A New Method of Tick Control in Cattle

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Tick control is a necessity in tick-enzootic countries in order to minimize risks associated with tick infestation and, particularly tick-born diseases, in exposed livestock populations.

The most commonly encountered shortcomings of the various modes of application can be summarized as follows:
—poor wetting of tick attachment sites in ears, skin folds and under the tail after spray-racing.
—high costs of charging and replenishment of dipvats.
—management problems such as over- or understrength treatment with resulting hassles of getting dipwash analyses in good time.
—capital investment for construction of spray-races and dipvats.
—water availability in arid and semi-arid regions.
—stress imposed on cattle by moving animals to installation, e.g., in areas with frequent treatment intervals.

The need to overcome the above shortcomings called for a more rational, economic and easy application method.

A breakthrough in tickicidal treatment was achieved with the development of a ready-to-use liquid formulation of our synthetic pyrethroid flumethrin (internal code No.: Bay Vq 1950) which is applied dermally to cattle as pour-on treatment. The product profile and a summary of laboratory and field data, with particular reference to the South African tick situation, are outlined below.

Product Characteristics

The active principle is the synthetic pyrethroid flumethrin of Bayer A.G., Leverkusen, whose outstanding tickicidal properties are discussed elsewhere (Stendel and Fuchs, 1982; Hopkins and Woodley, Hamel et al, 1982; Dorn et al, 1982). This pyrethroid is principally a mixture of diastereomeres, whose tickicidal action has been enhanced by purification of the trans-moieties. The product contains 1% m/v flumethrin in an oil-based ready-to-use formulation. Dispersion on skin/haircoat surface is facilitated by a specific spreading agent.

Tolerance

The formulation is well tolerated in all age groups and sexes up to 20 times the recommended use rate of 1 mg/kg body weight, as tested in various breeds of cattle.

In rats the dermal LD 50 was not to be calculated, since the maximum dermally applicable dose volume did not cause any clinical symptoms or deaths in rats submitted to testing.

Furthermore no skin irritation problems were experienced by users accidentally spilling the product.

Residues

Edible bovine tissues (liver, muscle, kidney, fat) did not reveal any detectable residues following six dermal treatments at weekly intervals at a dosage of 1.2 mg/kg bodyweight, which is 20% above the recommended dosage. Likewise, no active substance was detectable in milk samples from dairy cows treated identically. Cows were in early-, mid- and late stage of lactation. Milk for analyses was drawn 8, 19, 30, 42 and 66 hours following the final treatment. The lowest limit of detection was 0.05 mg/kg in all residue trials.

These results clearly demonstrate an exclusive dermal action without any detectable percutaneous penetration of active substance.

Recommended Dosage

The dose volume is based on 1 mg/kg body weight which, for example, equals 10 ml per 100 kg bodymass.

The formulation thus can be applied exactly to actual body weight assuring always appropriate tickicidal strenth.

Alternatively, the product can be applied according to age groups or general body size:

calves	up to 200kg = 20 ml
heifers	300 kg = 30ml
cows	400kg = 40 ml
heavy cows/bulls	500kg & above = 50 ml

Due to the small dose volume, complete retention of product in the haircoat is assured and, additionally the haircoat of treated animals is "marked" due to the oily nature of the formulation.

Application is easily performed with any graduated measuring beaker or cylinder for pour-on treatment of small animal numbers. Spot-on treatment of large cattle numbers is conveniently carried out with a calibrated dosing gun. Actually any type of gun can be used, since the formulation is not corrosive, as to date experiences have shown.

The required dose volume preferably is easily applied along the backline of cattle, when the animals pass through a crush or when kept in a yard.

Spot-treatment of tick clusters or at predilection sites in ears *(R. appendiculatus,* immature *R. evertsi)* and perional region (adult *R. evertsi)* also can be ideally applied.

Tickicidal Efficiency

Laboratory data

Tickicidal efficiency of flumethrin (Vq 1950) pour-on in comparison to a hand-sprayed formulation is basically identical despite survival of a limited number of female *B. decoloratus* ticks. In this context it is important, however, that no larval hatch took place from eggs deposited (Table 1). There is also no difference between 0.5 and 1.0 Omg/kg dose rates. Complete control of *B. microplus* (OP-resistant Biarra strain) following 0.5 and 1.0 Omg/kg pour-on application is achieved. Even in much lower concentration (0.1 and 0.3 mg/kg pour-on) prevention of larval hatch in *B. microplus* is extremely high (97.05 and 98.66%).

