Efficacy of CLiK® Spray-On in Preventing Naturally Occuring Blowfly Strike When Applied to Unmulesed Sheep

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ABSTRACT

Field studies were conducted in Australia to determine the efficacy of CLiK® Spray-On (50 g/L dicyclanil) in protecting unmulesed sheep from naturally occurring blowfly strike. Unmulesed sheep were treated on day 0 and inspected for flystrike at defined intervals thereafter. Any strikes detected were documented and resolved with a flystrike dressing. In the interest of animal welfare, untreated control groups were not maintained and blowfly pressure was determined by fly traps. Efficacy was calculated by determining the percentage cumulative strike rate at each site. In all, seven strikes were detected in 3028 CLiK-treated, unmulesed sheep. Six of these strikes were on the breech. Under conditions of moderate to high fly pressure, CLiK Spray-On protected unmulesed Merino and cross-breed sheep of various ages and wool lengths for the Australian registered protection period of 18-24 weeks, which had been previously determined using only mulesed animals.

INTRODUCTION

The prevention and control of blowfly strike caused by *Lucilia cuprina* (Wiedemann) is a vital component of sheep husbandry in Australia. Flystrike is estimated to cost the Australian sheep industry about AU$ 280 million per annum1 and it has been estimated that some three million sheep die each year as a consequence of strike.2 Mulesing is a procedure adopted as one management tool used to minimize the risk of flystrike on sheep and particularly Merinos. It involves the surgical removal of skin from around the breech of (generally) lambs to remove wrinkles and increase the area of bare perineal skin, which subsequently reduces the risk of flystrike caused by L. cuprina and other strike fly species. In recent years, the Australian sheep industry has faced strong challenges from animal rights groups on the use of the mulesing operation. These challenges have had an impact on the Australian wool industry and as a result it has been proposed that surgical mulesing should not be continued.

If mulesing is abandoned, sheep farmers will need to adopt alternative practices to manage the risk of flystrike on their animals.

There are several potential alternatives to mulesing being researched which leave the sheep with a wool-free, wrinkle-less bare area around the breech, e.g. breech clips applied to the backside of the sheep cause the loose skin to fall off; intradermal injection technology that causes the treated areas of skin to die, form a scab and then fall off leaving the stretched skin underneath; and breeding sheep with a naturally bare area.3,4 The role of breeding for plain body sheep and bare breeches has been recognized for a considerable time.5

Chemical treatments are currently widely and successfully used to control blowfly strike on sheep on Australian sheep farms. There are several compounds commercially available in different formulation types, which can be used as safe and effective tools to help in managing the problem.

The field development work undertaken with CLiK Spray-On Sheep Blowfly Treatment (50 g/L dicyclanil6; Novartis Animal Health Australasia Pty Limited; hereafter referred to as CLiK) in Australia was conducted with mulesed Merinos.7 It is reasonable to suggest that this is most likely the case for many, if not all, of the currently registered blowfly antiparasitics in Australia, given the regulatory need to field test such products in farming environments where adequate fly pressure would regularly occur and that mulesed sheep would have predominated in such areas.

CLiK was launched to the Australian market in spring 1998. While a lack of product complaints since launch would imply that the product performs within its registered claims on mulesed or unmulesed sheep, Novartis Animal Health Australasia Pty Limited had no direct evidence that the protection period for the product would be the same for mulesed and unmulesed animals (particularly in regions of moderate to high fly pressure where sheep have historically been mulesed). Thus, a series of trials

***Table 1**. Trial locations, animal details and treatment details*

Year	Site	Location	N=	Treatment group descriptiona	Wool growth (weeks)b	Treatment application site	Weight (kg)c	Dos(mL)
2005/06	1	Toogong, NSW	402	Merino-Border Leicester cross ewes	16	Body and crutch	82.0	36
2005/06	2	Mt Mercer, VIC	287	Merino ewes	4	Body and crutch	55.4	36
2006/07	3	Mt Mercer, VIC	275	Merino mixed sex lambs		Crutch and scrotum at marking	23.4	4 (ewes); 8(rams)
						Body at weaning	31.8	20
			175	Merino ewes	Off shears	Body and crutch	59.5	36
2006/07	4	Holbrook, NSW	305	Merino ram lambs		Crutch and scrotum at marking	16.4	8
						Body at weaning	27.0	16
2006/07	5	Illabo, NSW	350	Merino-Border Leicester cross ewes	36	Body and crutch	69.0	36
2006/07	6	Oberon, NSW	265	Merino ram lambs		Crutch and scrotum at marking	19.6	8
						Body at weaning	37.0	20
2006/07	7	Taralga, NSW	278	Merino-Border Leicester cross ewes	2	Body and crutch	68.0	36
2006/07	8	Oberon, NSW	265	Merino ram lambs		Crutch and scrotum at marking	21.0	8
						Body at weaning	29.0	16
2006/07	9	Wellington, NSW	193	Dohne ram lambs		Crutch and scrotum at marking	27.0	8
						Body at weaning	41.8	20
2006/07	10	Matheson, NSW	189	Merino wether lambs		Body and crutch	26.1	24

a All unmulesed sheep, ram lambs castrated at marking time; b lambs were spring born; c heaviest sheep

conducted across two years was initiated to gather field efficacy data so that reliable, up-to-date information on protection periods could be provided to Australian farmers.

