	42	34.4	28	36.8
Nov.	21	14.4	19	16.5	21	17.2	12	15.8
Dec.	11	7.5	7	6.1	5	4.1	5	6.6
Jan.	8	5.5	3	2.6	7	5.7	3	3.9
Feb.	4	2.7	2	1.7	4	3.3	2	2.6
Mar.	8	5.5	3	2.6	7	5.7	3	3.9
Apr.	3	2.1	1	0.9	2	1.6	2	2.6
May	3	2.1	2	1.7	2	1.6	1	1.3
June	1	0.7	1	0.9	2	1.6	0	0.0
Total	146	100.0	115	100.0	122	100.0	76	100.0
Not jetted	246		253		250		247	

Appendix 104

Jetting methods used in each district

District	Method of jetting						Total
	Hand wand		Jetting race		Other		
	No. of farms	%	No. of farms	%	No. of farms	%	
Albany	49	64.5	19	25.0	8	10.5	76
Esperance	11	61.1	7	38.9	0	0.0	18
Katanning	30	66.6	15	33.3	0	0.0	45
All districts	90	63.4	41	28.9	8	5.6	139

$\chi^2_4 = 8.0$ $P < 0.1$

Appendix 105

Relationship between jetting method and flock size

Flock size	Jetting methods						Total
	Hand wand		Jetting race		Other		
	No. of farms	%	No. of farms	%	No. of farms	%	
<1,000	21	80.8	2	7.7	3	11.5	26
1,000 - 2,999	20	58.8	10	29.4	4	11.8	34
3,000 - 4,999	26	65.0	13	32.5	1	2.5	40
5,000 - 9,999	15	60.0	10	40.0	0	0.0	25
>10,000	6	50.0	6	50.0	0	0.0	12

$\chi^2_8 = 15.0$ $P < 0.1$

Appendix 106

Relationship between jetting method and time of shearing

Month shearing commenced	Jetting methods						Total
	Hand wand		Jetting race		Other		
	No. of farms	%	No. of farms	%	No. of farms	%	
July/Aug.	12	60.0	8	40.0	0	0.0	20
Sept./Oct.	31	72.1	10	23.3	2	4.7	43
Nov./Dec.	19	59.4	12	37.5	1	3.1	32
Jan./Feb.	12	66.7	5	27.8	1	5.6	18
Mar./June	4	44.4	2	22.2	3	33.3	9

$\chi^2_8 = 16.8$ $P < 0.05$

Appendix 107

Chemicals used for jetting in each climatic zone

Climatic zone	Jetting chemicals used								Total
	Diazinon preparations		Lucijet ®		Suprex 100®		Vetrazin®		
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	
Coastal	15	42.9	7	20.0	4	11.4	9	25.7	35
Plantagenet	11	28.9	17	44.7	0	0.0	10	26.3	38
Mod. rainfall	14	38.9	5	13.9	6	16.7	11	30.6	36
Low rainfall	8	26.7	12	40.0	3	10.0	7	23.3	30
South-east	4	17.4	7	30.4	2	8.7	10	43.5	23

$\chi^2_{12} = 20.0$ $P < 0.1$

Appendix 108

Number of times sheep were crutched

No. of times crutched	Class of sheep									
	Ewes		Lambs		Weaners		Wethers		Rams	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
Nil	20	5.4	225	62.3	56	15.6	44	13.3	76	21.3
Once	300	80.4	125	34.6	279	77.5	262	78.9	253	71.1
Twice	48	12.9	11	3.0	23	6.4	22	6.6	26	7.3
Three times	3	0.8	0	0.0	2	0.6	3	0.9	1	0.3
Four or five times	2	0.6	0	0.0	0	0.0	1	0.3	0	0.0
Total	373	100.0	361	100.0	360	100.0	332	100.0	356	100.0
Mean ± S.E.	1.11		0.407		0.919		0.961		0.865	
Standard error	± 0.027		± 0.029		± 0.026		± 0.028		± 0.028	

Appendix 109

Month in which sheep were crutched.

Month crutched	Class of sheep									
	Ewes		Lambs		Weaners		Wethers		Rams	
	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%	No. of farms	%
July	13	3.1	3	2.0	15	4.5	20	6.3	14	4.5
Aug.	21	5.1	6	4.1	21	6.3	20	6.3	7	2.3
Sept.	43	10.4	17	11.6	25	7.6	29	9.1	27	8.8
Oct.	23	5.6	10	6.8	16	4.8	14	4.4	14	4.5
Nov.	7	1.7	1	0.7	6	1.8	7	2.2	5	1.6
Dec.	9	2.2	3	2.0	7	2.1	7	2.2	9	2.9
Jan.	9	2.2	5	3.4	8	2.4	9	2.8	8	2.6
Feb.	41	9.9	15	10.2	38	11.5	34	10.6	30	9.7
Mar.	106	25.6	40	27.2	87	26.3	70	21.9	76	24.7
Apr.	88	21.3	28	19.0	60	18.1	55	17.2	66	21.4
May	36	8.7	12	8.2	31	9.4	33	10.3	33	10.7
June	18	4.3	7	4.8	17	5.1	22	6.9	19	6.2
Total	414	100.0	147	100.0	331	100.0	320	100.0	308	100.0
Not crutched	20		225		56		44		76	

Appendix 110

The number of times per annum each class of sheep crutched in each district and climatic zone