Control of DDT-pyrethroid cross-resistant *B. microplus* at doses of 3, 10, 30ppm handspray and 1.0 mg/kg pour-on is equally high (Table 1).

TABLE 1. Efficiency of various flumethrin (Vq 1950) applications against artificial infestations of **Boophilus decoloratus** and **B. Microplus** in cattle*

			% efficiency	
Tick species	**Dosage**	**Type of application**	**Total tick counts**	**Prevention of larval hatch**
B. decoloratus OP— resistant (Gulu strain)	0,5mg/kg	pour-on	94,40	100,00
"	0,5mg/kg	pour-on	90,44	100,00
	1,0mg/kg	pour-on	98,94	100,00
B. decoloratus OP— resistant (Van Dyck strain)	10 ppm	hand-spray	100,00	—
	3 ppm	hand-spray	100,00	—
B. microplus OP— resistant (Biarra strain)	0,3mg/kg	pour-on	57,87	98,66
	0,1mg/kg	pour-on	65,16	97,05
	0,5mg/kg	pour-on	99,60	100,00
	1,0mg/kg	pour-on	99,80	100,00
B. microplus DDT— resistant (Malchi strain)	30 ppm	hand-spray	100,00	—
	10 ppm	hand-spray	98,90	—
	3 ppm	hand-spray	97,12	—
"	1,0mg/kg	pour-on	99,70	100,00

* Summarized from data kindly provided by Dr. W. Stendel, Elberfeld, West Germany.

Minidip treatment following artificial infestations with multihost ticks such as *Rhipicephalus evertsi, R. alpendiculatus, Hyalomma truncatum* and *Amblyomma spp* prevented oviposition completely at concentrations ranging from 5 to 40 ppm.

Field Data

The high tickicidal efficiency of the product was corroborated under field trial conditions in various regions of the Republic of South Africa in the period from January to April 1984.

Efficiency and residual action was tested against the five economically important tick species *(Rhipicephalus appendiculatus, R. evertsi, Amblyomma hebraeum, Boophilus decoloratus* and *Hyalomma spp). Hyalomma spp* and *R. evertsi* had an overall low incidence. The two most abundant tick species on the trial farms were *R. appendiculatus* and *B. decoloratus.*

In all trials a dose of 1 mb/kg body weight was applied by pouring the required volume along the backline; in some instances the product was additionally applied between the ears in order to assess any difference or efficiency against *R. appendiculatus.*

In tables 2 and 3, representative trial results against *R. appendiculatus, A. hebraeum* and *B. microplus* are summarized.

One day after treatment an overall cleansing effect was visible, the few remaining ticks still attached on some animals were all severely affected (faint leg movements, change of colour) by the tickicidal action, and dried up subsequently.

Principally, as proven under laboratory conditions, surviving engorged ticks were capable of ovipositing a small number of viable eggs.

TABLE 2. Average numbers of **Rhipicephalus appendiculatus** (0 + 0) in treated (10) and untreated (5) control cattle.

Trial a).

Day	**Controls (5)**	**treated group (10)**
— 3	161,2	159,3
0*	—	—
+ 1	154,6	40,1 (ticks affected)
+ 3	152,0	5,0
+ 5	181,0	0,8
+ 7	105,4	1,5
+ 14	261,2	32,6
+ 16*	—	—
+ 21	all controls	4,9
+ 28	treated and re-	15,8
+ 31*	moved from trial	—
+ 35		1,4
+ 42		1,3
+ 49*		7,7
+ 56		1,9

Treatments* with 1mg/kg flumethrin pour-on at days 0, 16, 31 & 49.

Trial b).

Day	**Controls (5)**	**treated group (10)**
0*	240,6	294,4
+ 3	8,4	0
+ 6	39,0	0
+ 13*	222,2	15,1
+ 20	210,4	0,2
+ 27	161,4	2,3

Treatment* with 1mg/kg bodyweight flumethrin pour-on at days 0 & 13.

TABLE 3. Average numbers of **Amblyomma hebraeum** (0 + 0) in treated (10) and untreated (5) control cattle.