MATERIALS AND METHODS

Ten field trials were conducted on commercial farms in the sheep producing regions of New South Wales (NSW) and Victoria (VIC) during the 2005/06 and 2006/07 blowfly seasons. The farms were selected from a wide geographic area to incorporate a range of climatic conditions (Table 1).

Study design

Clinical field trials to obtain data on the efficacy of CLiK in preventing blowfly strike on unmulesed sheep were conducted. The sheep were treated with CLiK on day 0 and inspected for flystrike at frequent intervals for an extended time period thereafter (Table 2). Any strikes detected were documented and then resolved with one of two registered flystrike dressings, viz. Extinosad® Lice, Fly and Maggot Eliminator (25 g/L spinosad; Elanco Animal Health) or Coopers® Mulesing Powder Insecticide (15 g/kg diazinon, 0.8 g/kg piperonyl butoxide, pyrethrins 1 g/kg; Coopers Animal Health). In the interest of animal welfare, untreated control groups were not maintained and blowfly pressure was determined by fly traps (Envirosafe Fly Catching System). Additionally, the presence of strikes in other flocks on a farm was considered supportive information for fly activity.

Table 2. *Generalized schedule of key study activities*

Week	Activity
Day 0	100 sheep at each site were weighed at random to determine doses or lambs were check weighed at marking treatments to ensure they were not >30 kg. All sheep were tagged with individual ear tags and treated with CLiK. Fly traps were set up.
Weekly from day 0	Co-operating farmers conducted paddock inspections at least three times per week
Weekly from week 1	Farmers inspected fly traps, completed fly counts and replaced attractant.
Monthly	Sheep were inspected in the yards until weather conditions were no longer favorable for fly activity or the trial was at week 18 (minimum protection period for CLiK) or CLiK had lost protection against fly. At site 7, some monthly inspections were completed in the paddock using binoculars as the sheep could not be readily mustered due to the prevailing drought conditions.

Experimental animals

Flock sizes ranged between 175 and 402 sheep and were largely fine wool but included some cross-bred animals (Table 1). Sheep of different wool lengths and age classes, including spring-born lambs, were enrolled. At sites 2, 3 and 5, mulesed Merino lambs, weaner Merino ewes and mature cross-bred ewes respectively were used as treated controls. Sheep at most sites were maintained on-pasture for the duration of the trial. Management was performed according to normal farm practice at these sites. Sheep at sites 4, 6 and 9 were kept in a feedlot situation, with shade and water available, due to drought conditions.

Lambs were not enrolled into a trial if they were likely to be mulesed at a later time. This was the case at site 10 where ewe lambs were not included as they were to be mulesed in the autumn of 2007.

Treatments

CLiK was administered to the sheep in accordance with the registered label application method. Applicators recommended by Novartis Animal Health Australasia Pty Limited were used. All applicators were fitted with a single aperture fan spray nozzle. Full body (i.e. body and breech) doses were determined according to the weight of the heaviest animal of 100 sheep weighed at random (Table 1). CLiK was applied as two bands over the back and a third over the breech. The bands were of equal volume and 10-15 cm in width. The two bands applied over the back commenced at the base of the neck, ended just above the tail and overlapped slightly along the midline. The breech band slightly overlapped the bands above the tail. For the treatment of lambs at tail docking and castration (or 'marking'), 4 mL was applied over the tail and surrounding wool. Ram lambs received an additional 4 mL over and around the area of the scrotum. A sample group of lambs were weighed to determine if they weighed more than 30 kg (maximum

limit for a 4 mL dose). At weaning time, lambs treated at marking were also treated with two bands applied over the back (Table 1).

Concurrent treatments on day 0

Due to a minor infestation of Bovicola ovis, the sheep at site 3 were treated with Clipguard® Pour-On Lousicide for Sheep (triflumuron; Novartis Animal Health Australasia Pty Limited) in accordance with label directions. The Clipguard treatment was allowed to dry before application of CLiK. It is noted that no post-treatment louse inspections were conducted to confirm the efficacy of this treatment. This treatment did not affect the overall interpretation of efficacy against blowfly strike as triflumuron has a lesser efficacy potential than CLiK.

