

THE PROTECTION OF SHEEP AGAINST BLOWFLY STRIKE.
II.—THE INFLUENCE OF THE LENGTH OF WOOL AT THE TIME OF
TREATMENT ON THE DURATION OF PROTECTION.

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Previous investigations into the mode of action of certain organic insecticides for the protection of sheep against blowfly strike have shown that varying degrees of protection were afforded to different groups of Merino sheep by the same concentration of a given formulation. This variable protection was particularly noticeable in sheep treated with compounds characterised by a high diffusion potential along the wool fibres from the fleece originally treated into the ever expanding new growth of wool beneath (du Toit and Fiedler, 1953). An analysis of the conditions prevailing during the tests indicated that the length of the wool staple at the time of application may have been responsible for this variation.

In order to determine the possible influence of fibre length on the duration of protection, a number of tests were conducted at Onderstepoort on sheep carrying wool of different lengths.

Experimental.

Each of five groups of five Merino sheep, were shorn at monthly intervals, so that at the time of treatment the staple lengths of the groups were as follows:—

- Group 1.— $\frac{1}{4}$ inch, freshly shorn.
- Group 2.— $\frac{1}{2}$ inch, one month after shearing.
- Group 3.— $\frac{3}{4}$ inch, two months after shearing.
- Group 4.—1 inch, three months after shearing.
- Group 5.— $1\frac{1}{4}$ inch, four months after shearing.

Benzene hexachloride was chosen as the protecting agent for these tests, as it possesses excellent properties of diffusion and is widely used. All the groups were treated simultaneously with a 0.5 per cent gamma B.H.C. suspension* by thoroughly saturating the wool over an area on the rump about 12 inches in diameter. A sixth group of sheep with a wool length of 1 to $1\frac{1}{2}$ inches remained untreated to serve as a control.

Wool grows at the fairly constant rate of $\frac{1}{4}$ inch per month under the conditions at which the sheep were maintained. Thus half an inch length of new wool could be expected at the end of two months beneath the treated portion of the staple. Insecticides such as B.H.C., Aldrin and Dieldrin, which readily diffuse into the constantly expanding zone of growing wool from the treated portion, render the whole length of the staple larvicidal for a certain period. The longer the

* Dubble Benhex, B.H.C. wettable powder, supplied by Messrs. Klipfontein Organic Products Corp., Transvaal.

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fleece at the time of treatment, the more insecticide is retained and the more there is available to impregnate the growing fibres. The aim of the present investigation, therefore, was to establish the relation between the duration of protection and the length of the wool staple at the time of treatment.

Commencing nine weeks after treatment, when the wool had grown an additional $\frac{1}{2}$ inch, the sheep were tested at weekly intervals for the degree of protection afforded. The two different methods applied in previous tests (du Toit and Fiedler, 1953), were used to afford as reliable a check as possible on the results. For the *in vivo* test first instar larvae of *Lucilia cuprina* Wied. were implanted on to the treated area according to the method of McLeod (1937). Death or survival of the maggots on the third day after application served as the criterion for assessing the degree of protection. Secondly, wool samples from the treated area were taken and subjected to the *in vitro* bio-assay method described in a previous paper (Fiedler and du Toit, 1951). In this case the new wool growth was severed from the zone originally treated and tested separately. The bio-assay test was found to be very sensitive and could demonstrate even partial protection. This represents an intermediate stage occurring towards the end of the period of protection when the insecticidal concentration in the wool has dropped to a level where complete kill of the larvae no longer occurs but where their normal development is impeded. Gamma B.H.C. affords full protection down to a concentration of 4 p.p.m. in the wool. At between 4 and 1 p.p.m. the compound is capable of exerting partial protection whereas lower concentrations exert no effect upon the young maggots.

Results.

In the following table, No. 1, the period of protection is given in weeks for the five groups of sheep:—

TABLE 1.

Duration of full and partial protection against strike afforded to five groups of sheep with different wool lengths at the time of treatment with a B.H.C. suspension at 0.5 per cent gamma.

Groups.....	I.		II.		III.		IV.		V.	
Wool Length.....	$\frac{1}{4}$ ".		$\frac{1}{2}$ ".		$\frac{3}{4}$ ".		1".		$1\frac{1}{4}$ ".	
Protection.....	Full.	Partial.	Full.	Partial.	Full.	Partial.	Full.	Partial.	Full.	Partial.
Time in Weeks.....	10	11	13	17	12	18	14	20	19	22
	10	11	14	19	13	20	14	40	22	23
	10	15	14	22	14	19	18	39	24	29
	14	18	17	23	14	20	21	39	26	40
	*	*	18	32	21	34	25	40	27	42
AVERAGE.....	11.0	13.7	15.2	22.6	14.8	22.2	18.4	35.6	23.6	33.2

(* sheep dead prior to testing.)

