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The assessment of crystals derived from Aloe spp. for potential use as an herbal anthelmintic thereby indirectly controlling blowfly strike

A.J. Scholtz[1,2#], S.W.P. Cloete[1,3], J.B. van Wyk[4] and T.C.deK. van der Linde[5]
[1]Institute for Animal Production: Elsenburg, Private Bag X1, Elsenburg 7607, South Africa
[2]Centre for Sustainable Agriculture and Rural Development, Faculty of Natural and Agricultural Sciences, University of the Free State, P.O. Box 339, Bloemfontein, 9300, South Africa
[3]Department of Animal Sciences, University of Stellenbosch, Private Bag X1, Matieland,7599, South Africa
[4]Department of Animal, Wildlife and Grassland Sciences, University of the Free State, P.O. Box 339, Bloemfontein 9300
[5]Department of Zoology and Entomology, University of the Free State, P.O. Box 339, Bloemfontein, 9300

Abstract

Dagginess predisposes sheep to breech strike and can be controlled with management practices (e.g. mulesing, crutching) or by treating the animal with an anthelmintic. The effect of regular treatment with crystals derived from Aloe spp as a natural anthelmintic was assessed in yearling Merino progeny born in 2004 (Trial 1) and 2005 (Trial 2), while the short-term effect of aloe treatment over 14 days was also considered (Trial 3). Animals were randomly allocated to a treatment group (aloe or distilled water). Natural challenge was used to ensure that all animals received an adequate gastro-intestinal nematode challenge, prior to being drenched with an aloe solution, or distilled water as a control treatment. Following treatment, gastro-intestinal nematode egg counts (FEC) were obtained at regular intervals to assess the effect of aloe treatment. Dag scores were also recorded prior to shearing as hoggets. The experimental outlay of all trials was factorial, with aloe treatment and sampling date as main effects. Recordings of FEC were subjected to a cube root transformation prior to analyses to normalise the distribution in all cases. When monthly FEC was considered in Trial 1 and 2, there was also no evidence of a reduced parasite burden in the treated group. No change was accordingly found in Trial 3, where the short-term effect of treatment was considered. The mean dag scores of individuals in Trials 1 and 2 were accordingly not affected by treatment with aloe. Alternative strategies for the reduction of FEC and flystrike thus need to be considered.

Keywords: Aloe, anthelmintic, nematode egg counts, Merino, breech strike
[#] Corresponding author. E-mail: ansies@elsenburg.com

Introduction

An indirect method to control blowfly is to reduce dagginess by sheep thereby making them less attractive for breech strike. Dags are accumulations of faecal material around the tail and crutch of sheep and are associated with sheep with loose, moist faeces adhering to the wool and can accumulate to form large masses (Reid & Cottle, 1999; Waghorn *et al*., 1999). Dags represent a major cost to sheep farmers, in monetary terms and because of the stress associated with flystrike (Waghorn *et al*., 1999). Gastro-intestinal nematode parasite infections have been associated with dag formation (McEwan *et al*., 1992; Larsen *et al*., 1994) and the control of helminth infections in livestock relies mainly on the use of anthelmintics (Piper & Barger, 1988; Waller, 1994) in combination with managerial practices. “Modern/chemical" anthelmintics however, are under scrutiny because of increased parasite resistance due to long term and continuous application (Van Wyk *et al*., 1997a; Waller, 1998; Bisset *et al*., 2001) and are perceived as unnatural and sometimes harmful to the environment. Moreover, livestock farmers in many developing countries cannot use commercial anthelmintics in intestinal parasite control programmes for a number of reasons; the unavailability or erratic supply of the drugs; the costs involved and the size of packaging (packed for comparatively large flocks of 50-100 head, which is more than the average number per family in resource poor communities) (Satrija *et al*., 2001). Farmers in developing countries have used traditional medicinal plants to treat internal parasites for centuries and it is possible that medicinal plants may become viable alternatives for modern synthetic anthelmintics in resource-poor agriculture if their efficacy can be substantiated in controlled studies (Satrija *et al.*, 2001).

Aloe ferox is used in traditional human and livestock medicines (Van Wyk *et al*., 1997b). For example, poultry are protected from tick and lice infestation, when fresh Aloe leaves are put in their drinking water (Dold & Cocks, 2001). This may suggest that Aloe has a repellent effect on some insects. An organic farmer propagated the dosing of his animals with an Aloe solution to control parasites in sheep and alleged that the use of Aloe resulted in a reduction in faecal egg count. Since the latter study was not conducted according to a proper scientific method, it needs verification. A study was thus undertaken to determine whether Aloe could be used to control gastro-intestinal parasites. It was furthermore tested if Aloe treatment would lead to a reduction in dagginess, thus making animals less attractive for blowfly strike.