Trial c).

Day	Controls (5)	Treated group (10)	
− 3	370,8	374,2	
0*	—	—	
+ 1	383,8	40,0	(all ticks affected)
+ 3	382,2	1,6	
+ 5	410,0	1,7	
+ 7	152,6	6,5	
+ 14	92,4	69,2	
+ 16*	—	—	
+ 21	all controls	4,6	
+ 28	treated and re-	28,4	
+ 31*	moved from trial	—	
+ 35		3,9	
+ 42		9,3	
+ 49*		37,2	
+ 56		1,9	

Treatment* with 1mg/kg flumethrin pour-on at days 0, 16, 31 & 49.

Average numbers of engorging female **Boophilus decoloratus** in treated (10) and untreated (5) control cattle.

Trial d).

Day	Controls (5)	Treated group (10)	
− 3	86,0	85,5	
+ 1	9,6	2,2	
+ 3	40,0	0	
+ 5	130,6	1	
+ 7	70,4	0	
+ 14	154,0	0	(Trial discontinued)

Under the existing tick pressure condition on the trial farms, a distinct re-infestation only occured around day 14 after initial treatment. As shown in tables 2 and 3, a bi-weekly treatment interval was sufficient to keep tick numbers at a minimum level.

Blue ticks *(B. decoloratus)* seem to be particularly susceptible due to their one-host life cycle, and were controlled for more than two weeks (Table 3).

In a trial with low *B. decoloratus* pressure and treatments at days 0, 16, and 35, only a total of 29 engorged ticks could be counted up to day +42. Seven of these ticks collected on day +1 and +35, laid only a small number of sterile eggs. These findings were confirmed in another trial with high blue tick pressure where apparently viable ticks (53) were collected 4 hours, 24 hours and 7 days after initial treatment and incubated. Only two of the 18 ticks collected after four hours, laid a few viable eggs. All other ticks did not oviposit.

The tickicidal efficiency against *R. appendiculatus* was particularly striking (table 2).

Within two to three days the highly infested ears were freed from all ticks. There was no difference in additionally treating between the ears and pour-on application along the backline only. A distinct bi-weekly re-infestation pattern could be observed in all trials with that species. The tick burdens between treatments remained extremely low, suggesting a pronounced protective action of the compound. A similar pattern of control was existing in *Amblyomma hebraeum* (Table 3). All ticks were severely affected and non-viable within one day after treatment. Single surviving fully engorged females did not oviposit.

The generally low numbers of *R. evertsi* and *Hyalomma spp* were effectively controlled in all trials without showing any particular reinfestation rates.

In all field trials a drastic drop in tick populations was experienced within 3-4 weeks, or even earlier. If this phenomenon is associated with generally low tick pressure due to the prolonged drought or limited seasonal rainfalls, it warrants further investigation.

The generally dry weather conditions did not allow testing of rain-fastness of the product under field conditions. Therefore artificially *B. microplus*-infested cattle were exposed to simulated rain (20 per animal) 1, 10 and 100 minutes after treatment (1 mg/kg body weight). In all instances full efficacy was achieved in all three tests, emphasizing immediate onset of tickicidal action following application.

It can be concluded from the above trials that flumethrin pour-on is a safe and highly efficient product, which does not require withdrawal periods.

The product has an outstanding tickcidal action, significantly reducing tick populations on pastures following several treatments.

The pronounced residual activity allows extension of treatment intervals, thus reducing treatment costs per annum. The ease of application gives clearcut advantages over conventional types of treatment, particularly in terms of stress reduction in dairy cows or stud animals.

Futhermore, individual dosing excludes any problems of over- and under strength frequently encountered during conventional treatments. Water shortages during dry spells, or in semi-arid situations will no longer interfere with or prevent efficient tick control.

References

1. Stendel, W. and R. Fuchs: 1982 Vet. Med. Rev., 2:115. 2. Hopkins, T.J. and I.R. Woodley: 1982 Vet. Med. Rev., 2:130. 3. Hamel, H.D., W. Esteves, B. Hees, M. Pulga and W. Roessger: 1982 Vet. Med. Rev., 2:140. 4. Dorn, H., H.D. Hamel and W. Stendel: 1982 Vet. Med. Rev., 2:147.

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