At first sight the results may not appear to be very consistent. Statistical analysis has revealed, however, that the correlation between the length of wool and duration of protection is highly significant for full protection ($rF=0.953$ xx) and significant for partial protection ($rP=0.9194$ x). It may be stated, therefore, that the duration of protection depends to a great extent upon the length of wool at the time of treatment.

The growth of wool may be expressed as a logarithmic function. For purposes of the present experiment, however, it is justifiable to regard the increase in fibre length as a straight line as only a comparatively short range, between $\frac{1}{4}$ inch and $1\frac{1}{4}$ inches, is taken into consideration.

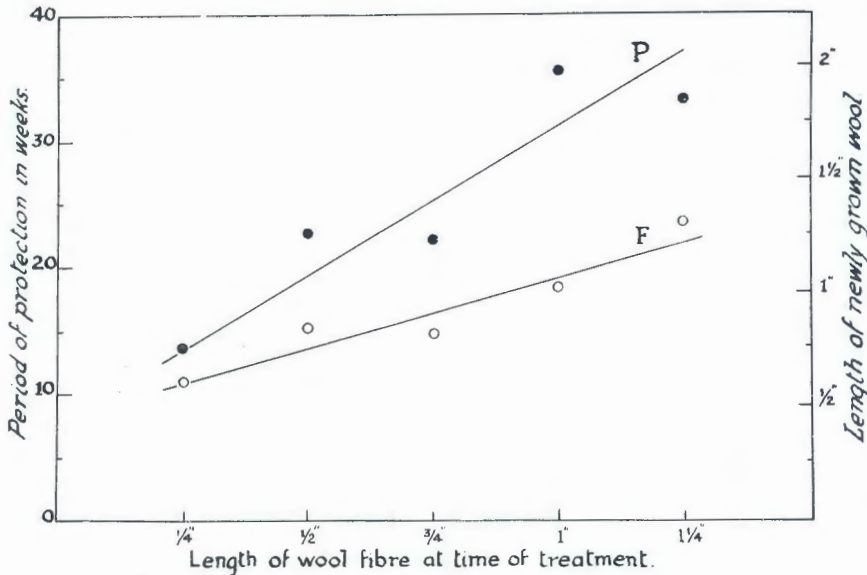


FIG. 1.—Correlation between length of wool staple at time of treatment with 0.5 per cent gamma B.H.C. suspension and the period of protection in weeks as well as the distance to which the compound is able to diffuse into the new wool growth at sufficient concentration to maintain (F) full and (P) partial protection against strike.

Fig. 1 expresses the results in diagrammatic form and it may be deduced from the interpolated means that partial protection increases more rapidly than full protection with increasing wool lengths at the time of treatment. Within the limited range studied an addition of $\frac{1}{4}$ inch in wool length at the time of treatment prolongs the period of full protection by about $2\frac{1}{2}$ weeks, whereas partial protection is prolonged by about 6 weeks. In terms of staple length it is evident, therefore, that gamma B.H.C. is able to diffuse along the fibres for an additional $\frac{1}{8}$ inch and about $\frac{1}{4}$ inch before reaching the 4 and 1 p.p.m. marks respectively—the lowest concentrations at which full and partial protection are afforded.

The longer the wool staple, the more insecticide can be absorbed in the wool grease. A long fleece, therefore, ensures a larger B.H.C. reservoir on the sheep and this enables the compound to diffuse over a greater distance with resultant longer protection.

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Conclusion.

The results appear to indicate that it is not advisable in practice to treat Merino sheep prophylactically against blowfly strike immediately after shearing as only a short period of protection may be expected. It would be advisable to withhold treatment with B.H.C. or any other insecticide with good powers of diffusion, for one or two months after shearing, or until the length of protection to be expected justifies treatment from the point of view of economy, provided blowfly activity is not so severe as to force treatment earlier.

SUMMARY.

The duration of protection afforded to sheep against blowfly strike by the treatment of the wool with an insecticide possessing good powers of diffusion is correlated with the length of wool at the time of treatment. For every additional $\frac{1}{4}$ inch in the length of fleece treated by B.H.C. wettable powder at a concentration of 0.5 per cent gamma, full protection is prolonged by $2\frac{1}{2}$ weeks and partial protection by 6 weeks.

REFERENCES.

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