Materials and Methods

The resource flock used were Merino sheep that were divergently selected for reproduction as described by Cloete *et al*. (2004). During 2003 the flock were subjected to reciprocal crossbreeding between the lines, with the intention of forming a genetic resource population for possible future genomic projects (Naidoo *et al*., 2005). Crossbred progeny was thus available from the 2003 year of birth onwards. From the 2005 drop, animals from the two crossbred lines were back-crossed either to the High (H) line or Low (L) line. Since their establishment the different lines were maintained as a single flock, except during joining. For the duration of the study, the lines were maintained on the Elsenburg Research Farm (33°51'S, 18°50'E) near Stellenbosch, in the south-western region of South Africa. The climate of the experimental site is Mediterranean, with 78% of the average rainfall of 606 mm being recorded in the months from April to September.

Natural challenge was used to ensure that all animals received an adequate gastro-intestinal nematode challenge, prior to being drenched with aloe, or with distilled water as a control treatment. For the Aloe solution 75 g of Aloe powder was dissolved in 1 litre of lukewarm distilled water in the afternoon (between 14:00 & 16:00) the day prior to the day it was used, stirred well, left overnight, stirred well again in the morning, the supernatant decanted for use and the resin-like deposit discarded. All experimental animals were dosed with either 10 cc of distilled water or with 10 cc of the abovementioned Aloe solution after the faecal samples were taken. Dosing was done by administering the treatment with a dosing gun. The study comprised of three separate studies. The effect of regular treatment with aloe was assessed in weaner progeny of the resource flock born in 2004 (Trial 1) and 2005 (Trial 2). The experimental animals were stratified according to live weight and randomly allocated within weight classes and selection lines to the treatment or the control group. After treatment, gastro-intestinal nematode egg counts (FEC) were obtained at regular intervals to assess the effect of aloe treatment. Data were available for eight sampling dates in Trial 1 and for four sampling dates in Trial 2. Monthly faeces samples for the determination of FEC were obtained directly from the rectum of between 73 and 142 animals in Trial 1 and between 41 and 185 animals in Trial 2. In Trial 3, FEC was determined in 15 treated and 15 control animals immediately prior to drenching (day 0) and again on day 3 and on day 14. Decisions for dosing of control (and/or treatment) animals with conventional anthelmintics for welfare purposes were based on FEC counts determined during the study. The identity of each animal and the type of treatment it received were recorded. All progeny were shorn as weaners in October and they had short wool during the peak blowfly season. Very few blowfly strikes were therefore recorded, and these data were not analysed because of an excess of very low frequencies. Dag scores for 139 (Trial 1) and 183 (Trial 2) animals were recorded prior to shearing, using a scorecard with scores from 1 to 5 (Figure 1).

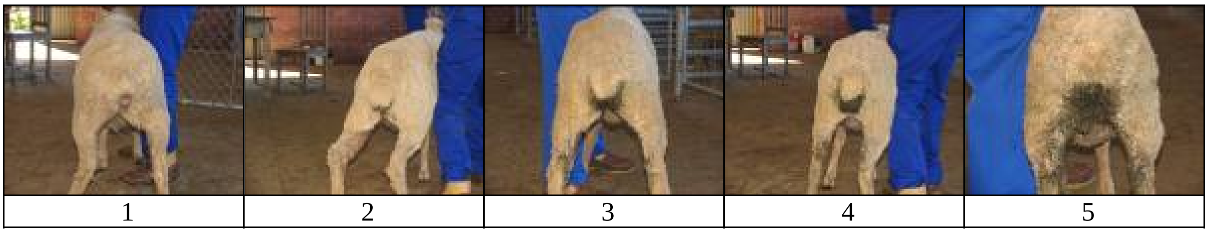

Figure 1 Photographic scorecard used to assist with the scoring of dags in the experimental animals.

The experimental outlay was factorial, with aloe treatment and sampling date as main effects. Eight sampling dates were considered in Trail 1, four in Trial 2, and three in Trial 3 as outlined above. As the same animals were sampled repeatedly in all experiments, the random effect of animal was included in all statistical analyses involving FEC. ASREML software (Gilmour *et al*., 1999) was used for this purpose. The software allows the fitting of various random effects in animal breeding, while also making provision for the prediction of least-squares means for fixed effects of interest. Apart from treatment and sampling date, the effects of selection line (as described above), sex (male or female) and birth type (single or multiple) were also considered in Trials 1 and 2. No additional fixed effects were considered in Trial 3, where a relatively small number of animals were involved. Two-factor interactions between the relevant effects were also considered, but were only retained in the final analysis when pertinent to the outcome of the study (treatment x sampling date) or significant (P <0.05). Recordings of FEC were subjected to the cube root transformation prior to analyses to normalise the distribution in all cases. The variance components for animal were used to derive repeatability coefficients for FEC, as described by Turner & Young (1969). The same basic procedure was used for the analysis of dag scores. However, since only one record was available per animal, this random effect of animal was dropped from the analysis.