At site 4, the lambs were vaccinated with Glanvac® 6 Vaccine (Corynebacterium pseudotuberculosis (ovis), Clostridium perfringens type D, C. tetani, C. novyi type B, C. septicum and C. chauvoei; Pfizer Animal Health), Scabigard® Vaccine (living virus prepared from contagious pustular dermatitis; Pfizer Animal Health) and dosed orally with Cydectin® Oral Drench for Sheep (moxidectin; Fort Dodge Australia Pty Limited).

The lambs at site 6 received concurrent treatments of Glanvac 6 B12 Vaccine, Scabigard Vaccine, Gudair® Vaccine (Mycobacterium paratuberculosis strain 316F; Pfizer Animal Health), RotateTM Oral Drench for Sheep and Lambs (levamisole hydrochloride and albendazole oxide; Novartis Animal Health Australasia Pty Limited) and Terramycin® Pinkeye Aerosol (oxytetracycline hydrochloride; Pfizer Animal Health).

The wether lambs at site 8 also received Glanvac 6 Vaccine, Scabigard Vaccine and Gudair Vaccine and those at site 9, Glanvac 6 Vaccine and Scabigard Vaccine. The lambs at site 10 were administered a treatment of Combi plus Selenium Oral Drench for Sheep and Lambs (albendazole, levamisole and selenium; Novartis Animal Health Australasia Pty Limited).

Blowfly challenge

The sheep were exposed to natural fly pressure from L. cuprina and other fly species of lesser importance. An Envirosafe trap was set up near each flock to help monitor fly pressure. The trap was emptied and the attractant replenished weekly by the co-operating farmers. The numbers of flies were recorded with L. cuprina differentiated from the other flies trapped. When a large number of flies were trapped, an aliquot counting technique was applied.

Assessment of efficacy

The limit of a product's protection against blowfly strike in Australia is reached when >1% of treated sheep sustain strikes on either the body or breech.8 Details of individual flystrikes, e.g. lesion size, maggot size, skin damage were recorded as strikes were detected.

The cumulative percentage strike rate for each flock was calculated using the formula: % strike rate = (number of strikes observed / number of animals treated) x 100.

A trial was deemed completed once weather conditions were no longer favorable for further fly activity or CLiK had lost protection (which did not occur).

Dag scores

'Dags,' or breech soiling, are caused by the build-up of fecal material around the backside and are a recognised predisposing condition for breech strike. Dag scores refer to the quantity and consistency of fecal material accumulating around the breech and extending down the hind legs. An animal with a score of 1 had no dags while an animal with a score of 5 had extensive wet soiling of the breech, extending down the hind legs to the pasterns.9

Meteorological data

Daily rainfall data was collected at each farm. Temperature (minimum and maximum) data was collected from the nearest Bureau of Meteorology weather station.

RESULTS

Efficacy

Strikes were recorded at sites 2, 5, 8 and 9

(Table 3). At site 2, the first ewe was struck in week 13 post-treatment. This was a small circular strike of low severity under the tail. The second ewe sustained a strike in week 17, with a small circular strike of low severity on the hip region. Larvae in both cases had developed to a length of 4 mm. One strike was recorded 24 weeks post-treatment at site 5. This was a small circular breech strike with minimal skin damage and maggots that had developed to 3 mm in size. The affected animal had been scouring. Two strikes were recorded in week 19 at site 8 in sheep with dag scores of 3; both were breech strikes (approximately 2 cm x 2 cm) with minimal skin damage and 2 mm maggots. Two strikes were recorded at site 9, 28 weeks post-treatment, which is outside the registered protection period for CLiK. The strike origin was the breech and both strikes had travelled up and over the tail causing moderate-high skin damage. Maggots had developed to >4 mm. No mulesed sheep were struck.

Blowfly pressure

Blowfly trap counts are summarized in Table 3. Strikes were recorded in non-trial animals at sites 5 and 10; the data of most interest is that from site 10, as strikes at site 5 occurred soon after the trial animals had been treated (Table 4).

Table 3. *Fly trap counts, rainfall and flystrike records*

Site	Treatment group description[a]	Treatment application site	Fly countsb	Rainfall (mm)c	No. of strikes	Strike rate %	Weeks post-treatment	
							Strikes recorded	Trial terminated
1	Merino-Border Leicester cross ewes	Body and crutch	2949	184	0			24
2	Merino ewes	Body and crutch	4634	207	2	0.70	13 and 17	24
3	Merino mixed sex lambs	Crutch and scrotum at marking	6422	91	0			21
		Body at weaning	6397	88	0			19
	Merino ewes	Body and crutch			0			19
4	Merino ram lambs	Crutch and scrotum at marking	977	159	0			28
		Body at weaning	809	128	0			22
5	Merino-Border Leicester cross ewes	Body and crutch	1021	81	1	0.29	24	24
6	Corriedale ram lambs	Crutch and scrotum at marking	1487	125	0			22
		Body at weaning	545	120	0			14
7	Merino-Border Leicester cross ewes	Body and crutch	635	131	0			18
8	Merino ram lambs	Crutch and scrotum at marking	7459	295	2	0.75	19	19
		Body at weaning	5285	343	0			21
9	Dohne ram lambs	Crutch and scrotum at marking	9751	163	2	1.04	28	28
		Body at weaning	4535	131	0			18
10	Merino wether lambs	Body and crutch	4603	396	0			18

a All unmulesed sheep, ram lambs castrated at marking time; b total number of L. cuprina flies trapped during trial period; c total amount of rainfall at each site during the trial period