	Times crutched											
	Ewes			Lambs			Weaners			Wethers		
	0	1	2 or more	0	1	2 or more	0	1	2 or more	0	1	2 or more
District												
Albany												
No. of farms	10	97	28	86	39	3	26	85	14	18	82	15
%	7.4	71.9	20.7	67.2	30.5	2.3	20.8	68.0	11.2	15.7	71.3	14.1
Esperance												
No. of farms	4	54	4	30	28	1	14	46	1	14	41	1
%	6.5	87.1	6.5	50.8	47.5	1.7	23.0	75.4	1.6	25.0	73.2	1.8
Katanning												
No. of farms	6	149	21	109	58	7	16	148	10	12	139	10
%	3.4	84.7	11.9	62.6	33.3	4.0	9.2	85.1	5.7	7.5	86.3	6.2
	$\chi^2_4 = 11.7$			$\chi^2_4 = 6.4$			$\chi^2_4 = 17.7$			$\chi^2_4 = 19.7$		
	$P < 0.05$			$P = 0.17$			$P < 0.001$			$P < 0.001$		
Climatic zone												
Coastal												
No. of farms	7	37	4	30	12	0	11	26	4	10	26	1
%	14.6	77.1	8.3	71.4	28.6	0.0	26.8	63.4	9.7	27.0	70.3	2.7
Plantagenet												
No. of farms	2	42	19	39	20	3	10	44	5	6	39	9
%	3.2	66.7	30.2	62.9	32.3	4.8	16.9	74.6	8.5	11.1	72.2	16.8
Moderate rainfall												
No. of farms	4	78	10	64	26	2	11	74	7	8	73	8
%	4.3	84.8	10.9	69.6	28.3	2.2	12.0	80.4	7.6	9.0	82.0	9.0
Low rainfall												
No. of farms	3	89	16	62	39	5	10	89	8	6	83	7
%	2.8	82.4	14.8	58.5	36.8	4.7	9.3	83.2	7.5	6.3	86.5	7.3
South-east												
No. of farms	4	54	4	30	28	1	14	46	1	14	41	1
%	6.5	87.1	6.5	50.8	47.5	1.7	23.0	75.4	1.6	25.0	73.2	1.8
	$\chi^2_8 = 27.8$			$\chi^2_8 = 10.9$			$\chi^2_8 = 13.9$			$\chi^2_8 = 27.2$		
	$P < 0.001$			$P = 0.21$			$P < 0.1$			$P < 0.001$		

Appendix 111

The relationship between flock size and the annual number of times each class of sheep crutched

Flock size	Times crutched											
	Ewes			Lambs			Weaners			Wethers		
	0	1	2 or more	0	1	2 or more	0	1	2 or more	0	1	2 or more
<1,000												
No. of farms	10	44	3	29	19	0	15	31	2	13	24	2
%	17.5	77.2	5.3	60.4	39.6	0.0	31.3	64.6	4.2	33.3	61.5	5.1
1,000—1,999												
No. of farms	2	38	8	23	23	1	9	35	3	6	34	4
%	4.2	79.2	16.7	48.9	48.9	2.1	19.1	74.5	6.4	13.6	77.3	9.1
2,000—4,999												
No. of farms	6	129	25	97	58	5	20	129	8	15	116	11
%	3.8	80.6	15.6	60.6	36.3	3.1	12.7	82.2	5.1	10.6	81.7	7.7
5,000—9,999												
No. of farms	1	66	10	57	16	3	7	63	8	7	63	5
%	1.3	85.7	13.0	75	21.1	3.9	9.0	80.7	10.3	9.3	84.0	6.7
>10,000												
No. of farms	0	16	5	16	4	1	4	14	3	1	17	3
%	0.0	76.2	23.8	76.2	19.0	4.8	19.0	66.7	14.3	4.8	8.1	14.3
	$\chi^2_8 = 26.3$			$\chi^2_8 = 14.9$			$\chi^2_8 = 17.3$			$\chi^2_8 = 18.5$		
	$P < 0.001$			$P < 0.1$			$P < 0.05$			$P < 0.05$		

Appendix 112

The relationship between time of shearing and the number of times per annum each class of sheep crutched

Time of shearing	Times crutched											
	Ewes			Lambs			Weaners			Wethers		
	0	1	2 or more	0	1	2 or more	0	1	2 or more	0	1	2 or more
July/Aug.												
No. of farms	2	81	8	47	42	1	10	79	2	9	79	4
%	2.2	89.0	8.8	52.2	46.7	1.1	11.0	86.8	2.2	9.8	85.9	4.4
Sept./Oct.												
No. of farms	2	123	19	84	51	4	16	111	10	17	96	11
%	1.4	85.4	13.2	60.4	36.7	2.9	11.7	81.0	7.3	13.7	77.4	8.9
Nov./Dec.												
No. of farms	4	30	13	28	17	2	8	32	3	4	33	4
%	8.5	63.8	27.7	59.6	36.2	4.3	18.6	74.4	7.0	9.8	80.5	9.8
Jan./Feb.												
No. of farms	5	28	4	28	7	0	7	23	3	4	23	0
%	13.5	75.7	10.8	80.0	2	0.0	21.2	69.7	9.1	14.8	85.2	0.0
Mar. to June												
No. of farms	4	16	2	15	4	1	8	11	3	6	10	2
%	18.2	72.7	9.1	75.0	20.0	5.0	36.4	50.0	13.6	33.3	55.6	11.1
	$\chi^2_8 = 31.5$			$\chi^2_8 = 13.3$			$\chi^2_8 = 18.3$			$\chi^2_8 = 13.1$		
	$P < 0.001$			$P = 0.1$			$P < 0.05$			$P = 0.1$		

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