Results, Discussion and Conclusions

Derived untransformed means (± s.d.) for FEC indicated extreme variation; being 1030 ± 1705 epg faeces for Trial 1, 3284 ± 3713 epg faeces for Trial 2 and 853 ± 477 epg faeces for Trial 3. The cube root transformation was effective in improving the distribution and respective means of 7.88 ± 4.65, 13.2 ± 4.97 and 8.59 ± 3.12 epg faeces were computed for the respective experiments. Derived repeatability coefficients (± s.e.) were low, namely 0.040 ± 0.030 in Trial 1, 0.123 ± 0.056 in Trial 2 and 0.054 ± 0.121 in Trial 3.

The administration of aloe did not affect the overall cube root transformed FEC in any of the Trials (Table 1). When monthly FEC in the long term studies (Trial 1 and 2) were considered, there was also no evidence of a reduced parasite burden in the treated group (Figure 2a and 2b). No change was accordingly found in Trial 3, where the possible shorter term effects of treatment were considered (Figure 2c). The mean dag scores of individuals in Trial 1 and Trial 2 were not affected by treatment with aloe (Table 1).

Table 1 Overall least squares means (± s.e.) for cube root transformed faecal egg count (FEC) and dag scores in animals treated with aloe or distilled water (Control) during Trials 1 to 3

Trial	Treatment		Significance
	Aloe	Control	
FEC (epg wet faeces)			
Trial 1 (2004 progeny)	8.3 ± 0.3	8.1 ± 0.3	n.s.
Trial 2 (2005 progeny)	13.9 ± 0.5	14.3 ± 0.6	n.s.
Trial 3 (short term)	8.8 ± 0.5	8.5 ± 0.5	n.s.
Dag scores (n)			
Trial 1 (2004 progeny)	2.33 ±	2.12 ± 0.15	n.s.
Trial 2 (2005 progeny)	2.22 ±	2.28 ± 0.16	n.s.

n.s. – Not significant (p> 0.10)

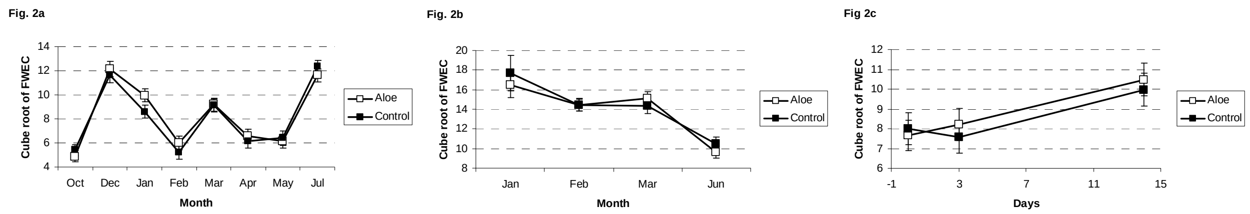

Figure 2 The interaction of treatment with aloe or distilled water (Control) with sampling date for Tria1 1 (Fig 2a), Trial 2 (Fig 2b) and Trial 3 (Fig 2c). Vertical lines about the means represent standard errors.

Results from this study showed no reduction in the parasite burden when treated with Aloe, as was propagated by the farmer. FEC was not accordingly independent of selection line (details not provided). The lack of effect of the Aloe treatment could be due to an inadequate way of administration or an ineffective dosage for the gastrointestinal challenge faced by the animals tested or a change in properties caused by the heat treatment during the initial preparation process of the Aloe crystals. However, it is conceded that this suggestion is speculative, and it should be subjected to scientific scrutiny.

An interesting observation of the study was that H line animals had lower dag scores than contemporaries in the L line, both in Trial 1 and in Trial 2 (Trial 1: 1.63 ± 0.09 *vs*. 2.86 ± 0.33; Trial 2: 1.73 ± 0.10 *vs*. 3.19 ± 0.25). The crosses were intermediate as would be expected, means ranging from 2.09 ± 0.29 for the H x L line in Trial 2 to 2.43 ± 0.16 in the L x H line in Trial 2. However, too little data was available to make definite conclusions pertaining to selection line effects on dag scores in the present study.

It is evident that treatment with Aloe failed to reduce the either the parasite burden or the mean dag score of sheep in the present study. At this stage it is unknown whether unprocessed aloe sap would also not be effective in the control of pathogens. Alternative administration methods or different dosages could possibly also be evaluated in future. Future research should focus on this aspect, as well as on alternative strategies for the reduction of FEC and a concomitant decline in the incidence of breech strike. The observed line difference in dag scores should also be studied further, using a larger and more informative data set.

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