Table 4. *Flystrikes recorded in non-study flocks*

Site	Week of study	Strikes (n=)
5	3	5
5	4	5
5	5	3
10	18	25

Meteorological data

Rainfall data is summarized in Table 3. There were regular rainfall periods of variable volumes towards the end of most trials. Temperature data (not presented) was considered normal and suitable for promot-

ing fly activity (i.e. 17 < 38oC).

DISCUSSION

The objective of these trials was to confirm that unmulesed sheep, treated with CLiK, were protected from flystrike to the extent defined on the current product label (i.e. 18-24 weeks). This protection period had been determined using mulesed sheep.

Sheep management and environmental conditions, particularly temperature and rainfall, largely determine patterns of flystrike in sheep. Development of prepupal larvae generally stops or at least slows when soil temperatures are <15°C. As soil temperatures begin to increase, larval development recommences and the 'over-wintering' population will emerge as adult flies. If these emerging flies encounter susceptible sheep, flystrike may occur. The next generation of flies produced from this emerging generation will be greater in number and if conditions remain suitable for flystrike, a 'fly wave' may occur. Rainfall intensity is also important, with frequent, small falls of rain being more conducive to flystrike than occasional heavy showers. Breech strike appears to replace body strike under drier conditions and when fly densities are low.2 It is noted that six of the seven strikes that occurred in this series of trials were breech strikes and that the trials proceeded during a time of below average rainfall.

The susceptibility of sheep to flystrike is largely determined by the level of moisture in the fleece.10 Blowflies are attracted to urine- or feces-stained wool, wounds, footrot, weeping eyes and sweat around the base of the horns of rams. Urine staining appears a particular risk in unmulesed ewes. At site 10, in week 18 post-treatment (the minimum limit of the registered protection period for CLiK), 25 individuals (14%) from a group of non-trial but CLiK-treated, unmulesed ewe lambs (n=180) that were grazing with the trial mob suffered flystrike. These strikes were all associated with urine staining of the breech. None of the unmulesed wethers enrolled in the trial were struck despite having been treated with CLiK at the same time.

Due to the relatively dry conditions prevailing during this series of trials, pasture quality was poor and this reduced the incidence of scouring and hence breech soiling in the sheep. On only four occasions were sheep identified as scouring and this was due to a shift from a pasture-based diet to a high grain diet (at sites 4, 5, 6 and 9).

The incidence of flystrike is also dependent on the presence of susceptible sheep, rather than the density of blowflies prevailing in the area. As few as 7-10 blowflies per hectare are enough to cause extensive flystrike in susceptible sheep.10 Moderate to high numbers of L. cuprina were trapped at most sites over the trial period. In 2005/06, low to moderate (site 1) and high (site 2) levels of fly activity were observed. High levels of fly activity were observed at the central and northern sites 8, 9 and 10 during 2006/07. Low to moderate activity was encountered at the southern sites (sites 4, 5, 6 and 7), except site 3 where high fly activity was observed. In comparison with Bowen et al.7, the average flies trapped/week was greater in the present study (178 vs. 81 [1995/96] and 28 [1996/97]). Bowen et al.7 used Lucitrap® fly traps in their studies compared to Envirosafe traps, which were used in the present study. It is not known whether there is a difference in trapping success between trap types.

In these trials, CLiK provided protection against blowfly strike on unmulesed Australian sheep within the registered claim period of 18-24 weeks. Within this time, no flock exceeded 1% cumulative strike, the level at which the Australian Pesticides and Veterinary Medicines Authority deems that protection has broken down.8 During the registration studies for CLiK, 6 flocks exceeded this limit and the collective data for these sites showed that a loss of protection happened at week 21 after treatment.7 There was no apparent breed effect (i.e. fine wool breed vs. cross-breed) in the present series of trials. While conditions were generally dry during the study period, fly trap results indicated significant and adequate fly chal-

lenge was present at many sites.

No adverse events were recorded following the concurrent applications of CLiK in conjunction with numerous other veterinary medicaments and vaccines.

These results demonstrate that farmers can use CLiK on unmulesed animals with confidence. It is, however, recommended that any chemical treatment be used in tandem with basic farm management practices such as correct tail docking technique, well-timed crutching and effective internal parasite control.

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